EP1 – Dysplasia


**MD Joaquin Lara**¹, MD Alan Garin³, MD Cristhian Herrera³, MD Selim Abara¹, MD Javier Besomi², MD Diego Villegas³, MD Hassan Neumann³, MD Carlos Tobar⁴

¹Centro de Cadera Clinica Las Condes, Santiago, Chile, ²Clinica Alemana de Santiago, Santiago, Chile, ³Hospital Padre Hurtado, Santiago, Chile, ⁴Clinica Avansalud, Santiago, Chile, ⁵Hospital San Borja Arriaran, Santiago, Chile

EP1.2 Incidence of signs of femoroacetabular impingement in adolescents with developmental dysplasia of the hip

Tobias Fauser¹, Jenna Powell¹, MD Tyler Freeman², MD Derek Axibal², MD Robin Dunn², MD Courtney O’Donnell¹, MD Stephanie W Mayer¹, MD Courtney O’Donnell¹

¹Children’s Hospital Colorado, Aurora, United States, ²University of Colorado Anschutz Medical Campus, Aurora, United States

EP1.3 Utilization of a transverse screw construct in periacetabular osteotomy: does this impact initial fragment stability and version control?

Tobias Fauser¹, Jenna Powell¹, MSc Todd Baldini², Kayla Burnim, Anne M Skelton, MD Mark Erickson¹, MD Stephanie Mayer¹, MD Courtney O’Donnell¹, MD Stephanie Mayer¹

¹Children’s Hospital Colorado, Aurora, United States, ²University of Colorado Anschutz Medical Campus, Aurora, United States

EP1.5 The Australian patient experience: Part B - Periacetabular Osteotomy intervention

**Miss Madison Morrish**, Mr David Georgy¹, Mrs Jessica Georgy

¹Australian Sports Physiotherapy, Melbourne, Australia

EP1.6 Cartilage degeneration is associated with increased joint contact stress in patients with hip dysplasia

Ms. Holly Thomas-Aitken³, Mr. Nicholas Bartschat¹, Dr John Clohisy¹, Dr Michael Willey¹, Dr Robert Westermann¹, Prof Jessica Goetz¹

¹University of Iowa, Iowa City, United States, ²Washington University, St. Louis, United States

EP1.12 How does clinical outcome correlate to acetabular coverage after periacetabular osteotomy?

**Dr Mazen Ibrahim**¹, Johanna Dobransky², Lilly Jean-Pierre³, Dr Paul Beaule², Dr Paul Beaule³

¹Children Hospital Eastern Ontario, Ottawa, Canada, ²The Ottawa Hospital, Ottawa, Canada, ³The Ottawa university, Ottawa, Canada

EP1.13 Hip arthroscopy in painful borderline hip dysplasia: A single institution retrospective experience

**Dr Jung-Mo Hwang**¹, Dr Jeong Kil Lee¹, Dr Deuk-Soo Hwang¹, Dr Young-Cheol Park¹

¹Chungnam National University of Hospital, Daejeon, South Korea

EP1.14 Removal of in-dwelling epidural catheter on post-operative day #1 leads to reduced hospital length of stay, improved ambulation, and overall decrease in pain and opioid use following Bernese peri-acetabular osteotomy (PAO)

**Dr Brian Lewis**¹, Dr William Norcross¹, Mr. Skip Maza³, Dr Steven Olson¹

¹Duke University Medical Centre, Durham, United States
EP1.15 Technique for combined hip arthroscopy and peri-acetabular osteotomy (PAO) with single table/single surgeon and post-free distraction

Dr Brian Lewis¹, Dr Dustin Woyski³, Dr Robert Kollmorgen², Dr Steven Olson¹
¹Duke University Medical Centre, Durham, United States, ²University of California San Francisco, Fresno, Fresno, USA

EP1.16 Neurophysiological changes during periacetabular osteotomy with minimal invasive approach

²MD, Consultant Head of Hip Unit. University Hospital Dexeus, Barcelona, Spain, ¹Neurotoc (Intraoperative Neuromonitoring Company), BARCELONA, SPAIN

EP1.17 Case report: Our first out-patient periacetabular osteotomy

MD Richard Santore², MD Michael Muldoon², Research Coordinator Robert Healey², Research Associate Austin Long²
¹Hip Preservation Centre of Excellence, San Diego, United States, ²Sharp Healthcare, San Diego, United States

EP1.18 Transfusion rate in periacetabular osteotomy cases reduced to zero percent (0%)

MD Richard Santore¹,², Research Coordinator Robert Healey¹,², MD Max Gosey¹, Research Associate Austin Long¹,², MD Michael Muldoon¹,²
¹Hip Preservation Centre of Excellence, San Diego, United States, ²Sharp Healthcare, San Diego, United States

EP1.19 Surgical management of adult borderline developmental hip dysplasia - a systematic review
Dr Sam Marsden¹, Mr Jonathan Hutt¹
¹St George’s University Hospitals NHS Foundation Trust, London, UK

EP1.20 Dysplasia with retroversion: Prevalence, acetabuloplasty rates, and outcomes from a large hip arthroscopy study group

Dean Matsuda¹, Benjamin Kivlan¹, Shane Nho³, Andrew Wolff⁴, Jonathan Salvo⁵, Jonathan Christoforetti⁶,⁷, Thomas Ellis⁸, Dominic Carreira⁹
¹DISC Sports and Spine, Marina del Rey, United States, ²Dusquene University, Pittsburgh, United States, ³Rush Medical Centre, Chicago, United States, ⁴Washington Orthopaedics and Sports Medicine, Washington DC, United States, ⁵Rothman Institute, Marlton, United States, ⁶Allen Orthopaedics and Sports Medicine, Allen, United States, ⁷Peachtree Orthopaedics, Pittsburgh, United States, ⁸Orthopedics ONE, Columbus, United States, ⁹Peachtree Orthopaedics, Atlanta, United States

EP1.21 Is the arthroscopic technique an effective tool in the treatment of borderline dysplasia?

MD Claudio Rafols¹, PhD, MD Juan Monckeberg¹, MD Tomas Amenabar¹
¹Meds Clinical Centre, Santiago, Chile

EP1.22 Does pain catastrophizing predict age of onset in symptomatic hip dysplasia and femoroacetabular impingement?

Ms Shawn Okpara¹, Dr Paul Nakonezny¹, Dr Joel Wells¹
¹UT Southwestern, Dallas, United States

EP1.23 Does severity of hip dysplasia predict pain and functional impairment in symptomatic patients?

Shawn Okpara¹, Dr Joel Wells¹, Terrul Ratcliff², Avneesh Chhabra¹
¹University of Texas at Southwestern, Dallas, USA
EP1.24 Minimal clinically important difference and substantial clinical benefit after a periacetabular osteotomy: Are we attaining patient satisfaction and using effective outcome measures?
Jeffrey Peck¹, Stacy Robustelli¹, Ernest Sink⁴
¹Hospital For Special Surgery, New York, United States

EP1.25 The periacetabular osteotomy in the treatment of symptomatic acetabular anteversion provides similar outcomes as in treatment for lateral centre edge defined dysplasia
Jeffrey Peck¹, Stacy Robustelli¹, Ernest Sink⁴
¹Hospital for Special Surgery, New York, United States

EP1.26 Can EOS imaging substitute for conventional radiography in measurement of acetabular morphology in the young dysplastic hip?
Ms. Jenna Powell¹, Dr Romie Gibly², Dr L. Wade Faulk², Mr. Patrick Carry², Dr Stephanie Watson Mayer², Dr Courtney O'Donnell²
¹Children’s Hospital Colorado, Aurora, United States, ²University of Colorado - Anschutz Medical Campus, Aurora, Aurora

EP1.27 Obliquity of the supra-acetabular cut and its effects on maximum lateral correction and initial fragment stability after periacetabular osteotomy: A cadaveric model
Ms. Jenna Powell¹, Mr. Todd Baldini², Mr. Tobias Fauser¹, Mr. Matthew Genelin¹, Dr Stephanie Mayer², Dr Courtney O'Donnell²
¹Children’s Hospital Colorado, Aurora, United States, ²University of Colorado - Anschutz Medical Campus, Aurora, United States

EP1.28 It is possible to return to sports after a periacetabular osteotomy in mild dysplastic athletes?
Md Luis J. Ramirez¹, MD Manel Ribas, MD Carломagno Cardenas¹, MD Vittorio Bellotti¹, MD Emanuele Astarita¹, MD Gabriel Chacon¹
¹Institut Universitari Quiron Dexeus, Icatme., Barcelona, Spain

EP1.29 Assisted treatment of hip congenital dislocation by arthroscopy surgical technique description
MD Leonardo Trujillo¹, MD Jairo Rincon
¹Asociacion Medica De Los Andes, Bogota, Colombia

EP1.30 Is the pelvic tilt in acetabular retroversion different to asymptomatic hips and does it change following anteverting peri-acetabular osteotomy?
Mr Saif Salih¹,², Mr George Grammatopoulos², Dr Paul Beaule³, Mr Johan Witt³
¹Sheffield Teaching Hospitals, Sheffield, United Kingdom, ²The Ottawa Hospital, Ottawa, Canada, ³University College London Hospital, London, United Kingdom

EP1.31 What is the inter and intra-observer reliability of a contemporary classification system for hip dysplasia?
Mr Saif Salih¹,², Miss Sophia Burns², Mr Mark Roussot², Mr Christian Merle³, Dr Margaret Hall-Craggs², Mr George Grammatopoulos², Mr Johan Witt³
¹Sheffield Teaching Hospitals, Sheffield, United Kingdom, ²University College London Hospital, London, UK, ³Centre for Orthopaedics and Trauma Surgery, University of Heidelberg, Germany

EP1.32 Pre-operative planning modalities for correction of acetabular dysplasia
Alexander Acuña¹, Dr Linsen Samuel², Dr Assem Sultan³, Dr Atul Kamath²
¹Case Western Reserve University School of Medicine, Cleveland, United States, ²Cleveland Clinic Foundation, Cleveland, United States
EP1.33 Is there a role for hip arthroscopy in the treatment of borderline dysplasia?
MD Pablo Slullitel, MD José Oñativia, MD Fernando Diaz-Dilernia, MD Agustin Garcia-Mansilla, MD Francisco Piccaluga, MD Gerardo Zanotti, MD Martin Buttaro, MD Fernando Comba
1The Ottawa Hospital, Ottawa, Canada, 2Italian Hospital of Buenos Aires, Buenos Aires, Argentina

EP1.34 Iliopsoas tendon-related pain following minimally invasive peri-acetabular osteotomy
Mr Shankar Thiagarajah
1Doncaster & Bassetlaw Teaching Hospitals, Doncaster, United Kingdom

EP1.35 Concurrent periacetabular osteotomy and femoral osteochondroplasty improves localized joint contact stress abnormalities in patients with head-neck offset deformities
Mrs. Holly Thomas-Aitken, Dr Jessica Goetz, Mr. Nicholas Bartschat, Dr John Clohisy, Dr Michael Willey, Dr Robert Westermann
1The University of Iowa, Iowa City, United States, 2Washington University in St. Louis, St. Louis, United States

EP1.36 Incorporating patient-specific femoral version into computational models of hip dysplasia augments the biomechanical improvement detected after surgical correction
Mrs. Holly Thomas-Aitken, Dr Jessica Goetz, Mr. Nicholas Bartschat, Dr John Clohisy, Dr Michael Willey, Dr Robert Westermann
1The University of Iowa, Iowa City, United States, 2Washington University in St. Louis, St. Louis, United States

EP1.37 How effective is peri-acetabular osteotomy in acetabular retroversion?
Dr Jeroen Verhaegen, Mr. Saif Salih, Mr. Shankar Thiagarajah, Mr. George Grammatopoulos, Mr. Johan Witt
1University College London Hospital (UK), London, United Kingdom, 2University of Antwerp, Antwerp, Belgium

EP1.38 Ganz periacetabular osteotomy in neglected developmental dysplasia of the hip: development of hip preservation in Indonesia
MD Anggun Esti Wardani, MD Andreas M.H Siagian, MD Dadang Rona Sasetyo
1RSUP Dr Soeradji Tirtonegoro, Indonesia, Klaten, Indonesia, 2RS Ulin, Banjarmasin, Indonesia

EP1.39 Detailing postoperative pain and opioid utilization after periacetabular osteotomy with automated mobile messaging
Dr Christina Hajewski, Dr Christopher Anthony, Mr. Edward Rojas, Dr Robert Westermann, Dr Michael Willey
1University Of Iowa Hospitals and Clinics, Iowa City, United States

EP1.40 Skeletal muscle mass is maintained after periacetabular osteotomy with standardized rehabilitation protocol
John Davison, Dr Robert Westermann, Dr Elizabeth Scott, Mohammad Kotob, Dr Amanda Paulson, Dr Jason Wilken, Edward Rojas, Dr Michael Willey
1University Of Iowa Hospitals and Clinics, Iowa City, United States

EP1.41 Anterior but not posterior wall deficiency is associated with worse outcomes at two to four-year follow-up in female patients undergoing hip arthroscopy for femoroacetabular impingement
Dr Jennifer Marland, Mrs Brandy Horton, Dr Hugh West, Dr James Wylie
1The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

EP1.42 Combined hip arthroscopy with periacetabular osteotomy or periacetabular osteotomy alone for the treatment of developmental dysplasia of the hip?
M.D. Gerardo Zanotti, M.D. Fernando Diaz-Dilernia, M.D. Jose Ignacio Oñativia, M.D. Fernando Comba, M.D. Martin Buttaro, M.D. Eduardo Genovessi, M.D. Francisco Piccaluga
1Hospital Italiano De Buenos Aires, Buenos Aires, Argentina
EP1.43 Pelvic osteotomies for acetabular dysplasia: Are there outcomes, survivorship and complication differences between different osteotomy techniques?

Dr Edward Beck¹, Dr Katlynn Paul¹, Dr Anirudh Gowd, Dr Jorge Chahla¹, Dr Shane Nho¹
¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, ²Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US

EP2 – Inguinal and adductor-related groin pain

EP2.1 Anterior knee pain associated to femoral cam morphology

MD Bruno Capurro¹, MD PhD Marc Tey¹, MD Juan Sanchez-Soler¹, MD Carmen Tara¹, MD, PhD Joan Carles Monllau¹, MD, PhD Vicente Sanchis-Alfonso²
¹Hospital del Mar, Universitat Autònoma de Barcelona, Spain, ²Hospital 9 de Octubre and Hospital Arnau de Vilanova, Spain

EP2.2 The role of femoroacetabular impingement in athletic pubalgia: state-of-the-art

Dr Ricardo Marta¹, Dr João Moura, Dr Luis Maia, Dr Joana Costa, Dr Tiago Barbosa, Dr João Lourenço
¹Hospital Da Senhora Da Oliveira, Guimarães, Guimarães, Portugal

EP3 – Femoral torsion

EP3.1 Tibial torsion abnormalities in adults presenting with hip pain

Mr Walid Elnahal¹, Mr Tom Pollard¹, Mr Antonio Andrade¹
¹Royal Berkshire Hospital, Reading, United Kingdom

EP3.2 Measurement of femoral neck anteversion: Are CT measurement methods reproducible?

Mr Mohammedabbas Remtulla¹, Dr Santosh Rai¹, Professor Damian Griffin¹, Mr Wael Dandachli¹
¹University Hospital Coventry And Warwickshire, Coventry, UK

EP4 – Lateral hip pain

EP4.1 Defining minimal clinically important difference and patient acceptable symptom state after isolated endoscopic gluteus medius repair

Dr Kelechi Okoroha¹, Dr Edward Beck¹, Dr Benedict Nwachukwu¹, Mr. Jonathan Rasio¹, Mr. Kyle Kunze¹, Dr Shane Nho¹
¹Chicago, Chicago, United States

EP4.2 Minimum five-year outcomes of endoscopic gluteus medius repair with concomitant arthroscopic treatment for labral tears

Dr Itay Perets¹, Edwin Chaharbakhshi², Dr Yosif Mansor³, Dr Lyall Ashberg⁴, Brian Mu⁵, Dr Benjamin Domb⁶
¹Hadassah Hebrew University Hospital, Jerusalem, Israel, ²Loyola Stritch College of Medicine, Maywood, United States, ³Chaim Sheba Medical Centre at Tel Hashomer, Ramat Gan, Israel, ⁴Atlantis Orthopaedics, Atlantis, United States, ⁵Rosalind Franklin University of Medicine and Science, North Chicago, United States, ⁶American Hip Institute, Chicago, United States

EP4.3 Platelet-rich plasma versus surgery for the management of recalcitrant greater trochanteric pain syndrome: a systematic review
EP4.4 Autologous conditioned serum for the treatment of gluteus medius and minimus tendinopathy: a biological alternative

Dr David Morgenstern¹, Dr Tarek Nasrawy¹, Dr Adi Friedman¹, Dr Leonid Kendel¹, Dr Gurion Rivkin¹, Dr Itai Perets¹
¹Hadassa Medical Centre, Mount Scopus, Israel

EP4.5 Reduction trochanteric osteotomy for GTPS

MD, PhD Marc Tey Pons¹,², MD, PhD Joan Cabello¹,², MD Xavier Lizano², MD Mahmoud Tahoun²
¹Hospital Universitari Del Mar, Barcelona, Spain, ²iMove Traumatologia, Barcelona, Spain

EP4.6 Description of a new open surgical technique for repair of chronic full thickness abductor muscle tears and evaluation mid-term results

Dr Jurek Pietrzak¹, Dr Wesley Verhoogt², Sr Kathleen Nortje¹, Dr Josip Cakic¹
¹University of the Witwatersrand, Johannesburg, South Africa, ²Gauteng Department of Health, Johannesburg, South Africa

EP4.7 Postoperative range of motion protocol following arthroscopic gluteus medius and minimus repair: an anatomic study

Dr Timothy Jackson¹, David Wright², Victor Truong¹, Michelle McGarry¹, Thay Lee¹
¹Orthopaedic Biomechanics Laboratory, Congress Medical Foundation, Pasadena, USA, ²Department of Orthopaedic Surgery, University of California, Irvine, Orange, USA

EP4.8 The Melbourne Hip MRI Score (MHIP Score): Reliability of a novel scoring system for MRI assessment of severity in gluteal tendinopathy

Asst Prof Jane Fitzpatrick¹, Mr Chi Kin Nathan Tso¹, Dr Hussain Khan², Prof Richard O’Sullivan³
¹University Of Melbourne, Melbourne, Australia, ²Australasian College of Sport and exercise Physicians, Melbourne, Australia, ³Monash University, Clayton, Australia

EP4.9 Preoperative predictors of achieving clinically significant athletic functional status after hip arthroscopy for femoroacetabular impingement at minimum 2-year follow-up

Dr Austin Stone², Dr. Edward Beck³, Dr Philip Malloy¹, Dr Jorge Chahla¹, Dr Benedict Nwachukwu¹, Dr William Neal¹, Dr Shane Nho¹
¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, ²Department of Orthopaedic Surgery, University of Kentucky, Lexington, US, ³Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, US

EP5 – Hip instability

EP5.1 Clinical and radiographic presentation of hip instability

Dr Dillon O’Neill¹, Mr. Peter Cannamela¹, Dr Alex Dukas¹, Dr Stephen Aoki¹
¹University Of Utah, Salt Lake City, United States

EP5.2 Functional evaluation in lateral step-down test in dancers with hip pain

Ms André Bento¹, Ms Guilherme Falotico¹, Pt Daniel Araujo¹, Pt Klever Fujikawa¹, Md Bruno Scatigna¹, Prof Moisés Cohen¹
¹Unifesp, Sao Paulo, Brazil
EP5.4 Treatment of hip micro instability with arthroscopic capsular plication: a retrospective case series
Dr Tatiana Charles1, Dr Marc Jayankura1, PhD Edgard Engelman1, Dr Frédéric Laude2
1University Hospital Erasme, Bruxelles, Belgium, 2Clinique du sport, Paris, France

EP5.5 Clinical results after arthroscopic capsular plication for hip micro instability: minimum 5 years follow-up
Doctor Leandro Ejinisman1,2, Katerina Elisman2, Dr Marc Safran2
1Usp, Sao Paulo, Brazil, 2Stanford University, Redwood City, USA

EP5.6 The predictive value of hip labrum size for clinical symptom and anatomical instability of the hip joint
Dr Shingo Hashimoto3, Dr Shinya Hayashi3, Dr Koji Takayama3, Dr Masanori Tsubosaka1, Dr Tomoyuki Kamenga3, Dr Yoshinori Takashima3, Dr Tomoyuki Matsumoto3, Prof Ryosuke Kuroda4
1Orthopedic Department, Kobe University Graduate School of Medicine, Kobe, Japan

EP5.7 Range of motion as a determinant of hip micro instability
Dr Justin Hopkins1, Katia Elisman1, Nicole Segovia1, Andrea Finlay1, Dr Marc Safran1
1Stanford University Medical Centre, Redwood City, United States

EP5.9 The effect of functional movement control on patient reported outcomes in individuals with non-arthritic hip pain
PhD PT Robroy Martin1, PhD ATC Ryan McGovern2, PhD PT Benjamin Kivlan1, MD John Christoforetti2
1Duquesne University, Pittsburgh, United States, 2Texas Health Sports Medicine, Allen, United States

EP5.10 Arthroscopic stabilization of labral tears in patients with hip dysplasia
Dr Jun-ki Moon1, Dr Chul-Ho Kim1, Dr Jae-Youn Yoon1, CNS Mi Yeon Jeong1, Dr Sun Hyung Lee2, Prof. Hee Joong Kim2, Prof. Pil Whan Yoon1
1Asan Medical Centre, Seoul, South Korea, 2Seoul National University Hospital, Seoul, South Korea

EP5.11 Can high intensity change of the joint capsule ligament on MRI be an indicator of hip joint instability?
MD PhD Seigo Oshima1, MD Jiro Nakashiro1
1Matsuyama Red Cross Hospital, Matsuyama city, Japan

EP5.12 Dynamic ultrasound and Platelet-Rich Plasma (PRP) to diagnose and treat hip micro instability
Dr Alexander Poor1, Dr Johannes Roedl1, Dr Adam Zoga2, Dr William Meyers3, Dr Struan Coleman3
1Vincera Institute, Philadelphia, United States, 2Thomas Jefferson University Hospital, Philadelphia, United States, 3Hospital for Special Surgery, New York, United States

EP5.13 Outcomes of arthroscopic surgery in patients with joint laxity and hypermobility syndromes: a systematic review
Dr Haitham Shoman1, Prabhvir Marway1, Mr Vikas Khanduja1
1Cambridge University Hospitals, Addenbrooke's, Apartment 1, United States

EP5.14 Can the FEAR index be used to predict micro instability in patients undergoing hip arthroscopy?
Jeremy Truntzer1, Daniel Hoppe2, Lauren Shapiro3, Marc Safran1
1Stanford University, Redwood City, USA, 2McMasters University, Hamilton, Canada

EP5.15 Generalized joint laxity is not associated with patient-reported outcomes following hip arthroscopic surgery
Dr Lauren Pierpoint1, Dr Hajime Utsunomiya1, Mr Patrick Quinn1, Dr Marc Philippon1
1Steadman Philippon Research Institute, Vail, United States
EP5.16 Borderline acetabular dysplasia and increased femoral anteversion is predictive of worse outcomes in females undergoing hip arthroscopy

**Dr Jennifer Marland**, Mrs Brandy Horton, Dr Hugh West, Dr James Wylie

\textsuperscript{1}The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

EP5.17 Epidemiological profile of dancers with groin pain

**Ms André Bento**, Pt Victor Alves, Pt Pedro Henrique Brandão, Pt Klever Fujikawa, Md Bruno Scatigna, Ms Guilherme Falotico

\textsuperscript{1}Unifesp, Sao Paulo, Brazil

EP6 – Posterior hip pain


Antônio Augusto Guimarães Barros, Rafael Baroni Carvalho, Cláudio Beling Gonçalves Soares, **MD Carlos Cesar Vassalo**, Eduardo Frois Temponi, Victor Atsushi Kasuya Barbosa, Luiz Eduardo Moreira Teixeira, George Grammatopoulos

\textsuperscript{1}Hospital Madre Teresa, Belo Horizonte, Brazil, \textsuperscript{2}The Ottawa Hospital, Ottawa, Canada

EP6.2 Reliable anatomic landmarks for safe surgical arthroscopic treatment of the deep gluteal space

**MD Bruno Capurro**, MD PhD Marc Tey, MD PhD Anna Carrera, MD PhD Fernando Marquês, MD PhD Alfonso León, MD PhD Joan Carles Monllau, MD PhD Francisco Reina

\textsuperscript{1}Hospital del Mar, Universitat Autònoma de Barcelona, , Spain, \textsuperscript{2}Medical Sciences Department. NEOMA Research Group. Universitat de Girona. , , Spain

EP6.3 Sciatic intraneural PRP injection to treat deep gluteal syndrome; bases in experimental animal model, technique and cases study

**MD Nicolas Fiz**, MD Ane Miren Bilbao, MD Juan Azofra, MD Jorge Gaudilla, MD Jaime Oraa, MD Beatriz Aizpurua, MD Leonor Lopez, MD Mikel Sanchez

\textsuperscript{1}Arthroscopic Surgery Unit (uca).

EP6.4 Brace immobilization following surgical repair of proximal hamstring tears does not affect postsurgical outcomes

**Orthopaedic Surgeon Lionel E. Lazaro**

\textsuperscript{1}Miami Orthopaedic and Sports Medicine Institute, Baptist Health South Florida, Miami, United States

EP6.5 Deep Gluteal Syndrome: Case series of posterior endoscopic treatment

Dr Fernando Leal, **Dr Jorge Cruz de Melo**, Enf MAnuel Padin, Dr Francisco Alpoim

\textsuperscript{1}Porto Hip Unit, Porto, Portugal

EP6.6 Ischiofemoral impingement: is there any difference in iliopsoas fixation?

**Raul Lins**, Alessandro Cavalcante, Gilson Falcão, Luis Felipe Elias

\textsuperscript{1}Universidade Federal de Pernambuco, Recife, Brazil, \textsuperscript{2}Hospital Vera Cruz, Campinas, Brazil

EP6.7 The safe zones for arthroscopic proximal hamstring repair: a cadaveric assessment of standard portal placement and relationship to major neurovascular structures

**Dr Charles Su**, Dr Marc Labelle, Dr Lakshmanan Sivasundaram, Dr Shane Nho, Dr Richard Mather III, Dr Michael Salata

\textsuperscript{1}University Hospitals Cleveland Medical Centre, Cleveland, United States, \textsuperscript{2}Rush University Medical Centre, Chicago, United States, \textsuperscript{3}Duke Sports Science Institute, Durham, United States
EP6.8 A new technique for surgical treatment of proximal hamstring tendinopathy in a triathlon athlete
MD Lincoln Paiva Costa¹, Rafael Baroni Carvalho¹, MD Antônio Augusto Guimarães Barros¹, **MD Carlos Vassalo**¹, Bertrand Sonnery-Cottet², Eduardo Frois Temponi¹
¹Hospital Madre Teresa, Belo Horizonte, Brazil, ²Hospital Ramsay-Générale de Santé, Hôpital privé Jean Mermoz; Centre Orthopédique Santy, FIFA Medical Centre of Excellence, Lyon, France

EP6.9 evaluation of the ischiofemoral space: prospective cohort
MD Antônio Augusto Guimarães Barros¹, Rafael Baroni Carvalho¹, Fernanda Bretz Gomes dos Santos¹, **MD Carlos Vassalo**¹, MD Lincoln Paiva Costa¹, Sérgio Gonçalves Pereira Couto¹, Karen Dezontini Bernardes¹, Ana Rita da Glória Soares¹
¹Hospital Madre Teresa, Belo Horizonte, Brazil

EP6.10 Endoscopic treatment of Hamstrings Tendinopathy
**Dr Fernando Leal**¹, Dr Jorge Cruz de Melo¹, Enf Manuel Padin¹, Dr Tiago Pato¹
¹Porto Hip Unit, Porto, Portugal

V6.11 A combined endoscopic and open surgical approach for chronic retracted proximal hamstring avulsion
Md ran atzman¹, Md Eyal Amar², Md Dror Maor², **Md Ehud Rath**²
¹Assuta Ashdod Medical Centre, Ashdod, Israel, ²Sackler Faculty of Medicine and Tel Aviv University, Tel Aviv, Israel

EP7 – The Capsule

EP7.1 Improved clinically meaningful long-term outcomes and higher survivorship after hip arthroscopy with complete vs partial capsular repair for femoroacetabular impingement syndrome
Dr Ian Clapp¹, **Dr Edward Beck**¹, Dr Benedict U. Nwachukwu¹, Dr Kyleen Jan¹, Dr Jorge Chahla¹, Dr Shane J. Nho¹
¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, ²Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US

EP7.2 Two-year patient reported outcomes for patients undergoing revision hip arthroscopy with capsular defects
Dr Jourdan Cancienne¹, Dr Edward Beck¹, Mr. Kyle Kunze¹, Dr Jorge Chahla¹, Dr Sunikom Suppauksorn¹, Katlynn Paul¹, **Mr. Jonathan Rasio**¹, Dr Shane Nho¹
¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

EP7.3 Evaluation of capsular closure versus capsulotomy in patients undergoing hip arthroscopy for femoroacetabular impingement measured by triaxial accelerometry
**Dr Marcos Belemmi**¹, PT Rony Silvestre, MD David Dabed, MD Jorge Hechenleitner, MD Cristian Diaz, PT Macarena Soldan, MD Claudio Rafols, MD Orlando Paredes
¹Clinica Meds, Santiago, Chile

EP7.4 Current trends in hip arthroscopy capsule management: a survey of hip arthroscopists
**Dr Andrea Spiker**¹, Dr Joseph Mitchell¹, Alison Karczewski¹, Dr Ryan Degen², Dr Bryan Kelly³
¹University Of Wisconsin - Madison, Madison, United States, ²Schulich School of Medicine and Dentistry, Fowler Kennedy Sports Medicine, London, Canada, ³Hospital for Special Surgery, New York, United States

V7.5 Anterior capsule reconstruction in native hip instability: A technique guide
**Dr Adrian Kurz**¹, Dr Muzammil Memon¹, Dr Dale Williams¹, Dr Olufemi Ayeni¹
¹McMaster University, Hamilton, Canada
EP8 – Planning, navigation and robotics

EP8.1 Smartphone health data quantifies the impact of femoroacetabular impingement syndrome and the post-operative recovery beyond the ceiling of traditional patient related outcomes measures.
Dr Arash Aframian1,2,3, Ms Shirley Tomdio4,5, Dr Scott Faucett4,5
1MSK Lab, Imperial College, London, UK, 2St George’s, University of London, London, UK, 3Imperial College Healthcare NHS Trust, London, UK, 4George Washington Hospital, Washington, USA, 5The Orthopaedic Care Centre, Washington, USA

EP8.3 A cadaveric study of arthroscopic hip cam impingement treatment: biomechanical comparison of contact pressures between partial versus complete femoral osteoplasty
Dr Sunikom Suppaksorn1, Dr Edward Beck1, Dr Jourdan Cancienne1, Mrs. Elizabeth Shewman1, Dr Jorge Chahla1, Ms. Laura Krivicich1, Mr. Jonathan Rasio1, Dr Shane Nho1
1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

EP8.4 Cadaveric model comparison of cam lesion resection and procedure time using an intraoperative-guide system
Dr Shane J. Nho1, Dr Edward Beck1, Ms. Hayley Taylor2, Laura Krivicich1, Mr. Jonathan Rasio1, Ruth Godbey2, Dr Sunikom Suppaksorn1, Dr Jourdan M. Cancienne1, Mr. William Kaiser2
1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, 2Stryker, San Jose, USA

EP8.5 Comparing radiographic measures of femoral torsion and acetabular anteversion using x ray, MRI, CT scan, and 3d hip map and its correlation to passive range of motion at hip
Dr Drew Ratner1, Dr James Genuario1
1UC Health Steadman Hawkins Clinic Denver, Denver, United States

EP9 – Children and adolescent hips

EP9.1 Parameters related to the distribution of stresses on the proximal femur are associated with, but cannot predict cam morphology in adolescent male soccer players: a 5-year follow-up study
MD Pim van Klij1, MD Rien Heijboer1, MD, PhD Abida Ginai2, MD, PhD Ian Verhaar1, MD, PhD Erwin Waarsing1, MD, PhD Rintje Agricola1
1Department of Orthopaedics, Erasmus University Medical Centre, Rotterdam, the Netherlands, 2Department of Radiology, Erasmus University Medical Centre, Rotterdam, the Netherlands

EP9.2 Hip arthroscopy for femoroacetabular impingement in adolescents is associated with clinically meaningful improvement and low clinical failure: a minimum five-year analysis
Dr Jonathan Rasio, Dr Kyleen Jan1, Dr Edward Beck1, Dr Benedict U. Nwachukwu1, Dr Ian Clapp1, Dr Jorge Chahla1, Dr Anirudh Gowd1, Dr Shane J. Nho1
1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

EP9.3 Outcomes of hip arthroscopy in adolescents with a sub-analysis on return to sport: a systematic review
Sarah Chen1, Dr David Maldonado1, Cammille Go1, Cynthia Kyin1, Dr Ajay Lall1, Dr Benjamin Domb1
1American Hip Institute, Chicago, United States
EP9.4 Multi-centre analysis of sports-related outcomes and return to play of adolescents following hip preservation surgery

**Dr Benjamin Kivlan**, **Dr Rob Roy Martin**, Dr John Christoforetti, Dr Andrew Wolff, Dr Shane Nho, Dr John Salvo, Dr Dean Matsuda, Dr Geoff Van Thiel, Dr Dominic Carreira

1Duquesne University, Pittsburgh, USA, 2Texas Health Sports Medicine, Allen, USA, 3Washington Orthopaedics and Sports Medicine, Washington, USA, 4Rush University Medical Centre, Chicago, USA, 5Rothman Institute, Philadelphia, USA, 6DISC Sports and Spine Centre, Marina del Rey, USA, 7Peachtree Orthopaedics, Atlanta, USA

EP9.5 Traumatic hip dislocations in the pediatric patient: injury patterns, outcomes, and selective hip arthroscopy

**MD Crystal Perkins**, BS Sam Broida, BS Asahi Murata, MD S. Clifton Willimon

1Children’s Healthcare of Atlanta, Atlanta, United States, 2Emory University School of Medicine, Atlanta, United States

EP9.6 What neuromonitoring changes can be expected during hip arthroscopy in the pediatric population?

Dr Trevor Shelton, Mr. Akash Patel, Ms. Lauren Agatstein, **Dr Brian Haus**

1Department of Orthopaedic Surgery, University of California, Davis, Sacramento, United States, 2Shriners Hospital for Children, Northern California, Sacramento, United States

EP10 – The Hip in Sport

EP10.1 Comparing outcomes of elite athletes verse non-athletes undergoing hip arthroscopy for treatment of femoroacetabular impingement syndrome

Ms. Kyleen Jan, Mr. Edward Beck, Mr. Ian Clapp, Dr Benedict Nwachukwu, **Mr. Jonathan Rasio**, Dr Shane Nho

1Rush University Medical Centre, Chicago,

EP10.3 FAI in professional basketball players: return to play, career length, and performance following hip arthroscopy

**Dr J.P. Begly**, Dr Marc Philippon, Dr Patrick Buckley, Dr Hajime Utsunomiya, MPH Karen Briggs

1The Steadman Philippon Research Institute, Vail, United States

EP10.4 Morphological changes of the hip are not correlated with rotation range of hip motion in elite soccer athletes

**Ms André Bento**, Ms Guilherme Falótico, Ms Ronaldo Cunha, Dr Gustavo Arliani, Professor Benno Ejinisman, Professor Moisés Cohen

1Unifesp, São Paulo, Brazil

EP10.5 Hip pathology identified at screening in professional volleyball players

**MD PhDC Georgios Tsikouris**, BS, MS Panagiota Vlaserou, MD M PhDC Ioanna Bolia, MPH, MBA Karen Briggs, MD Marc Philippon

1Athens Orthopaedic and Sports Medicine Centre, Athens, Greece, 2Steadman Philippon Research Institute, Vail, USA

EP10.6 Hip screening protocol using ultrasound and physical examination: results in elite weightlifters

**MD PhDC Georgios Tsikouris**, BS MS Panagiota Vlaserou, MD MS PhDC Ioanna Bolia, MPH MBA Karen Briggs, MD Marc J Philippon

1Steadman Philippon Research Institute, Vail, United States, 2Athens Kolonaki Orthopaedic and Sports Medicine Centre, Athens, Greece
EP10.7 Characterizing the prevalence of cam-type hip impingement in women’s professional ice hockey players

Dr Thomas Youm1, Dr Abigail Campbell1, Samuel Baron1, Dr Darryl Whitney1, Dr Cordelia Carter1, Dr Guillem Gonzalez-Lomas1

1NYU Langone Health, New York, United States

EP10.8 Defining the Minimal Clinically Important Difference (MCID) in athletes undergoing arthroscopic correction of Sports-Related Femoro-Acetabular Impingement (SRFAI). The Percentage of Possible Improvement (POPI)

Mr Patrick Carton1,2, Mr David Filan2

1The Hip and Groin Clinic, Waterford, Ireland, 2UPMC Whitfield, Waterford, Ireland

EP10.9 Return to sport rates and functional outcomes following bilateral hip arthroscopy in high-level athletes

Dr Philip Rosinsky1, Cynthia Kyin1, Dr Jacob Shapira1, Dr David Maldonado1, Dr Ajay Lall1, Dr Benjamin Domb1

1American Hip Institute, Chicago, United States

EP10.10 Anatomic factors affecting turnout in ballet dancers

Dr Angelina Vera1, Mr. David Dong1, Dr Bradley Lambert1, Dr Kevin Varner1, Dr Patrick McCulloch1, Dr Joshua Harris1

1Houston Methodist Hospital, Houston, United States

EP10.11 Treading water as a potential risk factor for femoroacetabular impingement of the hip

JOANNA LANGNER1, MD Garry Gold1, MD Marc Safran2, Marianne Black1, MD James MacKay1,3, PhD Feliks Kogan1

1Radiology, Stanford University, Stanford, United States, 2Department of Orthopaedic Surgery, Stanford, United States, 3Department of Radiology, University of Cambridge, Cambridge, UK

EP10.12 When is it safe to return to sport after hip arthroscopy for femoroacetabular impingement? Implementation of a standardised “Return to Play” test battery to guide rehabilitation

Dr Robert Lawton1, Anja Hönninger1,2, Christian Zantop1,2, Sozaburo Terai1,2, Dominik Hauner1,2, Jakob Schlachtner1,2, Priv. Doz. Dr Med. Thore Zantop1, Priv. Doz. Dr Med. Stefan Fickert1

1Sporthopaedicum, Straubing, Germany, 2Return to Play, Straubing, Germany

EP10.13 Clinical and ultrasound examinations of the dancer's hip

Michaela O'Connor1, Gabrielle K Steinl1, Dr Jamie Confino1, Connor Crutchfield1, Dr Christine Townsend1, Dr Zachary Bailowitz1, Dr Julia Iafrate1, Dr Christopher Visco, Dr T. Sean Lynch1

1Columbia University, New York, United States

EP10.14 The demographic characteristics of a large cohort of soccer players undergoing primary hip arthroscopy for femoroacetabular impingement: a gender specific and competitive level specific analysis

Dr Niv Marom1, Mr Matthew Dooley1, Mr Joost Burger1, Dr Anil Ranawat1, Dr Bryan Kelly1, Mr Danyal Nawabi1, Dr Struan Coleman1

1Hospital for Special Surgery (HSS), New York, United States

EP10.15 Effect of timing of hip arthroscopy on player return, career length, and competition-based performance for American professional athletes

Michael Schallmo1, Hunter Yancey1, Thomas Fitzpatrick1, T. David Luo1, Alejandro Marquez-Lara1, Allston Stubbs1

1Wake Forest School of Medicine, Winston-Salem, United States
Mr Yash Singh1,4, Ms Rachel Elwood1,4, Mr Osama Elhakeem1,4, Mr Ori Weiss3,4, Mr Vikas Khanduja1,2,4
1University Of Cambridge Clinical School, Addenbrookes, Cambridge, United Kingdom, 2Department of Orthopaedic Surgery, Addenbrookes, Cambridge, United Kingdom, 3Department of Orthopaedic Surgery, Meir medical centre, Kfar-Saba, Israel, 4Young Adult Hip Surgery, Department of Orthopaedics, Addenbrookes, Cambridge, United Kingdom

EP10.17 The effect of an eight-week rhythmic gymnastics-based power-flexibility program on the lower limb flexibility and power of contemporary dancers
Ms Lauren Skopal1, Associate Professor Lauren Netto2, Associate Professor Brad Aisbett1, Associate Professor Amir Takla3,4, Mr Troy Castricum1
1Deakin University, Melbourne, Australia, 2Curtin University, Perth, Australia, 3University of Melbourne, Melbourne, Australia, 4Swinburne University of Technology, Melbourne, Australia

EP10.18 Vail hip sports test as a measure of functional strength
Dr Matthew Crawford1, Mr. James Spratt1, Dr Lauren Pierpoint1, Mrs. Karen Briggs1, Dr Marc Philippon1
1Steadman Philippon Research Institute, Vail, United States

EP10.19 The outcomes and return to sports rate in elite athletes following hip arthroscopic surgery—A systematic review
Rachel Elwood, Dr Ori Weiss, Osama El-Hakeem, Yash Singh, Dr Vikas Khanduja
1Department of Trauma and Orthopaedics, Addenbrooke's Hospital, Cambridge University Hospitals NHS Foundation Trust, Cambridge, England

EP10.20 Outcomes of FAI correction in competitive and recreational athletes: results from a prospective multicentre cohort
Dr Robert Westermann1, Dr Jeff Nepple2, ANCHOR GROUP2, Dr Christopher Larson3
1University Of Iowa, Iowa City, 2Washington University, St Louis, MO, 3Twin Cities Orthopaedics, Minneapolis, MN

EP10.21 Non-contact anterior cruciate ligament tears during return to sport following hip arthroscopy for femoroacetabular impingement (FAI)
Dr James Wylie1, Mrs Brandy Horton1, Dr Hugh West1, Dr Jennifer Marland1
1The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

EP10.22 Return to basketball after hip arthroscopy: minimum two-year follow-up
Dr Austin Chen1, Brian Mu2, Cammille Go3, Dr Victor Ortiz-Declet1, Dr David Maldonado3, Dr Benjamin Domb3
1BoulderCentre for Orthopaedics, Boulder, United States, 2Rosalind Franklin University of Medicine and Science, North Chicago, United States, 3American Hip Institute, Chicago, United States, 4Kayal Orthopaedics, Westwood, United States

EP10.23 The influence of Cam and Pincer morphology on dynamic postural control in professional soccer athletes: an observational cross-sectional study
Ms André Bento1, Ms Guilherme Falótico1, Ms Ronaldo Cunha1, Pt Klever Fujikawa1, Dr Gustavo Arliani1, Professor Moisés Cohen1
1Unifesp, São Paulo, Brazil

EP11 – Labral repair

EP11.1 The hip labrum reconstruction: indications and outcomes—an updated systematic review
Latifah Al Mana1, Ryan Coughlin1, Veeral Desai1, Nicole Simunovic1, Andrew Duong1, Associate Professor Olufemi Ayeni1
1Mcmaster University, Hamilton, Canada
EP11.2 Effect of CAM femoroacetabular impingement (FAI) surgical correction on acetabular labrum seal
Dr Suzan Bsat1, Dr Hanspeter Frei2, Dr Paul Beaulé1
1The Ottawa Hospital, Ottawa, Canada, 2Carleton University, Ottawa, Canada

EP11.3 Return to sport and athletic function in an active population following primary arthroscopic labral reconstruction
Dr David Maldonado1, Sarah Chen1, Dr Ajay Lall1, Dr Philip Rosinsky1, Dr Rafael Walker-Santiago1, Dr Jacob Shapiro1, Dr Benjamin Domb1
1American Hip Institute, Chicago, United States

EP11.4 Hip arthroscopy and labral reconstruction: short-term outcomes with circumferential and segmental labral reconstruction: A systematic review
Dr David Maldonado1, Cynthia Kyin1, Dr Rafael Walker-Santiago1, Dr Jacob Shapiro1, Dr Philip Rosinsky1, Dr Ajay Lall1, Dr Benjamin Domb1
1American Hip Institute, Chicago, United States

EP11.5 Outcomes of hip labral reconstruction versus labral repair: A systematic review.
Dr David Maldonado1, Sarah Chen1, Dr Philip Rosinsky1, Dr Jacob Shapiro1, Dr Rafael Walker-Santiago1, Dr Ajay Lall1, Dr Benjamin Domb1
1American Hip Institute, Chicago, United States

EP11.6 Radiologic and demographics risk factors for labral reconstruction versus repair in primary hip arthroscopy. A predictive model.
Dr David Maldonado1, Jeffrey Chen1, Dr Ajay Lall1, Dr Benjamin Domb1
1American Hip Institute, Chicago, United States

EP11.7 Two-year outcomes of hip arthroscopic surgery with circumferential labral reconstruction
Dr David Maldonado1, Cynthia Kyin1, Dr Rafael Walker1, Dr Jacob Shapiro1, Dr Philip Rosinsky1
1American Hip Institute, Chicago, United States

EP11.8 The use of a mini all suture anchor reduces post-operative psoas irritation in patients undergoing hip arthroscopy for femoroacetabular impingement.
Mr Paul Haggis1, Mr Tony Andrade1
1Royal Berkshire Hospital, Reading, United Kingdom

EP11.9 The everted native acetabular labrum: description of patho-anatomy, MRI findings, and surgical treatment
Doctor Matthew Kraeutler1, Doctor Laura Vogel-Abernathie2, Doctor Mary Jesse3, Doctor Corey Ho3, Doctor Omer Mei-Dan2
1St. Joseph’s University Medical Centre, Paterson, United States, 2University of Colorado School of Medicine, Department of Orthopaedics, Aurora, United States, 3University of Colorado School of Medicine, Department of Radiology, Aurora, United States

EP11.10 Mechanical properties of tensile strength of ITB graft, a promising graft for labral reconstruction of the hip
Dr Fajar Mahda Spot Fajar Mahda1, Dr D R Sasetyo2
1Indonesia Hip and Knee Society (IHKS), Jl. Angsana 1 No.9 Rt/rw 003 Pejaten Timur, Pasar Minggu, Jakarta Selatan, Indonesia, 2Dr. Soeradji Tirtonegoro Hospital, Klaten, Indonesia

EP11.11 Outcomes following arthroscopic hip labral reconstruction: a systematic review and meta-analysis
Mr Michael Rahl1, Mr Collin LaPorte1, Ms Gabrielle Steinl2, Ms Michaela O’Connor2, Dr T. Sean Lynch2, Dr Travis Menge1
1Michigan State University/Spectrum Health, Grand Rapids, United States, 2Columbia University, New York, United States
EP11.12 Tensor fascia lata autograft for labral reconstruction: how much is too much?
MD Ginanjar B. Prathama1, MD Dadang Rona Sasetyo2
1Indonesian Hip and Knee Fellowship Program, South Jakarta, Indonesia, 2Dr. Soeradji Tirtonegoro General Hospital, Klaten, Indonesia

EP11.13 Circumferential labral reconstruction for femoroacetabular impingement in athletes: Return to sport and technique
MD John Scanialiato1, Jesse Chasteen3, Catherine Salfiti2, MD Andrew Wolff2
1Texas Tech University of The Health Sciences, El Paso, United States, 2Washington Orthopaedics and Sports Medicine, Washington, United States, 3Uniformed Services University School of Medicine, Bethesda, United States

EP11.14 Outcomes following labral augmentation using ITB allograft versus autograft
Dr Travis Dekker1, Dr Lauren Pierpoint1, Mr. James Spratt1, Dr William Grantham1, Dr Marc Philippon1
1Steadman Philippon Research Institute, Vail, United States

EP11.15 Influence of the labrum on hip chondrolabral mechanics during activities of daily living
Jocelyn Todd1, Dr Travis Maak1, Dr Jeffrey Weiss1
1University Of Utah, Salt Lake City, United States

EP11.16 Indications and outcomes of arthroscopic labral reconstruction of the hip—a systematic review
Dr Nikunj Trivedi1, Dr Lakshmanan Sivasundaram1, Dr Charles Su1, Dr Derrick Knapik1, Dr Chad Mather III2, Dr Shane Nho3, Dr Michael Salata1
1University Hospitals, Cleveland Medical Centre, Cleveland, United States, 2Duke University Medical Centre, Durham, United States, 3Rush University Medical Centre, Chicago, United States

EP11.17 Biomechanical evaluation of hip labral insufficiency using a 6 degrees of freedom robotic system: A cadaveric study
Mr Alex Brady1, Dr Hajime Utsunomiya1, Mr Joseph Krob1, Mr Samuel Rosenberg1, Mr Bryson Kemler1, Mr Grant Dornan1, Dr Marc Philippon1
1Steadman Philippon Research Institute, Vail, United States

EP11.18 The hip suction seal: the effect of pincer resection, chondrolabral junction separation, and labral repair/refixation on hip distractive stability
Dr Hajime Utsunomiya1, Mr Hunter Storaci1, Mr Samuel Rosenberg1, Mr Bryson Kemler1, Mr Grant Dornan1, Mr Alex Brady1, Dr Marc Philippon1
1Steadman Philippon Research Institute, Vail, United States

EP11.19 The hip suction seal: the role of acetabular labral height on hip distractive stability
Mr Hunter Storaci1, Dr Hajime Utsunomiya1, Mr Bryson Kemler1, Mr Samuel Rosenberg1, Mr Grant Dornan1, Mr Alex Brady1, Dr Marc Philippon1
1Steadman Philippon Research Institute, Vail, United States

EP11.20 clinical outcomes of arthroscopic repair of acetabular labral tears
MD Carlos Vassalo1, Rafael Baroni Carvalho1, MD Antônio Augusto Guimarães Barros1, MD Lincoln Paiva Costa1, MD Euler de Carvalho Guedes1, MD, PhD Marco Antônio Percope de Andrade2
1Hospital Madre Teresa, Belo Horizonte, Brazil, 2Departamento do Aparelho Locomotor da Faculdade de Medicina da UFMG, Belo Horizonte, Brazil
EP12.1 Intraoperative monitoring and intra-abdominal fluid extravasation during hip arthroscopy
Dr Bernardo Aguilera-Bohórquez, Ms Erika Cantor, Dr Orlando Ramos-Cardozo, Dr Mauricio Pachón-Vasquez
1Centro Médico Imbanaco De Cali S.a, Cali, Colombia, 2Universidad Javeriana de Cal, Cali, Colombia
EP12.2 Traction related complications using a post in hip arthroscopy. What alternatives do we have?
A systematic review
Mr. Carlos R. Arriaza, Mr. Carlos Suarez-Ahedo, Mr. Luis Perez-Carro
1Hospital Herrera Llerandi, Guatemala City, Guatemala, 2Instituto Nacional de Rehabilitacion, Tlalpan, Mexico, 3Hospital Clínica Mompia, Mompia, España

EP12.3 Preoperative duration of symptoms is associated with outcomes five years after hip arthroscopy for femoroacetabular impingement syndrome
Dr Benedict Nwachukwu, Dr Edward Beck, Mr. Ian Clapp, Mr. Kyle Kunze, Dr Jorge Chahla, Mr. Jonathan Rasio
1Steadman Philippon Research Institute, Vail, United States

EP12.4 Factors associated with primary hip arthroscopy failure in the young female population
Dr Ioanna Bolia, Dr Ashley Payne, Ms Karen Briggs, Dr Marc Philippon
1Steadman Philippon Research Institute, Vail, United States

EP12.5 Multimodal Intra Operative Monitoring (IOM) of sciatic and femoral nerves during Periacetabular Osteotomy (PAO): A novel method
Dr Federico De Meo, Dr Alejandra Climent, Dr Carломagno Cardenas, Dr Vittorio Bellotti, Dr Emanuele Astarita, Dr Gabriel Chacon, Dr Luis Ramirez, Dr Pietro Cavaliere, Dr Manuel Ribas
1Istituto Ortopedico del Mezzogiorno Franco Scalabrino, Messina, Italy, 2Intraoperative Neurophysiology Unit Department of Pediatric Neurology, Hospital Sant Joan de Deu, Barcelona, Spain, 3Hip Unit ICATME, Quiron Dexeus, Barcelona, Spain

EP12.6 Identifying the most successful procedures in hip arthroscopy: A multivariate analysis of 1,000 surgeries to assess which procedures work best, and which procedures need improvement
Dr Jon Hammarstedt, Joseph Laseter, Dr Asheesh Gupta, Dr John Christoforetti, Dr Ajay Lal, Dr Benjamin Domb
1Allegheny General Hospital, Pittsburgh, United States, 2Case Western Reserve University School of Medicine, Cleveland, United States, 3Nova Orthopaedic & Spine Care, Woodbridge, United States, 4Texas Health Sports Medicine at Allen, Allen, United States, 5American Hip Institute, Chicago, United States

EP12.7 Unplanned readmissions following hip arthroscopy: incidence and risk factors
Dr Jerry Du, Dr Derrick Knapik, Dr Nikunj Trivedi, Dr Lakshmanan Sivasundaram, Dr Richard Mather III, Dr Shane Nho, Dr Michael Salata
1University Hospitals Cleveland Medical Centre/ Case Western Reserve University, Cleveland, United States of America, 2MetroHealth Medical Centre, Cleveland, United States of America, 3Duke University School of Medicine, Durham, United States of America, 4Section of Young Adult Hip Surgery, Division of Sports Medicine, Department of Orthopaedic Surgery, Rush Medical College of Rush University, Rush University Medical Centre, Chicago, United States of America

EP12.8 Sexual function after hip arthroscopy for femoroacetabular impingement syndrome with capsular management: position matters
Dr Hannah Morehouse, Dr Kyle Sochacki, Dr Shane Nho, Dr Joshua Harris
1Houston Methodist Hospital, Houston, United States, 2Rush University Medical Centre, Chicago, United States
EP12.9 Rapidly destructive arthrosis of the hip two months after hip arthroscopy: A case report
Mr Kourosh Kalachi, Dr Scott Koenig, Dr Farshad Adib
1University of Maryland School of Medicine (UMSOM), Baltimore, United States of America

EP12.10 Incidence and risk factors for venous thromboembolism following hip arthroscopy: A population-based study
Mr. Zain Khazi1, Ms. Qiang An1, Dr Kyle Duchman1, Dr Robert Westermann1
1University of Iowa Hospitals and Clinics, Iowa City, United States

EP12.11 Pain management and activity tolerance in the early postoperative period following post-less low-pressure hip arthroscopy
Dr Matthew Kraeutler1, Ms. Laylaa Ramos2, Dr K Welton3, Dr Tigran Garabekyan1, Dr Omer Mei-Dan2
1St. Joseph’s University Medical Centre, Paterson, United States, 2University of Colorado School of Medicine, Aurora, United States, 3MultiCare Orthopaedics & Sports Medicine, Auburn, United States, 4Southern California Hip Institute, North Hollywood, United States

EP12.12 Hip Arthroscopy in the lateral position using a Post-less Distraction System
MD Michael Muldoon1,2, Research Coordinator Robert Healey1,2
1Hip Preservation Centre of Excellence, San Diego, United States, 2Sharp Healthcare, San Diego, United States

EP12.13 Outcomes of revision hip arthroscopy: A systematic review and meta-analysis
Michaela O’Connor1, Gabrielle K. Stein1, Dr Ajay Padaki1, Dr Kyle Duchman2, Dr Robert Westermann2, Dr T. Sean Lynch1
1Columbia University, New York, United States, 2University of Iowa Health Care, Iowa City, United States

EP12.14 Patient perception of femoroacetabular impingement
Dr Hasani Swindell1, Michaela O’Connor1, Connor Crutchfield1, Dr Jamie Confino1, Dr T. Sean Lynch1
1Columbia University, New York, United States

EP12.15 Post-operative oral thromboprophylaxis in at risk patients undergoing hip arthroscopy mitigates the risk with a low side-effect profile: A single surgeon series in a developing country.
Dr Wesley Verhoogt1, Dr Jurek Pietrzak2, Sr Kathleen Nortje2, Dr Josip Cakic2
1Gauteng Department of Health, Johannesburg, South Africa, 2University of the Witwatersrand, Johannesburg, South Africa

EP12.16 Association between sadness and symptom severity in pediatric and adolescent patients with hip pain
Kurt Wagner1, William C. Searls1, Meagan J. Sabatino1, Dr Heather M. Richard1, Dr David A. Podeszwa1, Dr Daniel J. Sucato1, Dr Henry B. Ellis1
1Texas Scottish Rite Hospital for Children, Dallas, United States, 2UT Southwestern Medical Centre, Dallas, United States

EP12.17 Surgeon accuracy of predicting patient-reported outcome and satisfaction scores in patients undergoing hip arthroscopy
Douglas Zaruta1, Raymond Kenney1, Joseph Schaffer1, Dan Kleehammer1, Molly McCann1, David Lawton1, Kelly Adler1, Brian Giordano1
1University of Rochester Medical Centre, Rochester, United States

EP12.18 The “Salvage” periacetabular osteotomy: Early outcomes in patients treated for iatrogenic hip instability
Christopher Brusalis1, Jeffrey Peck1, Geoffrey Wilkin2, Robert Buly1, Danyal Nawabi1, Anil Ranawat1, Bryan Kelly1, Ernest Sink1
1Hospital For Special Surgery, New York, United States, 2The Ottawa Hospital, Ottawa, Canada
EP13 – FAI surgery

EP13.1 Intra-articular platelet rich plasma injection after arthroscopic hip labral repair: Assessment of pain and function
Dr Mohamed Abd El-Radi1, Prof. Hatem Galal Said1, Dr Jesús Más Martínez2, Prof. Mohamed Abdel Hamid1, Dr Javier Sanz-Reig3, Dr Oliver Marin-Peña3, Prof. Hesham El-Kady1
1Assiut University Hospitals, Assiut, Egypt, 2Clinica Vistahermosa, Alicante, Spain, 3Hospital Universitario Infanta Leonor, Madrid, Spain

EP13.2 Health-related quality of life after hip arthroscopy for femoroacetabular impingement: A systematic review and meta-analysis
Chetan Gohal1, Saif Shamshoon1, Muzammil Memon1, Jeffrey Kay1, Nicole Simunovic1, Filippo Randelli2, Associate Professor Olufemi Ayeni11McMaster University, Hamilton, Canada, 2Istituto di Ricovero e Cura a Carattere Scientifico (IRCCS), Milan, Italy

EP13.3 Predictors of outcomes following hip arthroscopy for femoroacetabular impingement: A systematic review
Olawale Sogbein2, Ajay Shah1, Jeffrey Kay1, Muzammil Memon1, Nicole Simunovic1, Etienne Belzile3, Associate Professor Olufemi Ayeni11McMaster University, Hamilton, Canada, 2Laurentian University, Sudbury, Canada, 3Laval University, Quebec, Canada

EP13.4 FAI treatment with mechanical hip arthroscopy augmented with biological therapy: a prospective controlled study
Dr Ali Bajwa1,2, Mr Richard Villar1,2
1Princess Grace Hospital, London, United Kingdom, 2Villar Bajwa Practice, Cambridge and London, United Kingdom

EP13.5 Lateral cams: How important are the vessels?
Ms. Lindsay Barter1, Dr Nickolas Boutris1, Dr Luis Pulido1, Dr Thomas Ellis2, Dr Shane Nho3, Dr Joshua Harris1
1Department of Orthopaedics and Sports Medicine, Houston, United States, 2Orthopedic One, Upper Arlington, United States, 3Midwest Orthopaedics at Rush, Chicago, United States

EP13.6 Functional and clinical outcomes of patients undergoing revision hip arthroscopy with borderline hip dysplasia at two-year follow-up
Dr Jourdan Cancienne1, Dr Edward Beck1, Mr. Kyle Kunze1, Dr Jorge Chahla1, Dr Sunikom Suppauksorn1, Kaitlynn Paul2, Mr. Jonathan Rasio1,2, Dr Shane Nho1
1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

EP13.7 Preoperative hip strength is an independent predictor of achieving short-term clinically significant outcome after hip arthroscopy for femoroacetabular impingement syndrome
Dr Edward Beck1, Ms. Laura Krivicich1, Dr Benedict Nwachukwu2, Ms. Kyleen Jan1,2, Dr Sunikom Suppauksorn2, Dr Philip Malloy2, Mr. Jonathan Rasio1,2, Dr Shane Nho1
1Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, United States, 2Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

EP13.9 Successful arthroscopy for pincer-morphology: 2-year outcomes in patients with acetabular over coverage compared with matched controls
Mr Matthew J Brick1, Claudia R Brick2, Dr Catherine J Bacon3
1Orthosports North Harbour, Auckland, New Zealand, 2Monash University, Melbourne, Australia, 3Faculty of Medicine and Health Sciences, University of Auckland, Auckland, New Zealand
EP13.10 Factors associated with failure following hip arthroscopy for FAI in patients over 40

Dr Ioanna Bolia,
Ms Karen Briggs,
Dr Marc Philippon

1Steadman Philippon Research Institute, Vail, United States

EP13.11 The evolution of symptomatic versus asymptomatic femoroacetabular impingement: Case report of a professional hockey player with a ten-year follow-up

Dr Patrick Buckley,
Dr Ioanna Bolia,
Karen Briggs, MPH, MBA,
Dr Marc J. Philippon

1University Orthopaedic Associates and Robert Wood Johnson University Hospital, Wall Township, United States,
2Steadman Philippon Research Institute, Vail, United States

EP13.12 Arthroscopic FAI treatment with initial access to the peripheral compartment. Outcomes with a minimum two years follow up.

Dr Pedro Dantas,
Dr Sergio Gonçalves,
Dr Antonio Camporese,
Dr Vasco Mascarenhas,
Dr Oliver Marín-Peña

1Hospital Cuf Descobertas, Lisboa, Portugal,
2Hospital Curry Cabral, Lisboa, Portugal,
3Policlinico Abano Terme, Padova, Italy,
4Hospital da Luz, Lisboa, Portugal,
5Hospital Infanta Leonor, Madrid, Spain


Dr Yoshi Pratama Diaja,
Prof. Yong Chan Ha,
Prof. Sujin Kim,
Prof. Guen Young Lee

1Department of Orthopaedics and Traumatology, Fatmawati General Hospital, Jakarta, Indonesia,
2Department of Orthopaedic Surgery, Chung-Ang University College of Medicine, Seoul, Korea,
3Department of Radiology, Chung-Ang University College of Medicine, Seoul, Korea

EP13.14 Tracing outcomes and survivorship against age and gender in hip arthroscopy surgery

Dr David Maldonado,
Cammille Go,
Dr Ajay Lall,
Dr Benjamin Domb

1American Hip Institute, Chicago, United States

EP13.15 Anterior intra- and extraarticular sub spine impingement in patients with pincer FAI due to protrusio acetabuli and acetabular retroversion

Dr Med. Till Lerch,
Florian Schmaranzer,
Inga Todorski,
Simon Steppacher,
Guoyan Zheng,
Moritz Tannast,
Klaus Siebenrock

1Dept. of orthopaedic surgery, Inselspital Bern, University of Bern, Bern, Switzerland

EP13.16 Labral repair in femoroacetabular impingement; comparing patient outcomes between two different knotless suture anchors

Mr Paul Haggis,
Mr Tony Andrade

1Royal Berkshire Hospital, Reading, United Kingdom

EP13.17 Compressive cryotherapy is better than cryotherapy alone in reducing pain after hip arthroscopy for femoroacetabular impingement

MD Ianiv Klaber,
MD Eugene Greeff,
MD John O'Donnel

1Pontificial Catholic University of Chile, Santiago, Chile,
2Netcare Rosebank Hospital, Johannesburg, South Africa,
3Swinburne University, Melbourne, Australia,
4Hip Arthroscopy Australia, Melbourne, Australia

EP13.18 Impairment of sexual life in female patients with femoroacetabular impingement. A qualitative-quantitative study

Ms. Maria Jesus Lira,
MD Ianiv Klaber,
Ms Pamela Mery,
MD Daniel Schweitzer,
MD Claudio Rojas

1Pontificia Universidad Catolica De Chile, Santiago, Chile,
2Hospital del Tabajador de Santiago, Santiago, Chile,
3Clínica Dávila, Santiago, Chile
EP13.19 Acetabular morphology predicts early conversion to arthroplasty following isolated hip arthroscopy for femoroacetabular impingement

Dr Brian Giordano1, Dr Benjamin Kuhns2, Dr Itay Perets2, Leslie Yuen2, Dr Benjamin Domb2
1University Of Rochester Medical Centre Department of Orthopaedics & Rehabilitation, Rochester, United States, 2American Hip Institute, Hinsdale, United States

EP13.20 Proximal over-resection during femoral osteochondroplasty negatively affects the distractive stability of the hip joint

Orthopaedic Surgeon Lionel E. Lazaro1, Orthopaedic Surgeon Daniel P. Lim2, Trevor J. Nelson3, Sam A. Eberlein3, Orthopaedic Surgeon Michael B. Banffy2, PhD Melodie F. Metzger3
1Miami Orthopaedic and Sports Medicine Institute, Baptist Health South Florida, Miami, United States, 2Kerlan-jobe Orthopaedic Clinic, Los Angeles, United States, 3Cedar Sinai, Los Angeles, United States

EP13.21 Arthroscopic outcomes as a function of acetabular coverage from a large hip arthroscopy study group

Dr Dean Matsuda1, Dr Benjamin Kivlan2, Dr Shane Nho3, Dr Andrew Wolff4, Dr Jonathan Salvo5, Dr John Christoforetti6,7, Dr Thomas Ellis8, Dr Dominic Carreira9
1DISC Sports and Spine, Marina del Rey, United States, 2Duquesne University, Pittsburgh, United States, 3Rush Medical Centre, Chicago, United States, 4Washington Orthopaedics and Sports Medicine, Washington, United States, 5Rothman Institute, Philadelphia, United States, 6Texas Health Presbyterian Hospital Allen, Allen, United States, 7Allegheny Health Network, Pittsburgh, United States, 8Orthopedic ONE, Dublin, United States, 9Peachtree Orthopaedics, Atlanta, United States

EP13.22 Hip Arthroscopy for Femoroacetabular Impingement and Labral Tears: Minimum 2-year Outcomes

Dr Jun-ki Moon1, Dr Chul-Ho Kim1, Dr Jae-Youn Yoon1, CNS Mi Yeon Jeong1, Dr Sun Hyung Lee2, Prof. Hee Joong Kim3, Prof. Pil Whan Yoon3
1Asan Medical Centre, Seoul, South Korea, 2Seoul National University Hospital, Seoul, South Korea

EP13.23 Five-year outcomes after arthroscopic treatment for femoroacetabular impingement syndrome

Dr Axel Öhlin1, Dr Mattias Ahldén1, Dr Ida Lindman1, Dr Páll Jónasson1, Dr Neel Desai1, Dr Adad Baranto1, Dr Olufemi R. Ayeni2, Dr Mikael Sansone1
1University Of Gothenburg, Department of Orthopaedics, Goteborg, Sweden, 2McMaster University, Division of Orthopaedic Surgery, Department of Surgery, Hamilton, Canada

EP13.24 Simultaneous acetabular labrum reconstruction and remplissage of the femoral head-neck junction. Technical note

MD PHD Luis PEREZ-CARRO1, RN Natalia Fernandez-Escadjillo1, RN Linda Fernandez-Escadjillo1, MD Carlos Rodrigo Arriaza-Gutierrez1, MD Manuel Sumillera-Garcia1, MD PHD Ana Alfonso-Fernandez1
1Hospital Clinica Mompia Santander Spain, Santander, España

EP13.25 Hip arthroscopy for femoroacetabular impingement (FAI) patients with self-reported allergies: Do multiple allergies have an effect on outcome?

MD Nicholas Ramos1, MD Michael Gerhardt1, MD Michael Banffy1
1Kerlan Jobe Institute, Los Angeles, United States

EP13.26 Treatment of Impingement Cysts Using a Bioabsorbable Suture Anchor

Dr Brian Samuelsen1, Mr. James Spratt1, Dr Ashley Payne1, Dr Marc Philippon1
1Steadman Philippon Research Institute, Vail, United States
EP13.27 Sub spine type 2 is predictable by anteroposterior and false profile radiographic views: A cohort study

Dr Osamu Miyamoto¹, Dr Yoichi Murata¹, Dr Hajime Utsunomiya¹, Dr Akihisa Hatakeyama¹, Dr Marc Philippon², Dr Soshi Uchida¹
¹Wakamatsu hospital of University of Occupational and Environmental Health, Kitakyushu, Japan, ²Steadman Philippon Research Institute, Vail, United States

EP13.28 Patients with borderline hip dysplasia achieve clinically significant outcome after arthroscopic femoroacetabular impingement surgery: A case-control study with minimum 2-year follow-up

Dr Edward Beck¹, Dr Benedict Nwachukwu², Dr Jorge Chahla², Ms Kyleen Jan¹, Dr Timothy Keating², Dr Shane Nho³, Mr Jonathan Rasio²¹Department of Orthopaedic Surg, Wake Forest School of Medicine, Winston-Salem, United States, ²Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

EP13.29 - Clinical observation of the effect of hip arthroscopic surgery on femoral acetabular impingement syndrome (FAI) in elderly patients

Dr Chunbao Li¹, Dr Feng Gao¹, Dr Zhigang Wang¹, Dr Yujie Liu¹, Dr Zhongli Li¹
¹The Sport Medicine Centre of orthopaedics department of the Chinese PLA General Hospital (301 hospital), Beijing, China

E14 – Hip-spine syndrome HSPC

EP14.1 Hip spine extension syndrome: Physical examination

MD Andres Campos-Mendez², DO Hal David Martin¹
¹Baylor Scott & White Hip Preservation Centre, Dallas, United States of America, ²Instituto Nacional de Rehabilitación, Mexico City, Mexico

EP14.2 A finite element analysis of ischiofemoral impingement, femoroacetabular impingement, and femoral version to investigate the effects on the lumbar spine

Anthony Khoury¹², Tejas Mhetre², Hal Martin¹
¹Hip Preservation Centre, Baylor University Medical Centre at Dallas, Dallas, United States, ²Bioengineering Department, University of Texas at Arlington, Arlington, United States

EP14.3 Diagnostic imaging prevalence of sacroiliac joint abnormalities and clinical outcomes in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome

Dr Vignesh Krishnamoorthy¹, Dr Edward Beck¹, Dr Jourdan Cancienne¹, Ms. Laura Krivicich¹, Dr Sunikom Suppaucksorn¹, Dr Olufemi Ayeni², Mr. Jonathan Rasio¹, Dr Shane Nho¹
¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, ²Department of Orthopaedic Surgery, McMaster University, Hamilton, Canada

EP15 – Cartilage injury and repair

EP15.1 Factors predicting acetabular chondral damage in femoroacetabular impingement

Md, MSc Diren Arsoy³, Md Kenneth Milligan¹, Md Sujith Konan², Md Johan D. Witt²
¹Yale University, School of Medicine, Department of Orthopaedic Surgery, New Haven, United States, ²University College London Hospital, Department of Trauma and Orthopaedic Surgery, London, United Kingdom
EP15.2 Prevalence and clinical implications of chondral injuries after hip arthroscopy for femoroacetabular impingement syndrome
Dr Jorge Chahla2, Dr Edward Beck1, Dr Kelechi Okoroha2, Dr Jourdan Cancienne2, Mr. Kyle Kunze2, Mr. Jonathan Rasio2, Dr Shane Nho2
1Department of Orthopaedic Surgery, Wake Forest School of Medicine, Chicago, United States, 2Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

EP15.3 Do larger acetabular chondral defects portend inferior outcomes in patients undergoing arthroscopic acetabular microfracture? a matched-controlled study
Edwin Chaharbakhshi1, Dr David Hartigan2, John Spencer1, Dr Itay Perets3, Dr Ajay Lall4, Dr Benjamin Domb4
1Loyola Stritch College of Medicine, Maywood, United States, 2Mayo Clinic, Phoenix, United States, 3Hadassah Hebrew University Hospital, Jerusalem, Israel, 4American Hip Institute, Chicago, United States

EP15.4 Cartilage register of German speaking countries 4-year results of the module hip
PD Dr med. Stefan Fickert1, Dr med. Wolfgang Zinser2, Dr med. Christian Sobau3, Dr med. Johannes Weber4
1Sporthopaedicum Straubing Berlin Regensburg München, Straubing, Germany, 2St. Vinzenz Clinic, Dinslaken, Germany, 3ARCUS Klinik, Pforzheim, Germany, 4Dept. of Trauma Surgery, University Hospital, Regensburg, Germany

EP15.5 Magnetic resonance arthrography of the hip with hyaluronic acid as contrast medium. interobserver reliability in the diagnosis of articular cartilage lesions and labral tears.
Drs Elisabetta Nocerino1, Dr Daniele Priano1, Dr Federico Zaottini1, Dr Alberto Fioruzzi1, Dr Giacomo Folli1, Drs Daniela Maglione1, Drs Sara Favilla1, Dr Filippo Randelli1
1Irccs Policlinico San Donato, San Donato Milanese, Italy

EP15.6 Demographic and radiographic factors associated with intra-articular hip cartilage injury: A cross-sectional study of 1511 hip arthroscopy procedures
Mr. Lasse Ishøi1, Ass. Professor Kristian Thorborg1, Mr. Otto Kraemer1, Mr. Bent Lund2, Mr. Bjarne Mygind-Klavsen3, Prof. Per Holmich4
1Sports Orthopaedic Research Centre – Copenhagen (SORC-C), Department of Orthopaedic Surgery, Copenhagen University Hospital, Amager-Hvidovre, Denmark, Hvidovre, Denmark, 2Department of Orthopaedics, Horsens Regional Hospital, Denmark, Horsens, Denmark, 3Division of Sports Traumatology, Department of Orthopaedics, Aarhus University Hospital, Denmark, Aarhus, Denmark

EP15.7 Minimum 12-month follow-up of a randomized controlled trial comparing platelet-rich plasma versus hyaluronic acid in the treatment of symptomatic early osteoarthritis of the hip joint
Dr Matthew Kraeutler1, Ms. Shannon Miller2, Ms. Darby Houck2, Dr Omer Mei-Dan2
1St. Joseph’s University Medical Centre, Paterson, United States, 2University of Colorado School of Medicine, Aurora, United States

EP15.9 Differences in gene expression between femoroacetabular impingement (FAI) and end-stage hip osteoarthritis.
Dr Benjamin Kuhns1, Dr Gillian Soles1, Dr Cheryl Ackert-Bicknell1, Dr Brian Giordano1
1University Of Rochester Medical Centre Department of Orthopaedics & Rehabilitation, Rochester, United States

EP15.10 Sport activity and clinical outcomes after hip arthroscopy with microfracture at a minimum 2-year follow-up
MD, PhD Mattia Loppini2, MD Francesco La Camera1, MD Vincenzo Paolo Di Francia1, MD Riccardo Ruggeri1, Professor Guido Grappiolo, MD Federico Della Rocca
1Humanitas Clinical and Research Centre, Rozzano , Italy, 2Humanitas University, Pieve Emanuele,
EP15.11 Quantitative hip cartilage MRI of patients with hip dysplasia: Evaluation of DGEMRIC, T1ρ and T2* mapping

Mapping Sarfraz Malleck

1University Of Ottawa, Ottawa, Canada

EP15.12 Gel scaffolds and membranes, which one is a better choice in hip cartilage defects treatment: Advantages and disadvantages

MD PhD Jacek Mazek1, MD Antonio Porthos Salas2, MD PhD Tomasz Piontek3, MD Maciej Gnatowski1

1Ortopedia, Warszawa, Poland, 2Hip Arthroscopy Mexico, Poznan, Poland, 3Rehasport Clinic, Poznan, Poland

EP15.13 Amniotic suspension allograft injection for hip osteoarthritis: Prospective pilot study with 1 year follow up

MD Molly Meadows1, Katia Elisman1, MD Shane Nho2, MD Marc Safran1

1Stanford University, Redwood City, United States, 2Rush University, Chicago, United States

EP15.14 The role of microfracture in the treatment of full-thickness chondral defects in hip arthroscopy: a mean 8-year follow up study

Md José Oñativia1, Md Pablo Slullitel1, Md Gerardo Zanotti1, Md Martin Buttaro1, Md Francisco Piccaluga1, Md Fernando Comba1

1Hospital Italiano De Buenos Aires, Ciudad Autonoma De Buenos Aires, Argentina

EP15.15 Optimization of human articular chondrocytes isolation with a single enzymatic digestion procedure

Dr Lourenço Peixoto1

1Into, Rio De Janeiro, Brazil

EP15.16 Arthroscopic treatment of acetabular cartilage lesions in cam-type hip impingement with membrane induced chondrogenesis versus micro fracturing

Dr Jan Somers1, Dr Cyriëlle Stevens1,2, Dr Cedric Depuydt1,3

1Jan Yperman Hospital, Ypres, Belgium, 2University of Ghent, Ghent, Belgium, 3University of Louvain, Louvain, Belgium

EP15.17 Early results of autologous matrix induced chondrogenesis and bone marrow aspirate concentrate for acetabular cartilage lesions

Dr Jan Somers1

1Jan Yperman Hospital, Ypres, Belgium

EP15.19 The alpha angle in femoroacetabular impingement can predict the severity of acetabular cartilage damage

Mr. Hao-Che Tang1, Prof. Michael Dienst2

1Chang Gung Memorial Hospital, Keelung City, Taiwan, 2Orthopädische Chirurgie München, Munich, Germany

EP15.20 Sustained benefit of autologous matrix-induced chondrogenesis (AMIC) for hip cartilage repair in athletic patients

MD, PhD Fritz Thorey1, MD Dimitrios P. Giotis1

ATOS Hospital Heidelberg, Heidelberg, Germany

EP15.21 Reliability of arthroscopic classification of hip chondral lesions

MD Antônio Augusto Guimarães Barros1, Rafael Baroni Carvalho1, MD Carlos Cesar Vassalo1, MD Lincoln Paiva Costa1, Juan Gómez-Hoyos2, Vinicius de Oliveira Paganini1, MD, PhD Marco Antônio Percope de Andrade3

1Hospital Madre Teresa, Belo Horizonte, Brazil, 2Baylor Scott and White Research Institute, Hip Preservation Centre, Dallas, United States, 3Departamento do Aparelho Locomotor da Faculdade de Medicina da UFMG, Belo Horizonte, Brazil
EP15.22 Short-term results of mosaicplasty for the treatment of femoral head osteochondral lesions: a report of 5 cases and surgical technique
M.D. Gerardo Zanotti¹, **M.D. Fernando Diaz Dibernia**, M.D. Jose Ignacio Oñativia¹, M.D. Fernando Comba¹, M.D. Martin Buttaro¹, M.D. Francisco Piccaluga¹
¹Hospital Italiano De Buenos Aires, Buenos Aires, Argentina

EP15.23 Are chondrocytes overlying cam morphology suitable for therapeutic use?
**Dr Robert Westermann**, Mr Michael Slattery¹, Dr Mitchell Coleman¹
¹University Of Iowa, Iowa City, United States

V15.18 Technique of arthroscopic BMAC (Bone Marrow Aspirate Concentrate) supplementation in AMIC (Autologous Matrix Induced Chondrogenesis) for hip cartilage lesions
**Dr Jan Somers**¹
¹Jan Yperman Hospital, Ypres, Belgium

EP16 – Teamwork and training

EP16.1 Acetaminophen versus oxycodone-apap for pain management after hip arthroscopy: a randomized controlled trial
Samuel Baron¹, Matthew Kingery¹, **Dr Thomas Youm**¹
¹NYU Langone Health Department of Orthopaedic Surgery, New York, United States

EP16.2 Does use of a virtual reality hip arthroscopy simulator influence medical students’ attitudes toward a career in orthopaedic surgery?
**Dr Jonathan Bartlett**, Dr Fawz Kazzazi³, Dr Kendrick To², Mr John Lawrence², Mr Vikas Khanduja²
²Basildon & Thurrock University Hospital, London, United Kingdom, ³Addenbrookes Hospital, Cambridge, United Kingdom

EP16.3 The influence of distance from orthopaedic treatment centre on achieving minimally clinically important difference in patients undergoing surgery for femoroacetabular impingement
Mr. Reagan Chapman¹, Dr Benedict Nwachukwu¹, Dr Edward Beck¹, Ms. Elaine Lee¹, **Mr. Jonathan Rasio**, Dr Shane Nho¹
¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

**Miss Madison Morrish**, Mr David Georgy¹
¹Australian Sports Physiotherapy, Melbourne, Australia

EP16.5 How many opioid pain medications should we prescribe following hip arthroscopy? A randomized control trial
**MD Matthew Hartwell**, MD Ryan Selley¹, Joshua Barrett¹, Elijah Ogunkoya³, MD Vehniah Tjong¹, MD Michael Terry³
³Department of Orthopaedic Surgery, Feinberg School of Medicine, North western University, Chicago, United States
EP16.6 Pre-emptive analgesia in hip arthroscopy: no added benefit of intra-articular bupivacaine injection following preoperative peri-acetabular block

Dr Efi Kazum\textsuperscript{1}, Dr Ehud Rath\textsuperscript{1}, Dr Amir Shlaifer\textsuperscript{1}, Dr Zachary Sharfman\textsuperscript{2}, DO Hal David Martin\textsuperscript{3}, Dr Gilad Eizenberg\textsuperscript{1}, Dr Evgeny Reider\textsuperscript{1}, Dr Eyal Amar\textsuperscript{1}

\textsuperscript{1}Ichilov Sourasky Medical Centre, 6 Weizmann Street, Israel, \textsuperscript{2}Montefiore Medical Centre, The University Hospital for Albert Einstein College of Medicine, New York, U.S.A., \textsuperscript{3}Hip Preservation Centre, Baylor University Medical Centre, U.S.A

EP16.7 Do patients receive physical therapy for hip pain prior to consulting a hip surgeon?

Amanda Paulson\textsuperscript{1}, Zain Khazi\textsuperscript{1}, Dr Micheal Willey\textsuperscript{1}, Dr Robert Westermann\textsuperscript{1}

\textsuperscript{1}University Of Iowa Hospitals and Clinics, Iowa City, United States

EP16.8 What are the costs for conservative care prior to arthroscopic treatment of femoroacetabular impingement syndrome?

Zain Khazi\textsuperscript{1}, Dr Nicolas Bedard\textsuperscript{1}, Dr Robert Westermann\textsuperscript{1}

\textsuperscript{1}University Of Iowa Hospitals and Clinics, Iowa City, United States

EP16.9 Use of a single dose of IV Toradol to decrease post-operative opioid need and improve efficient discharge form the hospital following hip arthroscopy.

Dr Brian Lewis\textsuperscript{1}, Dr Robert Kollmorgen\textsuperscript{2}

\textsuperscript{1}Duke University Medical Centre, Durham, United States, \textsuperscript{2}University of California San Francisco- Fresno, Fresno, United States

EP16.10 Effect of neuromuscular relaxation on perineal pressures and hip distraction during traction for hip arthroscopy

Dr Tao Shan Lim\textsuperscript{1}, Dr Yi Ying Heng\textsuperscript{1}, Mr Artur Kotov\textsuperscript{2}, Mr Shaun Hontomin\textsuperscript{3}, Mr Francis Winfield\textsuperscript{4}, Dr Hon Earn Sim\textsuperscript{1}, Prof Thomas Ledowski\textsuperscript{4,5}

\textsuperscript{1}Joondalup Health Campus, Joondalup, Australia, \textsuperscript{2}University of Kiel, Kiel, Germany, \textsuperscript{3}University of Notre Dame, Fremantle, Australia, \textsuperscript{4}University of Western Australia, Perth, Australia, \textsuperscript{5}Royal Perth Hospital, Perth, Australia

EP16.11 Prospective evaluation of opioid utilization after hip and knee arthroscopy

Dr Elise Bixby\textsuperscript{1}, Gabrielle K Steinl\textsuperscript{1}, Michaela O’Connor\textsuperscript{1}, Connor Crutchfield\textsuperscript{1}, Dr Jamie Confino\textsuperscript{1}, John Cosgrove\textsuperscript{1}, Karen Yancopoulos\textsuperscript{1}, Dr T. Sean Lynch\textsuperscript{1}

\textsuperscript{1}Columbia University, New York, United States

EP16.12 Multimodal Pain Management in Hip Arthroscopy

Dr Travis Menge\textsuperscript{1}, Mr Collin LaPorte\textsuperscript{1}, Dr Guillaume Dumont\textsuperscript{2}, Dr Robert Boykin\textsuperscript{3}

\textsuperscript{1}Michigan State University/Spectrum Health, Grand Rapids, United States, \textsuperscript{2}University of South Carolina, Columbia, United States, \textsuperscript{3}EmergeOrtho, Asheville, United States

EP16.13 Hip arthroscopy learning curve after training at high volume centre: A retrospective single-surgeon study

MD Moriyuki Noguchi\textsuperscript{1}, PhD,MD Soshi Uchida\textsuperscript{2}, MD,PhD Hirota Abe\textsuperscript{3}, MD,PhD Hirotaka Sano\textsuperscript{1}, MD,PhD Daizo Sasaki\textsuperscript{1}, MD,PhD Taichi Irie\textsuperscript{1}, MD,PhD Takashi Inawashiro\textsuperscript{1}, MD Hiroshi Yoshimura\textsuperscript{1}, MD Hirotaka Kurata\textsuperscript{1}, MD Ryoichi Kameyama\textsuperscript{1}

\textsuperscript{1}Department of orthopaedics, Sendai City hospital, Sendai City, Japan, \textsuperscript{2}Department of orthopaedics, Wakamatsu Hospital for University of Occupational and Environmental Health, Kitakyusyu city, JAPAN

EP16.14 Opioid use in adolescents following hip arthroscopy

MD Crystal Perkins\textsuperscript{1}, BS Asahi Murata\textsuperscript{1}, MD S. Clifton Willimon\textsuperscript{4}

\textsuperscript{1}Children’s Healthcare of Atlanta, Atlanta, United States
EP16.15 Can perioperative multimodal drug administration reduce the need for opioids following hip arthroscopy?

Dr James Calabrese1, Dr Lauren Pierpoint1, Dr Marc J. Philippou1,2
1Steadman Phillipon Research Institute, Vail, United States, 2The Steadman Clinic, Vail, United States

EP16.16 Resident involvement in hip arthroscopy is associated with longer operative times but no increased short-term risks

Roy Lan1, Dr Linsen Samuel2, Dr Assem Sultan2, Daniel Grits2, Dr Atul Kamath2
1University of Tennessee Health Science Centre, Memphis, United States of America, 2Department of Orthopaedic Surgery, Cleveland Clinic Foundation, Cleveland, United States of America

EP16.17 Resident involvement in periacetabular osteotomy is associated with longer operative times but no increased short-term risks

Mr. Roy Lan1, Dr Linsen Samuel1, Dr Assem Sultan2, Mr. Daniel Grits2, Dr Atul Kamath2
1University Of Tennessee Health Science Centre, Memphis, United States, 2Cleveland Clinic Foundation, Cleveland, United States

EP16.18 Comparative efficacy of pre-operative quadratus lumborum blocks in hip arthroscopy

Dr John M Ryan2,3, MD Ryan Blackwell1, MD Michael Kushelev4, DO John Norton1, MD W. Kelton Vasileff1
1Ohio State University, Columbus, United States, 2Ohio State University Department of Orthopaedics, Columbus, United States, 3Ohio State University Sports Medicine Research Institute, Columbus, United States, 4Ohio State University Division of Physical Therapy, Columbus, United States

EP16.19 factors associated with initial interest and treatment selection of patients with femoroacetabular impingement syndrome

PT, DPT, SCS Kathryn Glaws1, PT, DPT Lindsey Brown1, PT, DPT Matthew Pomeroy6, MD John Ryan1,2, MD Bryant Walrod1,4, PT, PhD OCS Stephanie Di Stasi3,5, MD William Vasileff1,2
1Ohio State University Department of Orthopaedics, Columbus, United States, 2Ohio State University Sports Medicine Research Institute, Columbus, United States, 3Ohio State University Health and Rehab Sciences Doctoral Program, Columbus, United States, 4Ohio State University Department of Internal Medicine, Columbus, United States, 5Ohio State University Division of Physical Therapy, Columbus, United States, 6Children's Hospital Colorado Sports Medicine Centre, Aurora, United States

EP16.20 Improving perioperative communication in hip arthroscopy using an automated text messaging robot: a randomized-controlled trial

Dr Elizabeth Scott, Dr Chris Anthony, Dr Michael O'Connor, Dr Michael Willey, Dr Thomas Sean Lynch, Dr Robert Westermann1
1University Of Iowa, Iowa City, United States

EP16.21 Objective measures of physical performance assess functional limitations of hip dysplasia

Dr Elizabeth Scott1, Dr Jason Wilken1, Dr Robert Westermann1, Arthur Mercado1, John Davison1, Dr Michael Willey1
1University Of Iowa Hospitals and Clinics, Iowa City, United States

EP16.22 Comparing cost and outcomes for post-operative femoroacetabular impingement (FAI) patients that utilize telehealth services for physical therapy: a matched-pair analysis.

Mrs Brandy Horton1, Dr Jennifer Marland1, Dr Hugh West1, Dr James Wylie1
1The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States
EP17.1 Total hip replacement vs. hip resurfacing - which performs better following revision surgery? A case-controlled study

Miss Nurhan Abbud\textsuperscript{1}, Mr Benjamin Kent\textsuperscript{1}, Mr Mark Norton\textsuperscript{2}, Mr Rory Middleton\textsuperscript{2}
\textsuperscript{1}University Of Exeter Medical School, London, United Kingdom, \textsuperscript{2}Royal Cornwall Hospital Treliske, Truro, United Kingdom

EP17.2 Clinical outcomes after arthroscopic iliopectineus release

Dr Ahmed Abdelazeem, Dr Mohamed Ghanem, Dr Mahmoud Abdelkarim, Prof. Dr Khaled Abdelkader

EP17.3 Comparison of false profile radiographs and ultrasound for the screening of anterior inferior iliac spine type.

Dr Eyal Amar\textsuperscript{1}, Dr Ron Rosenthal\textsuperscript{1}, Dr Ran Ankori\textsuperscript{1}, Dr Barak Haviv\textsuperscript{2}, Dr Shai Factor\textsuperscript{1}, Dr Mahder Yilma\textsuperscript{1}, Dr Ran Atzmon\textsuperscript{1}, Prof. Ehud Rath\textsuperscript{1}
\textsuperscript{1}Tel Aviv Medical Centre affiliated to Tel Aviv University, Tel Aviv, Israel, \textsuperscript{2}Hasharon Hospital, Rabin Medical Centre, affiliated to Tel Aviv University, Petach Tikva, Israel, \textsuperscript{3}Assuta Medical Centre, Ashdod, Israel

EP17.4 Outcome following core decompression for non-traumatic avascular necrosis of the femoral head: a systematic review

MD Octavian Andronic\textsuperscript{1,2}, MD, DIC, MPH Haitham Shoman\textsuperscript{2,3}, MD Ori Weiss\textsuperscript{2,4}, MD, MA, MSc, FRCS(Orth) Vikas Khanduja\textsuperscript{5}
\textsuperscript{1}Department of Orthopaedics, Balgrist University Hospital, Forchstrasse 340, 8008, Switzerland, \textsuperscript{2}Department of Trauma and Orthopaedics, Addenbrooke's - Cambridge University Hospitals NHS Foundation Trust, Hills Road, Cambridge, CB2 0QQ, United Kingdom, \textsuperscript{3}Department of Global Health and Social Medicine, Harvard Medical School, Boston, USA, \textsuperscript{4}Department of Orthopaedic Medicine, Meir Medical Centre, Kfar-Saba, Israel

EP17.5 Multiple psychiatric comorbidities preoperatively increase costs for patients undergoing hip arthroscopy for labral repair

Ms. Jacqueline E. Baron\textsuperscript{1}, Mr. Zain M. Khazi\textsuperscript{1}, Dr. Kyle Duchman\textsuperscript{1}, Dr. Qiang An\textsuperscript{1}, Dr. Michael Willey\textsuperscript{1}, Dr. Robert W. Westermann\textsuperscript{1}
\textsuperscript{1}Department Of Orthopaedics and Rehabilitation, Iowa City, IA, United States

EP17.6 Extra-articular hip impingement

MD Antônio Augusto Guimarães Barros\textsuperscript{1}, Rafael Baroni Carvalho\textsuperscript{1}, Victor Atsushi Kasuya Barbosa\textsuperscript{1}, André Gomes Ribeiro\textsuperscript{1}, Fernando Henrique Ferreira Garrido\textsuperscript{1}, MD Lincoln Paiva Costa\textsuperscript{1}, MD Carlos Cesar Vassalo\textsuperscript{1}
\textsuperscript{1}Hospital Madre Teresa, Belo Horizonte, Brazil

EP17.7 Survivorship of hip arthroscopy for femoroacetabular impingement syndrome performed with modern surgical techniques and predictors of clinical failure

Dr Shane Nho\textsuperscript{1}, Dr Edward Beck\textsuperscript{2}, Dr Benedict Nwachukwu\textsuperscript{1}, Dr Gregory Cvetanovich\textsuperscript{3}, Dr William Neal\textsuperscript{1}, Dr Joshua Harris\textsuperscript{4}, Dr Alexander Weber\textsuperscript{5}, Dr Richard Mather\textsuperscript{6}
\textsuperscript{1}Rush University Medical Centre, Chicago, \textsuperscript{2}Department Of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US, \textsuperscript{3}Department of Orthopaedics, The Ohio State University Wexner Medical Centre, Columbus, US, \textsuperscript{4}Department of Orthopaedic Surgery, Houston Methodist University, Houston, US, \textsuperscript{5}Department of Orthopaedic Surgery, University of Southern California, Los Angeles, US, \textsuperscript{6}Department of Orthopaedic Surgery, Duke University, Durham, USA
EP17.9 Multi-centre analysis of changes in patient satisfaction and self-reported functional outcomes between year-1 and year-2 following hip preservation surgery
Dr Dominic Carreira,1 Dr Benjamin Kivlan,2 Dr Dean Matsuda,3 Dr John Christoforetti4, Dr Andy Wolff5, Dr Shane Nho6, Dr Misty Suri7, Dr Al Stubbs8, Dr Geoffrey van Thiel9, Dr John Salvo10, Steven Garden1
1Peachtree Orthopaedics, Atlanta, United States, 2Duquesne University, Pittsburgh, United States, 3DISC Sports and Spine Centre, Marina del Rey, United States, 4Allegheny Health Network, Pittsburgh, United States, 5Washington Orthopaedics and Sports Medicine, Washington, United States, 6Rush University, Chicago, United States, 7Ochsner Sports Medicine, Jefferson, United States, 8Wake Forest Baptist Health, Winston-Salem, United States, 9Ortho Illinois, Rockford, United States, 10Rothman Institute, Philadelphia, United States.

EP17.10 The effect of cam impingement on severity of synovitis; a multi-centre descriptive study
Dr Dominic Carreira, Dr Benjamin Kivlan, Dr Dean Matsuda, Dr John Christoforetti, Dr Andy Wolff, Dr John Salvo, Dr Shane Nho, Dr Al Stubbs, Dr Geoffrey van Thiel, Dr Misty Suri, Steven Garden

EP17.11 Intraabdominal pressure changes during hip arthroscopy. a prospective multi-centre study.
Dr Ana Castel-Oñate,1 Dr Oliver Marin-Peña MD,2 Dr Ricardo Cuellar,3 Dr Adrian Cuellar MD,4 Dr Jorge Ojeda-Levenfeld MD,1 Dr Alfonso Valles-Purroy MD,1 Dr Ayeni Olufemi R MD PhD,1
1University Hospital Príncipe de Asturias., Madrid, Spain, 2University Hospital Infanta Leonor, Madrid, Spain, 3Guipuzkoa Quiron Hospital, San Sebastian, Spain, 4University Hospital Donostia, San Sebastian, Spain, 5McMaster University, Hamilton, Canada

EP17.12 Early results of osteonecrosis of the femoral head treated with core decompression and hyaluronic acid-based cell-free scaffolds soaked in concentration of autologous bone marrow aspirate
MD Ahmet Fırat,1 MD Şahin Çepni1, MD Enejd Veizi1, MD Alper Murat Ulaşlıs1, MD Kasim Kılıçarslan1
1Ankara City Hospital, Ankara, Turkey, 2Lokman Hekim Hospital, Ankara, Turkey

EP17.13 Comparison of patient outcomes and satisfaction levels between arthroscopic debridement and conservative treatment of adhesive capsulitis of the hip
MD Jae-Young Lim1, MD Yoshi Pratama Diaja1,2, MD Yoo-Sun Won1, MD, PhD Eui-Chan Jang1, MD, PhD Jae Yoon Kim1, MD, PhD Yong-Chan Ha1
1Chung-Ang University College of Medicine, Seoul, South Korea, 2Fatmawati General Hospital, Jakarta, Indonesia

EP17.14 Is diabetes mellitus a negative prognostic factor for patients undergoing hip arthroscopy? a matched-controlled study
Dr Itay Perets,1 Edwin Chaharbakhshi2, Dr Gal Barkay3, Brian Mu4, Dr Ajay Lall5, Dr Benjamin Domb5
1Hadassah Hebrew University Hospital, Jerusalem, Israel, 2Loyola Stritch College of Medicine, Maywood, United States, 3Sheba Medical Centre, Ramat Gan, Israel, 4Rosalind Franklin University of Medicine and Science, North Chicago, United States, 5American Hip Institute, Chicago, United States

EP17.15 Mid-term outcomes of iliopsoas fractional lengthening (ifl) for internal snapping as a part of hip arthroscopy
Dr Itay Perets,1 Edwin Chaharbakhshi2, Dr Yosif Mansor3, Dr Lyall Ashberg4, Brian Mu5, Muriel Battaglia6, Dr Benjamin Domb7
1Hadassah Hebrew University Hospital, Jerusalem, Israel, 2Loyola Stritch College of Medicine, Maywood, United States, 3Chaim Sheba Medical Centre at Tel Hashomer, Ramat Gan, Israel, 4Atlantis Orthopaedics, Atlantis, United States, 5Rosalind Franklin University of Medicine and Science, North Chicago, United States, 6The University of Chicago Pritzker School of Medicine, Chicago, United States, 7American Hip Institute, Chicago, United States

EP17.17 Radiographic predictive factors of hip osteoarthritis: A systematic review
Dr Jacob Shapira,1 Jeffrey Chen1, Dr Ajay Lall1, Dr Philip Rosinsky3, Dr David Maldonado1, Dr Benjamin Domb1
1American Hip Institute, Chicago, United States
EP17.18 The evolution of hip arthroscopy: what has changed between 2008 and 2018 - a single surgeon’s experience

*Dr Philip Rosinsky*¹, Sarah Chen¹, Dr Jacob Shapira³, Dr David Maldonado¹, Dr Ajay Lall¹, Dr Benjamin Domb¹

¹American Hip Institute, Chicago, United States


Dr Filippo Randelli¹, Dr Daniele Priano¹, Dr Mauro Magnani¹, Dr Fabrizio Pace¹, Drss Sara Favilla¹, *Dr Alberto Fioruzzi*¹, Drss Daniela Maglione¹

¹Ircs Policlinico San Donato, San Donato Milanese, Italy

EP17.21 Localized contact pressure on the femoral head increases due to inversion of the acetabular labrum: A biomechanical study

*Dr Kiyokazu Fukui*¹, Dr Xipeng Wang², Dr Ayumi Kaneuji¹, Dr Norio Kawahara¹

¹Kanazawa Medical University, Uchinada-machi, Kahoku-gun, Japan, ²The Second Affiliated Hospital Nantong University, Nantong, China

EP17.22 Femoro-acetabular impingement in femoral neck stress fractures

*Dr Esteban Javier Garces Burbano*, Dr María José Del Pozo Zuñiga

¹Military Hospital HE1 Orthopaedics and Traumatology Department, QUITO, Ecuador

EP17.24 An understanding of patient factors and hip arthroscopy intraoperative findings in patients with self-reported trouble with sexual activity

Dr Misty Suri¹, *Dr Brian Godshaw*¹, Mr Arjun Verma¹

¹Ochsner Sports Medicine Institute, New Orleans, United States

EP17.25 Is the iliopsoas muscle a femoral head stabilizer? A systematic review

Dr Takashi Hirase¹, Mr. Jason Mallett¹, Ms. Lindsay Barter¹, Mr. David Dong¹, Dr Patrick McCulloch¹, *Dr Joshua Harris*¹

¹Houston Methodist Hospital, Houston, United States

EP17.26 Comparing different hip physical examination methods on the diagnosis of labral tear

Kourosh Kalachi, *Dr Farshad Adib*

¹University of Maryland School of Medicine, Baltimore, United States

EP17.27 Accuracy of magnetic resonance imaging measurement of labral width compared to intra-operative assessment

Dr Daniel Kaplan¹, Dr Mohammad Samim¹, Dr Christopher Burke¹, Dr Robert Meislin¹, *Dr Thomas Youm*¹

¹New York University Langone Medical Centre, New York, United States

EP17.28 MRI assessment of sub spine impingement: features beyond the anterior inferior iliac spine

Dr Mohammad Samim¹, Dr William Walter¹, Dr Soteros Gyftopoulos¹, Dr Lazaros Poultsides¹, *Dr Thomas Youm*¹

¹New York University Langone Medical Centre, New York City, United States

EP17.29 Arthroscopic versus open arthrotomy for treatment of native hip septic arthritis.

Zain Khazi¹, William Cates¹, Qiang An¹, Dr Kyle Duchman¹, Dr Brian Wolf¹, *Dr Robert Westermann*¹

¹University Of Iowa Hospitals and Clinics, Iowa City, United States

EP17.30 Risk factors and rate of prolonged opioid consumption after hip arthroscopy in opioid naïve patients

Zain Khazi¹, Dr Alan Shamrock¹, Dr Kyle Duchman¹, *Dr Robert Westermann*¹

¹University Of Iowa Hospitals and Clinics, Iowa City, United States
EP17.31 Multi-centre analysis of changes in patient satisfaction and self-reported functional outcomes between year-1 and year-2 following hip preservation surgery

Dr Benjamin Kivlan⁴, Dr Rob Roy Martin⁴, Dr John Christoforetti², Dr Andrew Wolff⁵, Dr John Salvo⁵, Dr Shane Nho⁶, Dr Dean Matsuda⁶, Dr Geoff Van Thiel⁴, Dr Dominic Carreira⁷

¹Duquesne University, Pittsburgh, USA, ²Texas Health Sports Medicine, Allen, USA, ³Washington Orthopaedics and Sports Medicine, Washington, USA, ⁴Rush University Medical Centre, Chicago, USA, ⁵Rothman Institute, Philadelphia, USA, ⁶DISC Sports and Spine Centre, Marina del Rey, USA, ⁷Peaktree Orthopaedics, Atlanta, USA

EP17.32 Adverse correlations between alpha angle and signal intensity of subchondral bone on 3-dimensional magnetic resonance imaging for the evaluation of cam morphology

Associate Professor Naomi Kobayashi¹, Dr Yohei Yukisawa¹, Dr Takayuki Oishi¹, Dr Shu Takagawa¹, Dr Shota Higashihira², Dr Yuichi Mochida³, Professor Yutaka Inaba³

¹Yokohama City University Medical Centre, Urahune-cho, Minimi-ku, Yokohama, Japan, ²Yokohama City University, Fukuura, Kanazawa-ku, Yokohama, Japan

EP17.34 Endoscopic management of proximal rectus femoris avulsion injury

Dr Robert Kollmorgen¹, Dr Eduardo Salazar¹

¹University Of California San Francisco Fresno, Fresno, United States

EP17.35 Arthroscopic treatment of intra-articular hip tumours

Dr Fernando Leal¹, Dr Jorge Cruz de Melo¹, Enf Manuel Padin¹, Dr Tiago Pato¹

¹Porto Hip Unit, Porto, Portugal

EP17.36 Ileopsoas tenotomy in patients undergoing hip arthroscopy: clinical outcomes at 4 years follow-up

MD, PhD Mattia Loppiν, Md Francesco La Camera¹, MD Rocco Cannata¹, MD Carmine Fabio Bruno, Professor Guido Grappiolo¹, MD Federico Della Rocca¹

¹Humanitas Clinical and Research Centre, Rozzano, Italy, ²Humanitas University, Pieve Emanuele, Italy, ³Università “Magna Graecia” di Catanzaro, Catanzaro, ³

EP17.37 Arthroscopic reduction and internal fixation of femoral neck Fracture: Technical note

Dr Jeong-Kil Lee¹, Dr Jung-Mo Hwang¹, Dr Deuk-Soo Hwang¹, Dr Young-Cheol Park¹

¹Chungnam National University School of Medicine, Daejeon, South Korea

EP17.38 Clinical observation of arthroscopic surgery for posterior dislocation of hip with labral tears

Dr Chunbao Li¹, Dr Chenhui Dong², Dr Chao Shi², Dr Zhigang Wang¹, Dr Yujie Liu¹, Dr Zhongli Li¹

¹The Sport Medicine Centre of orthopaedics department of the Chinese PLA General Hospital (301 hospital), Beijing, China, ²Sports medicine department of the 940th hospital of the Chinese PLA Joint Logistics Support Force, Beijing, China, ³Qitai County Hospital, Qitai Town, China

EP17.40 The clinical efficacy of arthroscopy application in hip brucella septic arthritis treatment and outcome follow-up

Dr Dong Chenhui¹, Dr Chunbao Li¹

¹The Sport Medicine Centre of orthopaedics department of the Chinese PLA General Hospital (301 hospital), Beijing, China

EP17.41 Abductor muscles increase hip stability against rotational and distractive forces: A quantitative study

Daniel Lim¹, Lionel Lazaro³, Trevor Nelson², Samuel Eberlein², Michael Banffy¹, Melodie Metzger²

¹Kerlan-Jobe Institute, Cedars-Sinai, Los Angeles, United States, ²Cedars-Sinai, Los Angeles, United States
EP17.42 Multiple iliopsoas tendons and its implications in internal snapping hip syndrome
Dr Benjamin Lin1, Dr Jonathan Bartlett2, Mr Thomas Lloyd1, Mr Dimitris Challoumas1, Ms Cecilia Brassett1, Mr Vikas Khanduja2
1Human Anatomy Teaching Group, University of Cambridge, Cambridge, United Kingdom, 2Department of Trauma & Orthopaedics, Addenbrooke’s Hospital, Cambridge, United Kingdom

EP17.43 Comparison of avascular necrosis methods in murine model.
Dr Vladislav Lobashov1, Prof Illdar Akhtiamov1, Dr Leisan Aminova1
1Kazan State Medical University, Kazan, Russian Federation

EP17.44 Motor vehicle collisions and labral tears
MD Michael Muldoon1,2, Research Coordinator Robert Healey1,2, Research Associate Austin Long1,2
1Hip Preservation Centre of Excellence, San Diego, United States, 2Sharp Healthcare, San Diego, United States

EP17.45 Hip Arthroscopy trends and outcomes: A national multicentre study
MD Oliver Marin-Pena1,2, MD Mohammed Abd El-Radi3, MD Raul Torres-Eguia3, MD Jesus Mas-Martinez3, MD Javier Sanz-Reig3, MD Juan Ribera4, MD Marc Tey-Pons5, MD Luis Perez-Carro6, MD Boris Garcia-Benitez7
1University Hospital Infanta Leonor, Madrid, Spain, 2Clinica CEMTRO, Madrid, Spain, 3Hospital HLA Vistahermosa, Alicante, Spain, 4Hospital Viamed Santa Angela de la Cruz, Seville, Spain, 5Hospital del Mar y la Esperanza, Barcelona, Spain, 6Clinica Mompia, Santander, Spain, 7Hospital San Juan de Dios Aljarafe, Seville, Spain, 8Assiut University Hospital, Assiut, Egypt

EP17.46 Standardizing the diagnostic evaluation of non-arthritic hip disorders through the Delphi method
Dr Michael Mcclincy1, Dr James Wylie2, Dr David Williams3, Dr Eduardo Novais3
1University Of Pittsburgh School of Medicine, Pittsburgh, United States, 2Intermountain Healthcare, Salt Lake City, United States, 3Boston Children's Hospital, Boston, United States

EP17.47 The Passive Flexion External Rotation (PFER) test for Femoro-Acetabular Impingement (FIA) syndrome: A retrospective exploratory study
Dr Nicholas MOHTADI1, Denise Chan1, Dana Hunter1, David Lindsay1, Dr Alex Rezansoff1
1University of Calgary Sport Medicine Centre, Calgary, Canada

EP17.48 Minimum 2-year follow-up results of hip arthroscopy for symptomatic collapsed osteonecrosis of the femoral head
Dr Jae-Youn Yoon1, Dr Jun-ki Moon1, Dr Chul-Ho Kim1, CNS Mi Yeon Jeong1, Dr Sun Hyung Lee1, Prof. Hee Joong Kim2, Prof. Pil Whan Yoon1
1Asan Medical Centre, Seoul, South Korea, 2Seoul National University Hospital, Seoul, South Korea

EP17.49 Multiple drilling and multiple matchstick-like bone allograft for large osteonecrotic lesions of the femoral head: An average 3-year follow-up study
Dr Jun-Ki Moon1, Dr Chul-Ho Kim1, Dr Jae-Youn Yoon1, CNS Mi Yeon Jeong1, Dr Sun Hyung Lee1, Prof. Hee Joong Kim2, Prof. Pil Whan Yoon1
1Asan Medical Centre, Seoul, South Korea, 2Seoul National University Hospital, Seoul, South Korea

EP17.50 In-office ultrasound-guided intra-articular hip injection vs. radiology and operating room-based fluoroscopic-guided intra-articular hip injection: A cost minimization analysis
Dr Michael Palmer1, Victoria Das1, Jessica Pykosz1, Dr Michael Ellman2, Dr Sanjeev Bhatia3
1The Christ Hospital, Cincinnati, United States, 2Pannora Orthopaedic and Spine Centre, Denver, United States, 3Cincinnati Sports Medicine & Orthopaedic Centre, Bon Secours Mercy Health, Cincinnati, United States, 4Hip and Knee Joint Preservation Centre, North western Medicine, Warrenville, United States
EP17.52 Statistical fragility and the role of p values in the hip arthroscopy literature
Dr Robert Parisien1, Dr David Trofa2, Michaela O’Connor2, Brock Knapp3, Emily Curry4, Dr T. Sean Lynch2, Dr Paul Tornetta III3, Dr Xinning Li3
1University of Pennsylvania, Philadelphia, United States, 2Columbia University Medical Centre, New York, United States, 3Boston University Medical Centre, Boston, United States, 4Boston University School of Public Health, Boston, United States

MD PHD Luis Perez-Carro1, RN Natalia fernandez-Escajadillo1, RN Linda Fernandez-Escajadillo1, MD Carlos Rodrigo Arriaza-Gutierrez1, MD Manuel Sumillera Garcia1, MD PHD Ana Alfonso Fernandez1
1Hospital Clinica Mompia. Santander. Spain, Santander, España

EP17.54 Physical Examination of the Hip: Current Practices and Future Directions
Dr Hal Martin1, Dr Lauren Pierpoint2, Dr Anthony Khoury1, Dr Marc J. Philippon2
1Baylor Scott & White Hip Preservation Centre at BUMC Dallas, Dallas, USA, 2Steadman Phillipon Research Institute, Vail, USA

EP17.55 The association between mental health status and patient-reported outcomes following hip arthroscopy for FAI
Dr Parag Jaiswal1, Karen Briggs2, Dr Lauren Pierpoint2, Dr Marc J. Philippon2
1Royal Free London NHS Foundation Trust, London, United Kingdom, 2Steadman Phillipon Research Institute, Vail, USA

EP17.56 The role of the M. sartorius in FAI and hip arthroscopy
Mr Tobias Röder

EP17.57 Arthroscopic assisted percutaneous osteosynthesis of the Pipkin II type femoral head fracture: A clinical case
Dr Roger Rojas Sayol1, Dr Julio De Caso Rodriguez1, Dr Àlex Grau Blanes1, Dr Judit Martinez Zaragoza1, Dr Ariadna Da Ponte Prieto1, Dr Sara Wahab Zuriarrain1, Dr Màrius Valera Pertegas1
1Hip and Trauma Orthopaedic Surgery Unit, Hospital de la Santa Creu i Sant Pau, Barcelona, Spain

EP17.58 Surgical treatment of proximal rectus femoris tendon avulsion
Dr John Ryan1, Dr Nicholas Walla1, Dr W. Kelton Vasileff1
1Ohio State University Sports Medicine, Columbus, United States

EP17.59 Hip preservation outcomes in subchondral insufficiency fractures of the femoral head: A systemic review
Michael Gaudiani1, Dr Linsen Samuel2, Dr Assem Sultan2, Dr Atul Kamath2
1Case Western Reserve University School of Medicine, Cleveland, United States, 2Cleveland Clinic Foundation, Cleveland, United States

EP17.60 Is hip arthroscopy cost-effective for the treatment of femoroacetabular impingement (FAI)? A systematic review of economic evaluations
Dr Haitham Shoman1, Dr Ori Weiss1, Mr. Vikas Khanduja1
1Cambridge University Hospitals Addenbrookes, Cambridge, United Kingdom

EP17.61 The brief resilience scale correlates with pre and post-operative outcomes following hip arthroscopy
Ariel Silverman1, Dr Steven DeFroda1, Matthew Quinn1, Dr Brian Cohen1, Dr Ramin Tabaddor1
1Alpert Medical School, Brown University, Providence, United States
EP17.63 Differences in radiographic measurements on standing versus supine pelvic radiographs
Dr Andrea Spiker\(^1\), Dr Ryan Graf\(^1\), Sean Duminie\(^1\), Dr Stephanie Kliethermes\(^1\), Dr David Goodspeed\(^1\)
\(^1\)University Of Wisconsin - Madison, Madison, United States

EP17.64 Nonoperative management of posterior wall fractures of the acetabulum in NFL players
Mr. James Spratt\(^1\), Dr Brian Samuelsen\(^1\), Dr Matthew Crawford\(^1\), Dr Marc Philippon\(^1\)
\(^1\)Steadman Philippon Research Institute, Atlanta, United States

EP17.65 Medial joint space may be a predictor of arthritic changes following hip arthroscopy for symptomatic labral tears.
Dr Yoshinori Takashima\(^1\), Dr Shingo Hashimoto\(^1\), Dr Tomoyuki Matsumoto\(^1\), Dr Shinya Hayashi\(^1\), Dr Koji Takayama\(^1\), Dr Yuichi Kuroda\(^1\), Dr Masanori Tsubosaka\(^1\), Dr Tomoyuki Kamenaga\(^1\), Prof Ryosuke Kuroda\(^1\)
\(^1\)Kobe University Graduate School of Medicine, Kobe Tyouuku kusunoki cho 7-5-1, Japan

EP17.66 Outcomes of hip arthroscopy in pre-operative opioid users
MD Mikhail Zusmanovich\(^2\), BS MBA Kamali Thompson\(^1\), MD Abigail Campbell\(^1\), MD Thomas Youm\(^1\)
\(^1\)Nyu Langone Health, New York, USA

EP17.67 Pelvofemoral flexion test- hip deep flexion with pelvic posterior tilting is associated with preoperative patient-related outcomes and hip flexion strength: A cohort study
PT Satoshi Tateishi\(^1\), PT Makoto Takahashi\(^1\), PT Shuto Higuchi\(^1\), Dr Akiko Hachisuka\(^1\), Dr Hajime Utsunomiya\(^1\), Dr Soshi Uchida\(^1\)
\(^1\)Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu, Japan

EP17.68 The iliocapsularis muscle adjoins the medial branch of the iliofemoral ligament: A histologic anatomy study
Dr Hajime Utsunomiya\(^1\), Mr Masahiro Tsutsumi\(^2\), Ms Alex Scibetta\(^1\), Dr Akimoto Nimura\(^3\), Dr Soshi Uchida\(^3\), Dr Johnny Huard\(^1\), Dr Keiichi Akita\(^2\), Dr Marc J Philippon\(^1\)
\(^1\)Steadman Philippon Research Institute, Vail, United States, \(^2\)Tokyo Medical and Dental University, Tokyo, Japan, \(^3\)Wakamatsu Hospital of University of Occupational and Environmental Health, Kitakyushu, Japan

EP17.70 Exploring the validation of a Japanese version of the International Hip Outcome Tool 12: Reliability, validity, and responsiveness
Dr Nobuyuki Watanabe\(^1,2,3\), Dr Satona Murakami\(^2,3\), Prof. Soshi Uchida\(^4\), PT Satoshi Tateishi\(^5\), Dr Hidetsugu Ohara\(^6\), Prof Yasuhiro Yamamoto\(^7\), Dr Taiki Kojima\(^8\)
\(^1\)Tosei General Hospital, Seto, Japan, \(^2\)Department of Orthopaedic Surgery, Graduate School of Medical Sciences, Nagoya City University, Nagoya, Japan, \(^3\)Department of Rehabilitation Medicine, Graduate School of Medical Sciences, Nagoya City University, Nagoya, Japan, \(^4\)Department of Orthopaedic Surgery, Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu, Japan, \(^5\)Department of Rehabilitation Medicine, Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu, Japan, \(^6\)Department of Orthopaedic Surgery, Hirakata City Hospital, Hirakata, Japan, \(^7\)Department of Occupational Therapy, Health Science University, Minamitsuru-gun, Japan, \(^8\)Department of Anaesthesiology, Cincinnati Children’s Hospital Medical Centre, Cincinnati, USA

EP17.71 The best Technique for Leg Length Measurements Pre and Post Total Hip Arthroplasty: What is the current evidence?
Dr Ori Weiss\(^1\), Dr Sathisvaran Kanavathy\(^2\), Dr Vikas Khanduja\(^1\)
\(^1\)Department of Trauma and Orthopaedics, Addenbrooke’s Hospital, Cambridge University Hospitals NHS Foundation Trust, Box 37, Hills Road, Cambridge, CB2 0QQ, UK, \(^2\)Royal Melbourne Hospital, Melbourne, Australia.
EP17.72 Patients with femoroacetabular impingement syndrome have altered gait mechanics in the sagittal plane compared to normal controls

   Dr James Wylie¹, Dr Jennifer Marland¹, Dr Hugh West¹, Dr Caitlin Miller¹, Dr Tristin Turner¹, Dr William McDermott¹

¹The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

EP17.73 Arthroscopic excision of intra-articular osteoid osteoma of the hip: a case series

Dr Yan Xu¹

²The Third Hospital of Peking University, Beijing, China

EP17.74 Arthroscopic treatment of internal snapping hip: approach and results

Doctor Gang Chen¹, Master Hsueh Yang²

¹The West China College of Medicine, Sichuan University, Chengdu, China, ²The West China College of Medicine, Sichuan University, Chengdu, China

EP17.75 Classification and prognosis of hip pigmented villonodular synovitis

Doctor Gang Chen¹, Master Yang Hsueh²

¹West China Hospital, Sichuan University, Chengdu, China, ²West China Hospital, Sichuan University, Chengdu, China

EP17.76 What can the simplified Chinese version of International Hip Outcome Tool (iHOT-12) revealed in young patient undergo hip arthroscopy?

Dr QingFeng Yin¹, Dr Chunbao Li²

¹The Second Hospital of Shandong University, Jinan, China, ²The PLA general hospital, Beijing, China

EP17.77 Mid-term patient reported outcomes of hip arthroplasty following prior hip arthroscopy: A matched case-control study with minimum 5-year follow-up

Dr Philip Rosinsky¹, Jeffrey Chen¹, Dr Jacob Shapira¹, Dr David Maldonado¹, Dr Ajay Lall¹, Dr Benjamin Domb¹

¹American Hip Institute, Chicago, United States

EP19 – Measuring Outcomes

EP19.1 Defining the MCID, PASS and SCB for arthroscopic hip preservation surgery at minimum five-year follow-up

Dr Benedict Nwachukwu¹, Dr Edward Beck¹, Mr. Kyle Kunze¹, Dr Jorge Chahla¹, Mr. Jonathan Rasio¹, Dr Shane Nho¹

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

EP19.2 High preoperative expectations are associated with achieving clinically significant outcome improvement after hip arthroscopy for femoroacetabular impingement syndrome

Dr Jorge Chahla¹, Dr Edward Beck¹, Dr Benedict Nwachukwu³, Mr. Thomas Alter¹, Dr Joshua Harris², Mr. Jonathan Rasio¹, Dr Shane Nho¹

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, ²Department of Orthopaedic Surgery, Houston Methodist, Houston, United States

EP19.4 Patient kinesiophobia and pain catastrophization affect patient recovery and return to activity after hip arthroscopy for femoroacetabular impingement syndrome

Dr Edward Beck Beck¹, Mr. Ian Clapp¹, Dr Benedect Nwachukwu¹, Mr. Jonathan Rasio¹, Dr Shane Nho¹

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago,
EP19.5 Least Absolute Shrinkage and Selection Operator (LASSO) model for achieving the minimal clinically important difference following hip arthroscopy: an analysis of 1,103 patients
Dr Jourdan Cancienne¹, Ms. Elaine Lee², Dr Edward Beck², Dr Brian Waterman², Ms. Katlynn Paul¹, Dr Benedict Nwachukwu¹, Mr. Jonathan Rasio³, Dr Shane Nho¹
¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, ²Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US

EP19.6 Preoperative performance of PROMIS in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome
Dr Benedict Nwachukwu¹, Dr Edward Beck¹, Mr. Reagan Chapman¹, Dr Kelechi Okoroha¹, Mr. Jonathan Rasio³, Dr Shane Nho¹
¹Chicago, Chicago, United States

EP19.7 Does failure to meet threshold scores for MHHS and iHOT-12 correlate to reoperations following hip arthroscopy?
Dr Philip Rosinsky¹, Jeffrey Chen¹, Dr David Maldonado¹, Dr Jacob Shapira¹, Dr Ajay Lall¹, Dr Benjamin Domb¹
¹American Hip Institute, Chicago, United States

EP19.8 Factors associated with pain catastrophizing in hip arthroscopy
Dr Guillaume Dumont¹, Dr Travis Menge², Mrs Nicole Battle¹, Mr Zachary Thier¹
¹University Of South Carolina School of Medicine, Columbia, United States, ²Spectrum Health Medical Group, Grand Rapids, USA

EP19.9 The impact of general physical and mental health, BMI, and pain catastrophizing on a non-arthritic hip specific outcome measure (iHOT-33)
Dr Guillaume Dumont¹, Dr Travis Menge², Mrs Nicole Battle¹, Mr Zachary Thier¹
¹University Of South Carolina School of Medicine, Columbia, United States, ²Spectrum Health Medical Group, Grand Rapids, USA

EP19.10 Clinically relevant threshold values for success following hip arthroscopy using the Patient Reported Outcomes Measurement Information System (PROMIS) questionnaire. Determining the Minimum Clinically Important Difference (MCID) and Patient Acceptable Symptomatic State (PASS)
Dr Benjamin Kuhns¹, David Lawton¹, John Reuter¹, Dr Judith Baumhauer¹, Brian Giordano¹
¹University Of Rochester Medical Centre Department of Orthopaedics & Rehabilitation, Rochester, United States

EP19.11 Hip specific patient reported outcomes scores decrease in an age dependent manner
Dr Ehud Rath¹, Dr Zachary Sharfman², Dr Ran Atzmon, Dr Hal Martin, Dr Oleg Dolkart¹, Dr Eyal Amar¹
¹Tel Aviv Sourasky Medical Centre and the Sackler Faculty of Medicine at Tel Aviv University, Tel Aviv, Israel, ²Montefiore Medical Centre, Bronx, USA

Dr Nobuyuki Watanabe¹,², Dr Satona Murakami³, Prof Soshi Uchida³, PT Satoshi Tateishi⁵, Dr Hidetsugu Ohara⁶, Prof. Yasuhiro Yamamoto⁷, Dr Taiki Kojima⁸
¹Tosei General Hospital, Seto, Japan, ²Department of Orthopaedic Surgery, Graduate School of Medical Sciences, Nagoya City University, Nagoya City, Japan, ³Department of Rehabilitation Medicine, Graduate School of Medical Sciences, Nagoya City University, Nagoya City, Japan, ⁴Department of Orthopaedic Surgery, Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu City, Japan, ⁵Department of Rehabilitation Medicine, Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu City, Japan, ⁶Department of Orthopaedic Surgery, Hirakata City Hospital, Hirakata City, Japan, ⁷Department of Occupational Therapy Health Science University, Minamitsuru-gun, Japan, ⁸Department of Anaesthesiology, Cincinnati Children's Hospital Medical Centre, Cincinnati, USA
Dr Malynda Wynn¹, Dr Robert Westermann¹, Dr Alan Shamrock¹, Zain Khazi¹, Dr Michael Willey¹, Dr John Davison¹
¹University Of Iowa Hospitals and Clinics, Iowa City, United States

EP19.14 Defining meaningful functional improvement on the visual analogue scale for satisfaction at 2-years after hip arthroscopy for femoroacetabular impingement syndrome
Dr Edward Beck¹, Dr Benedict Nwachukwu², Dr Nabil Mehta³, Kyleen Jan¹, Kelechi Okoroha², Mr Jonathan Rasio³, Dr Shane Nho²
¹Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, United States, ²Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

S1 – Dysplasia

S1.5 - Ottawa classification for symptomatic acetabular dysplasia: Assessment of interobserver and intraobserver reliability
Dr Kamal Bali¹, Dr Kevin Smit², Dr Mazen Ibrahim², Dr Stephane Poitras³, Dr Geoffrey Wilkin¹, Dr Etienne Belzile³, Dr Paul Beaule¹
¹The Ottawa Hospital, Ottawa, Canada, ²Children Hospital of Eastern Ontario, Ottawa, Canada, ³University Hospital of Quebec, Quebec City, Canada

S1.6 - Characterising the acetabular articular cartilage/cotyloid fossa ratio in the young adult hip: Differentiating between dysplasia and impingement
M.D. Pablo Slullitel¹, PhD. Andrew Speirs², M.HK., B.Sc. Johanna Dobransky¹, B.A. Cheryl Kreviazuk¹, M.D. Johan Witt³, M.D. George Grammatopoulos⁴, M.D. Paul Beaule¹
¹The Ottawa Hospital, Ottawa, Canada, ²Department of Mechanical and Aerospace Engineering, Carleton University, Ottawa, Canada, ³University College Hospital London, United Kingdom

S1.7 - What is the pelvic tilt in acetabular dysplasia, and does it change following peri-acetabular osteotomy?
Dr Mark Roussot¹,², Mr Saif Salih³, Mr George Grammatopoulos⁴, Mr Johan Witt¹
¹University College London Hospital, United Kingdom, ²Department of Orthopaedic Surgery, University of Cape Town, South Africa, ³Sheffield Teaching Hospitals, United Kingdom, ⁴Ottawa Hospital, Canada

S1.8 - Midterm Outcomes of Concurrent Hip Arthroscopy and Periacetabular Osteotomy for the Treatment of Hip Dysplasia with Associated Intra-Articular Pathology
Dr Adam Edelstein¹, Dr Adam Khan², Karla Crook², Dr Wahid Abu-Amer², Dr Cecilia Pascual-Garrido², Dr Jeffrey Nepple¹, Dr John Clohisy²
¹Medical College of Wisconsin Department of Orthopaedic Surgery, Milwaukee, United States, ²Washington University Department of Orthopaedic Surgery, Saint Louis, United States

S2 – Inguinal and adductor-related groin pain

S2.6 - The cleft sign of the pubis is associated with soccer activity and anterior acetabular over coverage: a cohort study
Dr Keisuke Nakayama¹, Dr Hajime Utsunomiya¹, Dr Fumitaka Hirano¹, Dr Shinichiro Takada¹, Dr Akihisa Hatakeyama¹, Dr Takamasa Toyoshima¹, Dr Akinori Sakai¹, Dr Soshi Uchida¹
¹Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyushu, Japan
S2.8 - Radiographic prevalence of symphysis pubis abnormalities and clinical outcomes in patients with femoroacetabular impingement syndrome
Dr Vignesh Krishnamoorthy¹, Dr Edward Beck¹, Mr. Kyle Kunze¹, Dr Jourdan Cancienne¹, Mr. Jonathan Rasio¹, Dr Olufemi Ayeni¹, Dr Shane Nho¹
¹Chicago, Chicago, United States

S3 – Femoral torsion

S3.5 - Decreased femoral version is an independent cause of anterior intra and extra articular sub-spine FAI-3D CT Impingement simulation study
Dr Till Lerch¹, Florian Schmaranzer¹, Simon Steppacher¹, Guoyan Zheng¹, Moritz Tannast¹, Klaus Siebenrock¹
¹Dept. of orthopaedic surgery, Inselspital Bern, University of Bern, Bern, Switzerland

S3.6 - Femoral retroversion does not portend inferior mid-term outcomes after hip arthroscopy: A pair-matched controlled cohort analysis
Dr Ajay Lall¹, Muriel Battaglia², Dr David Maldonado³, Dr Itay Perets³, Joseph Laseter⁴, Dr Benjamin Domb¹
¹American Hip Institute, Chicago, United States, ²The University of Chicago Pritzker School of Medicine, Chicago, United States, ³Hadassah Hebrew University Hospital, Jerusalem, Israel, ⁴Case Western Reserve University School of Medicine, Cleveland, United States

S3.7 - The bipolar hip: combined acetabular and femoral pathomorphology determine hip motion
Dr Jessica Shin¹, Ms. Temitope Adeyemi¹, Dr Taylor Hobson¹, Dr Christopher Peters¹, Dr Travis Maak¹
¹University Of Utah, Salt Lake City, United States

S3.8 - Femoral versus acetabular osteotomy for treating combined version deformities leading to femoroacetabular impingement
Mr Paul Haggis¹, Mr Saif Salih², Mr Tom Pollard¹, Mr Johan Witt², Mr George Grammatopoulos², Mr Tony Andrade¹
¹Royal Berkshire Hospital, Reading, United Kingdom, ²University College London Hospital, London, United Kingdom

S4 – Lateral hip pain

S4.5 - Arthroscopic partial release of the gluteus maximus tendon for external snapping hip syndrome. functional outcome and strength evaluation at mid-term follow-up
Dr Filippo Randelli¹, Dr Mauro Magnani¹, Dr Fabrizio Pace¹, Drss Sara Favilla¹, Drss Daniela Maglione¹, Dr Nicolò Cosmelli¹, Dr Alberto Fioruzzi¹
¹Irccs Policlinico San Donato, San Donato Milanese, Italy

S4.6 - Leucocyte-rich Platelet-rich Plasma (LR-PRP) treatment of gluteal tendinopathy: A double blind Randomised Controlled Trial with 2 year follow up.
Asst Prof Jane Fitzpatrick¹, Professor Max Bulsara², Professor Ming Hao Zheng³, Professor John O'Donnell⁴
¹University Of Melbourne, Melbourne, Australia, ²University of Notre Dame, Fremantle, Australia, ³University of Western Australia, Crawley, Australia, ⁴Swinburne University, Melbourne, Australia
S4.7 - Abductor cuff tears repair: Twelve years’ experience with a minimal invasive technique and midterm results

**Md Manuel Ribas Fernandez**¹, Md Carlomagno Cardenas Nylander¹, Md Vittorio Bellotti¹, Md Emanuele Astarita¹, Md Gabriel Chacón¹, Md Luis Ramírez¹

¹University Hospital Dexeus, Barcelona, Spain

S4.8 - Endoscopic abductor tendon repair with two-year follow up: Influence of tear type and tendon involvement

**MD JW Thomas Byrd**¹, MSN, RN Kay Jones

¹Nashville Hip Institute, Nashville, United States, ²Nashville Sports Medicine Foundation, Nashville, United States

S5 – Hip instability

S5.5 - Borderline acetabular dysplasia: evaluating preoperative low-dose computed tomography characteristics as a predictor of symptomatic instability

Dr Elizabeth Graesser¹, Maria Schwabe¹, Dr Cecilia Pascual-Garrido¹, Dr John Clohisy¹, **Dr Jeffrey Nepple**³

¹Washington University Department of Orthopaedic Surgery, Saint Louis, United States

S5.6 - The pull test. A dynamic test to confirm hip micro instability

**Doctor Kostas Economopoulos**³, Doctor Christopher Kweon², Doctor Albert Gee², Dr Anikar Chhabra³

²Department of Orthopaedics, University of Arizona College of Medicine-Phoenix, Phoenix, United States, ³Department of Orthopaedics, University of Washington, Seattle, United States, ⁴Department of Orthopaedics, Mayo Clinic Arizona, Phoenix, United States

S5.7 - The Femoro Epiphyseal Acetabular Roof (FEAR) index is a predictor of worse outcome of hip arthroscopy in female patients at two to four-year follow-up.

**Dr Jennifer Marland**¹, Mrs Brandy Horton¹, Dr Hugh West¹, Dr James Wylie¹

¹The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

S5.8 - Arthroscopic iliofemoral ligament augmentation to treat micro instability: between the capsular plication and the PAO in borderline dysplasia.

**MD Nicolas Fiz**¹, MD Ane Miren Bilbao, MD Jorge Guadilla, MD Juan Azofra, MD Jaime Oraa, MD Beatriz Aizpurua, MD Leonor Lopez, MD Mikel Sanchez

¹Arthroscopic Surgery Unit (Uca), Vitoria-Gasteiz, Spain

S6 – Posterior hip pain

S6.5 - Anatomical description of a sciatic ancillary branch to the gluteus maximus muscle

**MD Andrés Campos-Méndez**², MD Salvador Campos-Dorador¹, MD Juan Gómez-Hoyos¹, MS Anthony Khoury¹, PT Ricardo Schröder¹, PhD Ian James Palmer¹, DO Hal David Martin¹

¹Baylor Scott & White Hip Preservation Centre, Dallas, United States of America, ²Instituto Nacional De Rehabilitacion, Mexico City, Mexico

S6.6 - Paradoxical function of Psoas muscle: The hidden root of pain in pelvis?

**Dr Aleksandar Vojvodic**¹, Dr Sava Stajic², PhD Slobodan Kapor³, PhD Jelena Mihailovic⁴, Dr Luis Perez Carro⁵

¹Clinical Hospital Centre “Zemun”, Belgrade, Serbia, ²Clinical Hospital Centre “Dragisa Misovic”, Belgrade, Serbia, ³School of Medicine, University of Belgrade, Belgrade, Serbia, ⁴Yale School of Medicine, Yale University, New Haven, United States of America, ⁵Clinical Hospital Centre “Mompia”, Santander, Spain
S6.7 - Surgical outcomes of a novel surgical technique- arthroscopic proximal hamstring repair
**MD, MS Amanda N. Fletcher**, MD Brian C. Lau¹, MD Gregory Pereira¹, MMCi Carolyn Hutyra¹, MD, MBA Richard C. Mather III¹
¹Duke University Medical Centre, Department of Orthopaedic Surgery, Durham, US

S6.8 - Prevalence and preoperative risk factors for postoperative deep gluteal syndrome after hip arthroscopic labral preservation surgery
**Dr Soshi Uchida¹**, Dr Kazuha Kizaki¹, Dr Fumitaka Hirano¹, Dr Hal Martin², Prof Akinori Sakai³
¹Wakamatsu hospital of University of Occupational and Environmental Health, Kitakyushu, ²Hip Preservation Centre, Baylor University Medical Centre, Dallas, United States of America

S7 – The capsule

S7.5 - Hip mobility, translations, and micro instability before and after cam FAI surgery
**Dr Geoffrey Ng¹**, Dr Hadi El Daou², Mr Marcus Bankes³, Prof Ferdinando Rodriguez y Baena², Dr Jonathan Jeffers²
¹Department of Surgery & Cancer, Imperial College London, London, United Kingdom, ²Department of Mechanical Engineering, Imperial College London, London, United Kingdom, ³Department of Orthopaedics, Guy’s and St Thomas’ NHS Foundation Trust, London, United Kingdom

S7.6 - The importance of minimizing capsulotomy to maintain hip stability: A cadaveric study
**Dr Hajime Utsunomiya¹**, Mr Alex Brady¹, Mr Samuel Rosenberg¹, Mr Joseph Krob¹, Mr Bryson Kemler¹, Mr Grant Dornan¹, Dr Marc Philippon¹
¹Steadman Philippon Research Institute, Vail, United States

S7.7 - Must we crash through the wall to enter a hip joint or can we gently use a door instead? Capsular closure versus capsular preservation in hip arthroscopy
**Dr Ali Bajwa¹²**, Mr Richard Villar¹²
¹Princess Grace Hospital, London, United Kingdom, ²Villar Bajwa Practice, Cambridge, United Kingdom

S7.8 - Outcomes of open capsular plication of the hip at a mean of six years postoperatively: Do results deteriorate with time?
**Dr Jeffrey Nepple¹**, Dr Wahid Abu-Amer¹, Emmanuel Engermann¹, Dr Cecilia Pascual-Garrido¹, Dr Perry Schoenecker¹, Dr John Clohisy¹
¹Washington University Department of Orthopaedic Surgery, Saint Louis, United States

S8 – Planning, navigation and robotics

S8.4 - Novel three-dimensional measurements for assessing hip morphology
MS Daniel F. Duecker¹, MD James W. Genuario², MD, MBA Richard C. Mather³, MD, PhD Struan H. Coleman¹, MD, MS Shane J. Nho⁴, **PhD Floor M. Lambers¹**
¹Stryker Sports Medicine, Freiburg, Germany, ²University of Colorado School of Medicine, Denver, USA, ³Duke Health, Durham, USA, ⁴Hospital for Special Surgery, New York, USA, ⁵Rush University Medical Centre, Chicago, USA
S8.5 Frequency of posterior femoroacetabular impact in patients with suspected anterior femoroacetabular impingement evaluated with a 3-Dimensional dynamic study

Dr Bernardo Aguilera-Bohórquez1, Dr Ruddy Coaquirá1,2, Ms Erika Cantor1
1Centro Médico Imbanaco De Cali S.a, Cali, Colombia, 2Universidad Javeriana de Cali, Cali, Colombia

S8.6 - Utility of 3D printed models in the treatment of femoroacetabular impingement: A matched cohort study

Dr Ivan Wong1, Dr A P Tejaswi Ravipati2
1Dalhousie University, Halifax, Canada, 2Nova Scotia Health Authority, Halifax, Canada

S8.7 - Validation of computer navigated arthroscopic osteoplasty of the femoral head - experimental case control study on CT based printed models

Assist. prof. Klemen Strazar1, Uroš Meglic1
1University Medical Centre Ljubljana, Ljubljana, Slovenia

S8.8 - Dynamic calculation and volumetric measurement in planning and assessing surgical resection in femoroacetabular hip impingement

Ph Dr Alberto Frances-Borrego1, PhDr Yaiza Lopiz2, Ph Alvaro Arriaza-Cantos3, Dr Julio Otero Otero4, PhDr Antonio Ruiz Ollero5, Radiology Technician Catalina Nieto Gongora6, Ph Dr Ana Crespo Rodriguez2
1Hospital Clinico San Carlos, Madrid, Spain, 2Hospital Clinico San Borja Arriaran, Santiago, Chile, 3Clinica Las Condes, Santiago, Chile, 4Clinica Avansalud, Santiago, Chile, 5Hospital Dipreca, Santiago, Chile

S9 – Children and adolescent hips

S9.5 - Ischiofemoral impingement in adolescents: From clinical presentation to return to sports

Dr Javier Besomi1,2, MD Alan Garin1, MD Cristhian Herrera3, Pt Pedro Salgado1, MD Selim Abara1,5, MD Luis E. Moya1, MD Carlos Tobar4, MD Joaquin Lara3
1Clinica Alemana De Santiago, Santiago, Chile, 2Hospital Clinico San Borja Arriaran, Santiago, Chile, 3Hospital Clinico San Carlos, Madrid, Spain, 4Hospital Clinico San Carlos, Madrid, Spain, 5Hospital Clinico San Carlos, Madrid, Spain

S9.6 - Ten-year outcomes in adolescents following hip arthroscopy for FAI and labral repair

Dr Travis Menge1, Ms Karen Briggs1, Dr Ioanna Bolia1, Dr Marc Philippon1
1Steadman Philippon Research Institute, Vail, United States, 2Spectrum Health Medical Group Ortho and Sports Med, Grand Rapids, United States

S9.7 - FAI surgery in the adolescent patient population: Mild deformities and lack of sports participation are associated with an increased risk of treatment failure

Dr Jeffrey Nepple1, Dr Yi-Meng Yen2, Dr Ira Zaltz3, Dr David Podeszwa4, Dr Ernest Sink5, Dr Young-Jo Kim2, Dr Daniel Sutato4, ANCHOR Group, Dr John Clohisy1
1Washington University Department of Orthopaedic Surgery, Saint Louis, United States, 2Harvard Medical School Department of Orthopaedic Surgery at Boston Children’s Hospital, Boston, United States, 3William Beaumont Hospital Department of Orthopaedic Surgery, Royal Oak, United States, 4Texas Scottish Rite Hospital, Dallas, United States, 5Hospital for Special Surgery Department of Orthopaedic Surgery, New York, United States

S9.8 - Hip arthroscopy in slipped capital femoral epiphysis: Articular damage and time to scope

Dr Javier Besomi1,2, MD Valeria Escobar3, MD Juanjose Valderrama4, MD Selim Abara1,5, MD Luis E. Moya1, MD Jaime Lopez1, MD Claudio Mella1, MD Carlos Tobar4, MD Joaquin Lara2
1Clinica Alemana De Santiago, Santiago, Chile, 2Hospital Clinico San Borja Arriaran, Santiago, Chile, 3Universidad de Chile, Santiago, Chile, 4Hospital Clinico Mutual de Seguridad, Santiago, Chile, 5Hospital DIPRECA, Santiago, Chile, 6Clinica Avansalud, Santiago, Chile, 7Clinica Las Condes, Santiago, Chile
S10 – The hip in sport

S10.4 - Biomechanical evaluation of the hip joint motion in water polo players
Doctor Leandro Ejnisman1,2, Dr Kimberly Hall2, Thomas Andricchi2, Lexie Ross2, Dr Marc Safran2
1Universidade de Sao Paulo, Sao Paulo, Brazil, 2Stanford University, Redwood City, USA

S10.5 - Hip screening of a professional ballet company using ultrasound-assisted physical examination: diagnosing the at-risk hip
Ms Michelle Rodriguez1, Ms Michele Philippon2, Ms. Karen Briggs2, Dr Marc Philippon2
1Manhattan Physio Group, Physical Therapy and Wellness Centre, New York, United States, 2Steadman Philippon Research Institute, Vail, USA

S10.6 - Arthroscopic treatment for femuroacetabular impingement in elite athletes- 5-year follow up
Dr Ida Lindman1, Dr Axel Ohlin, Dr Mikael Sansone
1Orthocenter Gothenburg, Gothenburg, Sweden

S10.7 - Patient-reported outcomes for a return to running rehabilitation program following hip arthroscopy
Dr Alan Reynolds1, Dr Ryan McGovern2, Dr John Christoforetti2
1Allegheny General Hospital, Pittsburgh, United States, 2Texas Health Sports Medicine, Dallas, United States

S10.8 - Psychological readiness after hip arthroscopy
Michaela O’Connor1, Connor Crutchfield1, Dr Jamie Confino1, Gabrielle K Stein1, Dr T. Sean Lynch1
1Columbia University, New York, United States

S11 – Labral repair

S11.5 - A cadaveric study comparing hip contact pressures between acetabulum labral repair vs total labral reconstruction
Dr Sunikom Suppauksorn1, Dr Edward Beck2, Dr Jourdan Cancienne1, Dr Jorge Chahla1, Ms. Laura Krivicich1, Mr Jonathan Rasio, Dr Shane Nho1
1Rush University Medical Centre, Chicago, US, 2Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US

S11.6 - The effect of cam impingement on complexity of labral tears; A multi-centre descriptive study
Dr Dominic Carreira1, Dr Benjamin Kivlan2, Dr Dean Matsuda3, Dr Shane Nho4, Dr John Salvo5, Dr Geoffrey van Thiel6, Dr Al Stubbs9, Dr Misty Suri10, Dr John Christoforetti6, Dr Andy Wolff5, Dr Steven Garden1
1Peachtree Orthopaedics, Atlanta, United States, 2Duquesne University, Pittsburgh, United States, 3DISC Sports and Spine Centre, Marina del Rey, United States, 4Rush University Medical Centre, Chicago, United States, 5Washington Orthopaedics and Sports Medicine, Washington, United States, 6Allegheny Health Network, Pittsburgh, United States, 7Rothman Institute, , United States, 8Ortho Illinois, Philadelphia, United States, 9Wake Forest Baptist Health, Winston-Salem, United States, 10Ochsner Sports Medicine, Jefferson, United States

S11.7 - Primary labral reconstruction in patients with femuroacetabular impingement, irreparable labral tears, and severe acetabular chondral defects decreases the risk and rate of conversion to total hip arthroplasty. A pair-matched study
Dr David Maldonado1, Cammille Go1, Joseph Laseter2, Dr Ajay Lall3, Michael Kopscik3, Dr Benjamin Domb1
1American Hip Institute, Chicago, United States, 2Case Western Reserve University School of Medicine, Cleveland, United States, 3Medical University of South Carolina, Charleston, United States
S12 – Communicating risk and managing complications

S12.5 - Iatrogenic cartilage injury during hip arthroscopy: a common occurrence that results in superficial cartilage cell death
Dr Robert Westermann1, Dr Jocelyn Compton1, Mr Mike Slattery1, Dr Mitchell Coleman1
1University Of Iowa, Iowa City, United States

S12.6 - There is a low rate of infections and subsequent 30- and 60-day admission rates in primary hip arthroscopy, revision hip arthroscopy and cases converted to total hip arthroplasty.
Dr Wesley Verhoogt1, Dr Jurek Pietrzak2, Sr Kathleen Nortje2, Dr Josip Cakic2
1Gauteng Department of Health, Johannesburg, South Africa, 2University of the Witwatersrand, Johannesburg, South Africa

S12.7 - Intraabdominal fluid extravasation after hip arthroscopy: Incidence and risk factors
Dr Bernardo Aguilera-Bohórquez1, Dr Salvador Ramirez1,2, Ms Erika Cantor1, Dr Miguel Sanchez1,2, Dr Miguel Brugiatti1,2, Dr Orlando Cardozo1,2, Dr Mauricio Pachón-Vasquez1
1Centro Médico Imbanaco De Cali S.a, Cali, Colombia, 2Universidad Javeriana de Cali, Cali, Colombia

S12.8 - The effects of hip arthroscopy without a perineal post on venous blood flow, muscle damage, peripheral nerve conduction, and perineal injury: A prospective study
Dr Matthew Kraeutler1, Dr K Welton2, Dr Tigran Garabekyan3, Dr Laura Vogel-Abernathie4, Dr Daniel Raible5, Mr Jesse Goodrich6, Dr Omer Mei-Dan4
1St. Joseph's University Medical Centre, Paterson, United States, 2MultiCare Orthopaedics & Sports Medicine, Auburn, United States, 3Southern California Hip Institute, North Hollywood, United States, 4University of Colorado School of Medicine, Aurora, United States, 5Nerve Watch, LLC, Wheat Ridge, United States, 6University of Colorado Boulder, Boulder, United States

S13 – FAI surgery

S13.5 - Influence of surgery interval between first and second hip in bilateral hip arthroscopy for femoroacetabular impingement
Dr Jesus Mas Martinez1, Dr Javier Sanz-Reig1, Dr David Bustamante Suarez de Puga1, Dr Carmen Verdu Roman1, Dr Manuel Morales Santias1, Dr Enrique Martinez Gimenez1
1Traumatologia Vistahermosa, Alicante, Spain

S13.6 - Long-term patient reported outcomes following isolated acetabuloplasty for femoroacetabular impingement - 5-year average follow up
Dr Matthew Hartwell1, Dr Ujash Sheth1, BA Patrick Nelson1, BA Allison Morgan1, BA Claire Fernandez1, Dr Vehniah Tjong1, Dr Michael Terry1
1Department of Orthopaedic Surgery, Feinberg School of Medicine, North western University, Chicago, United States
S13.7 - 15-year follow up after surgical hip dislocation for patients with cam-type femoroacetabular impingement results in high survivorship

Dr Till Lerch1, Florian Schmaranzer1, Inga Todorski1, Simon Steppacher1, Moritz Tannast1, Klaus Siebenrock1
1Dept. of orthopaedic surgery, Inselspital Bern, University of Bern, Bern, Switzerland

S13.8 - Surgical treatment of femoroacetabular impingement: arthroscopy vs surgical hip dislocation – a propensity matched analysis

Dr Jeffrey Nepple1, Dr Ira Zaltz2, Dr Asheesh Bedi3, Dr Paul Beaule4, Dr Michael Millis5, Dr Rafael Sierra6, Dr Ernest Sink7, Anchor Group, Dr John Clohisy1
1Washington University Department of Orthopaedic Surgery, Saint Louis, United States, 2William Beaumont Hospital Department of Orthopaedic Surgery, Royal Oak, United States, 3University of Michigan Department of Orthopaedic Surgery, Ann Arbor, United States, 4The Ottawa Hospital Division of Orthopaedic Surgery, University of Ottawa, Ottawa, Canada, 5Harvard Medical School Department of Orthopaedic Surgery at Boston Children’s Hospital, Boston, United States, 6Mayo Clinic Department of Orthopaedic Surgery, Rochester, United States, 7Hospital for Special Surgery Department of Orthopaedic Surgery, New York, United States

S14 – Hip-spine syndrome

S14.5 - Concomitant lumbar spine pathology in patients undergoing hip arthroscopy: A matched cohort analysis

Dr Jonathan Haskel1, Samuel Baron1, Dr Mikhail Zusmanovich1, Dr Thomas Youm1
1NYU Langone Orthopaedic Hospital, New York, United States

S14.6 - Low back pain-related disability, but not pain, is associated with worse patient-reported hip function for patients with non-arthritic hip disease.

Dr John Ryan1,4, BS Haley Bordner1, PT, DPT Lindsey Brown1,2,3, PT, DPT, SCS Kathryn Glaws1, MD W. Kelton Vasileff1,4, MD Bryant Walrod1,5, PT, PhD, OCS Stephanie Di Stasi1,3
1Sports Medicine Research Institute, The Ohio State University Wexner Medical Centre, Columbus, United States, 2Health and Rehabilitation Sciences Doctoral Program, School of Health and Rehabilitation Sciences, The Ohio State University, Columbus, United States, 3Division of Physical Therapy, School of Health and Rehabilitation Sciences, The Ohio State University, Columbus, United States, 4Department of Orthopaedics, The Ohio State University, Columbus, Unites States, 5Department of Family Medicine, The Ohio State University, Columbus, United States

S14.7 - The influence of lumbosacral spine pathology on achieving meaningful clinical improvements in patients undergoing arthroscopic surgery for femoroacetabular impingement syndrome

Mr. Reagan Chapman1, Dr Edward Beck1, Dr Anirudh Gowd1, Dr Benedict Nwachukwu1, Mr. Jonathan Rasio1, Dr Brian Waterman1, Dr Shane Nho1
1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, US

S14.8 - Improvement in lower back pain and function after hip arthroscopy

Dr Yuhang Sun1, BS MBA Kamali Thompson1, MS Christon Darden1, Dr Thomas Youm1
1Nyu Langone Health, New York, USA
S15 – Cartilage injury and repair

S15.4 - Can a biopolymer scaffold injected arthroscopically restore articular cartilage and delay hip osteoarthritis?

Dr Ivan Wong1,2, Dr Rakesh John2
1Dalhousie University, Halifax, Canada, 2Nova Scotia Health Authority, Halifax, Canada

S15.5 - Short-term outcomes following hip arthroscopic microfracture augmented with allograft cartilage

T. David Luo1, Michael Koulopoulos1, Amy Trammell1, Alejandro Marquez-Lara1, Ian Al’Khafaji1, Allston Stubbs1
1Wake Forest Baptist Medical Centre, Winston-Salem, USA

S15.6 - Biological reconstruction versus traditional microfracture techniques in hip preservation arthroscopic surgery for FAI.

Mr Rishi Chana1, Mr Anshul Sobti
1Princess Margaret Hospital, Windsor, United Kingdom

S15.7 - Injectable autologous chondrocyte implantation (ACI) in acetabular cartilage defects – three-year clinical and radiological results

Dr Jörg Schröder1, Prof. Dr Carsten Perka1, Dr David Krüger1
1Charité, Berlin, Germany

S15.8 - 24 months after arthroscopic matrix-associated autologous chondrocyte transplantation of the hip – significant improvement of PROs and MRI using an injectable hydrogel

Dr Stefan Fickert1, Dr Katharina Bretschneider2, Prof. Dr Siegfried Trattnig3, Prof. Dr Stefan Landgraebner4, Dr Albrecht Hartmann4, Prof. Dr Michael Dienst5, Dr Jörg Schröder6, Prof. Dr Klaus- Peter Günther2
1Sporthopaedicum Straubing Regensburg Berlin München, Straubing, Germany, 2University Centre for Orthopaedics & Trauma, University Hospital Carl Gustav Carus, Dresden, Germany, 3MR-Center of Excellence, Department of Radiology and Nuclear Medicine, Medical University of Vienna, , Austria, 4Department of Orthopaedics and Trauma Surgery, University of Duisburg-Essen, , Germany, 5Orthopedic Surgery München, OCM Clinic GmbH, , Germany, 6Center for Musculoskeletal Surgery, Campus Virchow-Klinikum, Charité-Universitätsmedizin Berlin, , Germany

S16 – Teamwork and training

S16.4 - In office screening by a physiotherapist for new hip patients increases efficiency of a hip arthroscopists clinic

Dr Jennifer Marland1, Dr Hugh West1, Dr James Wylie1
1The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

S16.5 - The (lack of) diagnostic value of an intra-articular anaesthetic injection in detecting intra-articular pathologies

Mr. Daniel Hibscher1, Dr Shlomo Bloom1, Dr Michal Guindy1, Dr Keren Hod1, Dr Yehuda Freedman1
1Assuta Medical Centre, Tel-Aviv, Israel

S16.6 - The Training Effect of a Virtual Reality Hip Arthroscopy Simulator

Dr Jonathan Bartlett1, Mr John Lawrence2, Dr Matt Yan2, Mr Max Stewart3, Mr Borna Gueval2, Mr Vikas Khanduja2
1Basildon & Thurrock University Hospital, London, United Kingdom, 2Addenbrookes Hospital, Cambridge, United Kingdom, 3Cambridge School of Clinical Medicine, Cambridge, United Kingdom
S16.7 - What is the revision rate in the learning curve of arthroscopic hip preservation surgery and why are they performed - is it a failure of patient selection or surgical technique?

**Dr Joshua Harris**, David Dong, Domenica Delgado, Thomas Yetter, Brayden Gerrie, Haley Goble, Lindsay Barter

1*Houston Methodist Hospital, Houston, United States*

S16.8 - Pain management trends in hip arthroscopy

**Dr Travis Menge**, Dr Robert Boykin, Dr Guillaume Dumont

1*Michigan State University/Spectrum Health, Grand Rapids, United States, 2EmergeOrtho, Asheville, United States, 3University of South Carolina, Columbia, United States*

S17 – Free Paper Session

S17.1 Predictors of mid-term clinical outcomes after hip arthroscopy: a prospective analysis of 1038 patients with 5-year follow-up

**Dr Ajay Lall**, Sarah Chen, Cammille Go, Dr Rafael Walker-Santiago, Dr David Maldonado, Dr Benjamin Domb

1*American Hip Institute, Chicago, United States*

S17.2 Mental health disorders in hip arthroscopy: An evaluation of its prevalence and associated factors

**Dr Guillaume Dumont**, Dr Travis Menge, Mrs Nicole Battle, Mr Zach Thier

1*University Of South Carolina School of Medicine, Columbia, United States, 2Spectrum Health Medical Group, Grand Rapids, USA*

S17.3 FABER distance on clinical exam compared to exam under anaesthesia to determine contribution of soft tissue constraint in patients with FAI

**Dr Lorenzo Fagotti**, Dr Ashley Payne, MPH Karen Briggs, Dr Marc Philippon

1*University Of South Carolina School of Medicine, Columbia, United States, 2Steadman Clinic, Vail, USA*

S17.4 Bernese periacetabular osteotomy. Is the operative fluoroscopy more reliable than the intraoperative radiography to assess an adequate acetabular correction?

Dr Joaquin Lara, **Dr Alan Garin**, Dr Cristhian Herrera, Dr Selim Abara, Dr Hassan Neumann, Dr Diego Villegas, Dr Javier Besomi, Dr Carlos Tobar

1*Clinica Las Condes - Universidad de Chile, Santiago, Chile, 2Clinica Alemana de Santiago - Universidad del Desarrollo, Santiago, Chile, 3Clinica Avansalud, Santiago, Chile*

S17.5 Effect of post-free distraction arthroscopy on acute pain, discharge time and narcotic consumption

**Dr Robert Kollmorgen**, Dr Thomas Ellis, Dr Brian Lewis, Dr Joshua Harris

1*University Of California San Francisco Fresno, Fresno, United States, 2Orthopedic One, Columbus, United States, 3Duke University Medical Centre, Durham, United States, 4Houston Methodist, Houston, United States*

S17.6 Iliopsoas-related pathology, prevalence, and procedures findings and outcomes from a large hip arthroscopy study group

**Dean Matsuda**, Benjamin Kivlan, Shane Nho, Andrew Wolff, Jonathan Salvo, Jonathan Christoforetti, Thomas Ellis, Drominic Carreira

1*DISC Sports and Spine, Marina del Rey, United States, 2John G. Rangos School of Health Sciences, Pittsburgh, United States, 3Rush Medical Centre, Chicago, United States, 4Washington Orthopaedics and Sports Medicine, Washington DC, United States, 5Rothman Institute, Marlton, United States, 6Allen Orthopaedics and Sports Medicine, Allen, United States, 7Orthopedics ONE, Columbus, United States, 8Peachtree Orthopaedics, Atlanta, United States*
PL2 – Evidence in FAI syndrome

PL2.6 - Femoroacetabular Impingement Randomised controlled Trial (FIRST): A multi-centre randomized controlled trial comparing arthroscopic lavage and arthroscopic osteochondroplasty on patient important outcomes in the treatment of young adult FAI

Associate Professor Olufemi Ayeni1, FIRST Investigators1
1Mcmaster University, Hamilton, Canada

PL5 – Trainee Competition Presentations

PL5.1 how can we define clinically important improvement in pain scores after hip arthroscopy for femoroacetabular impingement syndrome? minimum two-year follow-up study

Dr Edward Beck1, Mr. Kyle Kunze2, Dr Benedict Nwachukwu2, Dr Jorge Chahla2, Ms. Kyleen Jan1; Mr. Jonathan Rasio2, Dr Shane Nho2
1Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, US, 2Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, US

PL5.2 - Femoroacetabular impingement syndrome is strongly predictive for development of hip osteoarthritis within 10 years follow-up: data from the CHECK cohort

Dr Rintje Agricola1, Dr Michiel van Buuren1, Dr Joanne Kemp2, Dr Erwin Waarsing1, Dr Harrie Weinans3, Dr Jan Verhaar1, Dr Jos Runhaar4, Dr Sita Bierma-Zeinstra1,4
1Department of Orthopaedics, Erasmus University Medical Centre, Rotterdam, the Netherlands, 2LaTrobe Sports & Exercise Medicine Research Centre, La Trobe University, Melbourne, Australia, 3Department of Rheumatology and Orthopaedics, University Medical Centre Utrecht, Utrecht, the Netherlands, 4Department of General Practice, Erasmus University Medical Centre, Rotterdam, the Netherlands

PL5.3 - Promising outcomes of hip mosaicplasty by minimally invasive anterior approach using osteochondral autografts from the ipsilateral femoral head

Dr Roxana Viamo-Guerra1,2, Dr Nicolas Bonin2, Dr Olivier May3, Dr Augustin Le Viguelloux2, Eng. Mo Saffarini4, Dr Frédéric Laude1
1Clinique du Sport Paris V, Paris, France, 2Ortho-Lyon-Clinic, Lyon, France, 3Clinique Médipole-Garonne, Toulouse, France, 4ReSurg, Nyon, Switzerland

PL5.4 Does hip joint preservation surgery prevent total hip arthroplasty?

Mr Mark Sohatee1, Mr Mohammed Ali3, Mr Vikas Khanduja3, Mr Ajay Malviya4
1NHS, Newcastle, United Kingdom, 2South Tyneside and Sunderland NHS Foundation Trust, Sunderland, United Kingdom, 3Cambridge University NHS Foundation Trust, Cambridge, United Kingdom, 4Northumbria NHS Foundation Trust, Newcastle, United Kingdom

PL5.5 - Acetabular retroversion has increased prevalence in patients presenting with slipped upper femoral epiphysis: A significant risk factor?

Mr Pranai Buddhdev1, Mr Jitendra Balakumar2, Mr David Slattery2
1NHS, Bushey, United Kingdom, 2Royal Children’s Hospital, Melbourne, Australia
PL5.6 - Sharp Ledge Adjoining the Articular Cartilage Following Femoral Osteochondroplasty Does Not Create Instability in the Hip Joint

Dr Lionel E. Lazaro¹, Dr Daniel P. Lim², Trevor J. Nelson³, Sam A. Eberlein³, Dr Michael B. Banffy², Dr Melodie F. Metzger³

¹Miami Orthopaedic and Sports Medicine Institute, Baptist Health South Florida, Miami, United States, ²Kerlan-Jobe Orthopaedic Clinic, Los Angeles, United States, ³Cedar Sinai, Los Angeles, United States

Principles Hip Preservation Pre-Conference Course Abstracts

Physiotherapy Stream

PHP.PT.1.5 - RTP for Athletes following FAIS
Mario Bizzini¹
¹Schulthess Clinic, Zürich, Switzerland

PHP.PT.2.2 - Muscular defects and assessment in Hip pain
Mr Keelan Enseki
¹Upmc Centres for Rehab Services, Pittsburgh, United States

PHP.PT.3.4 - Pre-operative physiotherapy
Mrs Louise Grant¹
¹Physiocure Physiotherapy Clinic, Leeds, United Kingdom

PHP.PT.3.5 - Is there a connection between pelvic floor dysfunction and FAI?
Yael Mass-Steinfield¹
¹Maagalim Health, Kadima, Israel

Asia Region Programme Stream

PHP.A.1.2 - Subjective scores and objective measures
Dr Nobuyuki Watanabe¹
¹Tosei General Hospital, Seto, Japan

PHP.A.1.3 - Radiological assessment
Dr Seigo Oshima¹
¹Matsuyama Red Cross Hospital, Matsuyam, Japan

PHP.A.1.4 - The pathology: femoroacetabular impingement syndrome
Dr Shingo Hashimoto¹
¹Kobe University Graduate School of Medicine, Kobe, Japan

PHP.A.2.1 - Hip arthroscopy surgical set-up: position, portals
Dr Hao-Che Tang
¹Tri-service General Hospital, Taipei, Taiwan

PHP.A.2.5 - Mini-anterior approach: surgical technique
Sheng-Hao Wang
¹Tri-service General Hospital, Taipei, Taiwan
PHP.A.2.6 - Safe surgical dislocation: surgical technique

Shang-Lin Hsieh¹
¹China Medical University Hospital, Taichung, Taiwan

PHP.A.3.1 - Arthroscopic management of hip micro instability and dysplasia

Kotaro Shibata¹
¹Osaka Saiseikai Noe Hospital, Osaka, Japan

English Speaking Programme Stream

PHP.E.1.7 - Conservative treatment and surgical indications

Dr Hugh West¹
¹Intermountain Healthcare, Salt Lake City, United States

PHP.E.3.1 - Arthroscopic management of hip microinstability and dysplasia

Dr Dominic Carreira¹
¹Peachtree Orthopaedics, Atlanta, United States
functional outcomes in patients with untreated intra-articular lesions

MD Joaquin Lara1, MD Alan Garin1, MD Cristhian Herrera1, MD Selim Abara1, MD Javier Besomi2,5, MD Diego Villegas3, MD Hassan Neumann3, MD Carlos Tobar4
1Centro de Cadera Clinica Las Condes, Santiago, Chile, 2Clinica Alemana de Santiago, Santiago, Chile, 3Hospital Padre Hurtado, Santiago, Chile, 4Clinica Avansalud, Santiago, Chile, 5Hospital San Borja Arriaran, Santiago, Chile

Introduction: Developmental dysplasia of the hip (DDH) has been recognized to be a condition leading to osteoarthritis. Periacetabular osteotomy (PAO) has showed good results on hip preservation treatment for these cases. Nevertheless, intraarticular damage may be responsible for persistent postoperative symptoms, so performing hip arthroscopy before PAO has emerged as an alternative to address it.

Objectives: Identify the prevalence of intraarticular damage, functional outcomes of patients undergoing PAO with untreated intra-articular lesions and the survivorship free total hip arthroplasty (THA) at long-term follow up.

Methods: Retrospective review of 103 hips in 92 patients, mean age 26 years old (19-31), 96% females. Mean follow up 7 years (range 3-16). Intraarticular damage was evaluated with high resolution Magnetic Resonance Imaging (MRI) previous to perform PAO, using International Cartilage Repair Society (ICRS) classification. Modified Harris Hip Score (HHS) was obtained in all patients.

Results: 100% of the cases had labral tears on MRI, hypertrophic labrum in 80,8% and paralabral cysts in 20,8%. Acetabular chondral damage was grade 2 in 88,5% of the hips. HHS was good and excellent in 94%. Survivorship free of THA at 15 years was 87%.

Discussion: Previously published reports of arthroscopic intervention for the treatment of DDH have proven controversial. Chondolabral damage is a common finding in patients with DDH. Despite that, excellent results are obtained with PAO without labral repair. We think the focus should be in the biomechanical and anatomical correction of the hip in patients with DDH.
EP1.2 Incidence of signs of femoroacetabular impingement in adolescents with developmental dysplasia of the hip

Tobias Fauser¹, Jenna Powell¹, MD Tyler Freeman², MD Derek Axibal², MD Robin Dunn², MD Courtney O'Donnell¹,², MD Stephanie W Mayer¹,²

¹Children’s Hospital Colorado, Aurora, United States, ²University of Colorado Anschutz Medical Campus, Aurora, United States

Biography:

Dr. Mayer is an orthopaedic surgeon who specializes in pediatric, adolescent and young adult sports medicine. She completed an orthopaedic surgery residency at Duke University where she served as an assistant team physician for the volleyball, basketball, soccer, lacrosse and football teams. She then completed a pediatric orthopaedic fellowship at Children’s Hospital Colorado as well as a sports medicine fellowship at Hospital for Special Surgery in New York City where she served as an assistant team physician for the New York Knicks and New York Liberty.

Dr. Mayer has many clinical and research interests in sports medicine and specializes in the treatment of hip injuries and femoroacetabular impingement including hip arthroscopy, knee ligament, cartilage, meniscal, and patellar injuries, and shoulder injuries including labral and rotator cuff tears. A former student-athlete in volleyball at Texas Christian University and current marathon runner, Dr. Mayer is dedicated to the prevention and treatment of injuries in active patients and returning them to activities of all levels.

Dr. Mayer serves as Assistant Head Team physician for the Colorado Avalanche as well as team physician for the University of Denver hockey team and DU Athletics.

Purpose

Coxa profunda is traditionally considered indicative of deep socket or pincer-type deformity. However, radiographic findings of acetabular retroversion or global over coverage can also be seen in developmental hip dysplasia (DDH), disputing this association. Many patients with DDH also have radiographic evidence of cam-type anatomy. This study examines the incidence of radiographic characteristics of acetabular retroversion, deep acetabula, and cam-type anatomy in dysplastic hips.

Methods

86 hips in 45 patients (83.7% female, age 17.1 ± 4.4 years) with dysplastic hips seen between 2015-2017 were examined. Radiographic incidence of coxa profunda, protrusio acetabuli, crossover sign, ischial spine sign, lateral centre edge angle (LCEA), acetabular index (AI), and alpha angle on both the anterior posterior (AP) and lateral views when a Dunn lateral radiograph was available (n = 60) was measured.

Results

Coxa profunda was observed in 51.16% of hips with significant female bias (p < 0.05) in agreement with past observations. Protrusio acetabuli was observed in 1.16% of hips, crossover sign in 52.33%, and ischial spine sign in 27.91%. Abnormal lateral alpha angle (≥ 55°) was observed in 11.7% of measured hips.

Signs of ischial spine (p = 0.8932) or crossover (p = 0.9920) did not predict coxa profunda. Although non-significant, coxa profunda was more frequently observed in hips without an ischial spine sign (32/44). AI, LCEA, AP alpha angle, and lateral alpha angle also did not predict coxa profunda (p > 0.08). Although, hips with higher AI or lower LCEA were non-significantly more likely to have coxa profunda.
Conclusion

Mixed radiographic parameters may be observed in dysplastic hips. Coxa profunda and indicators of acetabular retroversion were observed with relatively high frequency in this population.

Significance

Although acetabular dysplasia and signs of a deep acetabulum or pincer deformity are traditionally thought of as mutually exclusive, we found that 51% of dysplastic hips had coxa profunda, 52% had a crossover sign, and 28% had ischial spine sign. Additionally, 12% had increased lateral alpha angle suggesting cam-type femoroacetabular impingement. Our data suggests the presence of coxa profunda or signs of acetabular retroversion should not be thought of as a surrogate for pincer-type impingement.
EP1.3 Utilization of a transverse screw construct in periacetabular osteotomy: does this impact initial fragment stability and version control?

Tobias Fauser¹, Jenna Powell¹, MSc Todd Baldini², Kayla Burnim, Anne M Skelton, MD Mark Erickson¹², MD Stephanie Mayer¹², MD Courtney O'Donnell¹²

¹Children's Hospital Colorado, Aurora, United States, ²University of Colorado Anschutz Medical Campus, Aurora, United States

Purpose

Treatment of acetabular dysplasia with periacetabular osteotomy (PAO) requires precise correction of femoral head coverage and optimization of acetabular version. Achieving stability of the acetabular fragment increases the success of maintaining the correction and may decrease risk of non-union. Thus, more robust fixation techniques such as the inclusion of a transverse screw may allow improved control of acetabular version, increase the chances of a well-maintained correction, and decrease the incidence of non-union. This study compares the traditional configuration of four antegrade screws to a construct including three antegrade and one transverse screw.

Methods

Ten cadaveric specimens with bony pelvis, sacrum, and L4-L5 underwent bilateral PAOs fixed with four 4.5mm screws. One hip utilized the traditional construct (A) of 4 antegrade screws fixed from the iliac crest to the fragment, and one hip utilized the novel construct (B) of 3 antegrade screws and 1 transverse screw passed retrograde from the acetabular fragment to the ilium. Laterality of the assigned configuration was randomized.

The specimens were mounted in neutral on a servo hydraulic loading system with a vertical force applied to the acetabulum via a standard endoprosthesis. Each pelvis was loaded to clinical failure (5mm of fragment displacement) and ultimate failure while intra-articular force and actuator data was collected. Acetabular version was collected from motion capture.
Results
Matched pairs t-tests significantly demonstrated that construct B tolerated a higher load than construct A before reaching clinical failure (p < 0.05; mean construct A 149.6 ± 70.2N, construct B 220.4 ± 79.9N).
Stiffness was non-significantly higher with construct B than with construct A (p = 0.13; construct A 34.21 ± 16.96N/mm, construct B 44.47 ± 15.63N/mm). Construct B also tolerated a non-significantly higher load than construct A before reaching a change in acetabular version greater than 0.5° (p = 0.20; construct A 369.4 ± 240.8N, construct B 396.8 ± 209.0N).

Conclusion
These findings indicate that the addition of a transverse screw may afford small increases in initial fragment stability and stiffness after PAO. Utilization of a transverse screw in a PAO fixation construct may allow greater initial stability of the acetabular fragment.
EP1.5 The Australian patient experience: Part B - periacetabular osteotomy intervention

Miss Madison Morrish, Mr David Georgy, Mrs Jessica Georgy
Australian Sports Physiotherapy, Melbourne, Australia

Biography
Dedicated and thorough Physiotherapist with experience in the Management of Musculoskeletal and Orthopaedic cliental. Supportive and always meticulous, David endeavours to provide a prompt diagnosis and effective treatment to aid recovery and get clients back on track.

Co-Director of ASP & Senior Physiotherapist
Bachelor of Physiotherapy (University of South Australia)
Sports trainer & sports physiotherapy experience
Working in conjunction with orthopaedic surgeons and medical professionals
Post-operative orthopaedic rehabilitation
Clinical Supervisor for Masters of Physiotherapy students from Bond University and Bachelor of Physiotherapy students from ACU University
Member of Australian Physiotherapy Association (APA)
Registered member of Australian Health Practitioner Regulation Agency (AHPRA)
Certificate 1 in Dry Needling

A Periacetabular Osteotomy (PAO) is a surgical intervention for the treatment of hip dysplasia; a condition resulting from a deformity of the acetabulum.

Previously, the patient of interest had a previous hip arthroscopy before the surgery. Despite the current research in advancing surgical technique such as reducing the size of the scar, there is little discussion about the patient's physical and mental experience which plays a major role in recovery.

The aim of this single subject study is to determine and understand the outcomes and experiences of a patient following Periacetabular Osteotomy performed in Australia.
EP1.6 Cartilage degeneration is associated with increased joint contact stress in patients with hip dysplasia
Ms. Holly Thomas-Aitken¹, Mr. Nicholas Bartschat¹, Dr John Clohisy², Dr Michael Willey¹, Dr Robert Westermann¹, Prof Jessica Goetz¹
¹University of Iowa, Iowa City, United States, ²Washington University, St. Louis, United States

Biography
Dr Westermann is a staff physician at the University of Iowa Hospitals and Clinics, and the team physician for the Hawkeyes.

Objectives
Osteoarthritic joint degeneration has been associated with elevations in computationally derived joint contact stress. The purpose of this study was to determine if a similar association between cartilage damage and elevated joint contact stress exists in patients with hip dysplasia.

Methods
Discrete element analysis was used to compute hip contact stresses during the stance phase of walking gait for 18 patients diagnosed with dysplasia. Contact stresses >2 MPa were considered deleterious (previously determined for patients with hip dysplasia) and summed over the walking gait cycle to obtain a contact stress over-exposure metric. This over-exposure metric was calculated for each of the six acetabular regions evaluated arthroscopically for cartilage damage at the time of surgical intervention (anterior central, anterior peripheral, superolateral central, superolateral peripheral, posterior central, and posterolateral peripheral). Zonal chondromalacia grades were correlated with the contact stress over-exposure for each acetabular region using two-sided Wilcoxon rank sum tests with Holm-Bonferroni corrections for multiple comparisons.

Results
Contact stress-time over-exposure in the anterior and superolateral peripheral regions averaged 2.6±1.5 MPa-s and 3.9±1.8 MPa-s, respectively, which was significantly higher (p<0.001) than that any other region. The average chondromalacia grade in the anterior peripheral region was 2.4±1.2, and the average chondromalacia grade in the superolateral peripheral region was 3.1±0.9, which was significantly higher (p<0.001) than in any other region. Contact stress-time over-exposure strongly correlated (R² = 0.915) with average chondromalacia grade across the six acetabular regions.

Discussion
The strong correlation between contact stress-time over-exposure and macroscopic cartilage damage validates the use of DEA-computed contact stress information for identifying regions of tissue damage in dysplasia. These results suggest the benefit of corrective surgery to reduce excess contact stress below damage-inducing thresholds could mitigate further cartilage damage and thereby preserve the native hip.

Reference
EP1.12 How does clinical outcome correlate to acetabular coverage after periacetabular osteotomy?

Dr Mazen Ibrahim1, Johanna Dobransky2, Lilly Jean-Pierre3, Dr Paul Beaule2,3
1Children Hospital Eastern Ontario, Ottawa, Canada, 2The Ottawa Hospital, Ottawa, Canada, 3The Ottawa university, Ottawa, Canada

Biography:
Clinical fellow of paediatric orthopaedic in the Children Hospital Eastern Ontario
Lecturer of Orthopaedic surgery Helwan University

Stability relationship between the femoral head and acetabulum is complex, and there are near infinite number of bony morphologic and dynamic/functional configurations that exist along a spectrum of stability. It is important to understand the 3D anatomy of acetabular dysplasia/impingement when planning a corrective osteotomy to restore normal anatomy and minimize the chance of leaving residual deformity in one plane and over-coverage in the other. The aim of our study is to evaluate the outcome of periacetabular osteotomy, as well as, correlating the radiographic parameters with the functional outcome. Fifty-six patients (67 hips) underwent periacetabular osteotomy, with complete PROMs included in our study. There were 9 male (16.1%) and 47 female (83.9%) patients with a mean age of 27.7 years (SD 9.1) and a mean body mass index of 24.7 kg/m2 (SD 4.2). We used the Hip2Norm, an object-oriented-platform program, to perform 3D analysis of hip joint morphology using 2D anteroposterior pelvic radiographs. The lateral centre-edge angle, anterior coverage, posterior coverage, total femoral coverage, and alpha angle were measured for each hip in both pre- and post-operative plain antero-posterior pelvis x-ray. The presence or absence of crossover sign, posterior wall sign, and the value of acetabular retroversion index were identified automatically by Hip2Norm. Patient-reported outcome scores were collected preoperatively and at final follow-up with the Hip Disability and Osteoarthritis Outcome Score (HOOS). At a mean follow-up of 2.7 years (SD 1.6), all functional outcome scores significantly improved overall. Radiographically, only postoperative retroversion had a negative correlation with the improvement of the HOOS activity of daily living and quality of life subscales (r=-0.27 & -25, p=0.02 & 0.03, respectively). Hip functional outcome reached the threshold of minimum clinically important difference (responders) for pain, activity daily living and quality of life HOOS subscales, were 40(59.7%), 43 (64.2%), 45(80.6%), respectively and this was statistically related to positive crossover sign with retroversion index more than 20% (p=0.04,0.02,0.008, respectively). Our study demonstrated the postoperative cross over sign with retroversion index more than 20 degrees as an important modifier influencing the functional outcome of periacetabular osteotomy.
EP1.13 Hip arthroscopy in painful borderline hip dysplasia: A single institution retrospective experience

Dr Jung-Mo Hwang, Dr Jeong Kil Lee, Dr Deuk-Soo Hwang, Dr Young-Cheol Park
1Chungnam National University of Hospital, Daejeon, South Korea

Biography:
I have trained hip arthroscopy by Deuk-Soo, Hwang.

Background: The decrease in bony coverage is a cause of joint micro instability, which has shown increased stress on the acetabular labrum as it shares an increased load and acetabular labral change may predispose to adjacent articular cartilage disorder and hip osteoarthritis in patients with hip dysplasia. Patients with borderline hip dysplasia are generally not candidates for periacetabular osteotomy because of the invasive procedure. The purpose of this article was to investigate the size of acetabular labrum and clinical outcomes for the patients with borderline hip dysplasia following arthroscopic treatment at out institution.

Methods: A retrospective study was conducted at our institution from May 1996 to April 2013, 1436 patients who underwent hip arthroscopy for symptomatic intra-articular hip disorder were enrolled. From this cohort, a borderline hip dysplasia group compromising 162 cases with a lateral centre-edge angle (LCEA) ≥20° and <25° and minimum of 5 years follow-up, was included in this study. Patients with Tönnis grade 2 or greater, and severe hip dysplasia (LCEA <20°) were excluded. The morphologic measurement of acetabular labrum was evaluated using both preoperative MRI and intraoperative arthroscopy. Clinical outcomes including the Tönnis grade, modified Harris Hip Score, Non-Arthritic Hip Score, Hip Outcome Score–Activity of Daily Living, and visual analogue scale (VAS) for pain were obtained in all patients preoperatively and at a minimum of five years postoperatively. Revision surgery and complications between normal hip and borderline hip dysplasia were recorded.

Results: The mean follow-up was 97.4 months (range, 60–263 months). The mean LCEA was 22.3 (range, 20–25). The morphologic measurement of acetabular labrum was 7.64±1.49 mm in normal hip group and 7.73±1.39 mm in the borderline hip dysplasia group, respectively, and there was no statistical significance between the two groups. Tönnis grade was mild progressed (average, 1.4). At the last follow-up, there was significant improvement (p < 0.001) in all patient reported clinical outcome scores and VAS.

Conclusion: Based on our data, arthroscopic treatment relieves symptoms and does not speed up osteoarthritis in painful borderline hip dysplasia. Therefore, if patients have no response to conservative treatment, hip arthroscopy is a useful treatment option.
EP1.14 Removal of in-dwelling epidural catheter on post-operative day #1 leads to reduced hospital length of stay, improved ambulation, and overall decrease in pain and opioid use following Bernese peri-acetabular osteotomy (PAO)

Dr Brian Lewis1, Dr William Norcross1, Mr. Skip Maza1, Dr Steven Olson1

1Duke University Medical Centre, Durham, United States

Biography:
Dr Lewis is fellowship trained in hip preservation surgery and has an active clinical interest in how to improve pain control and speed recovery while minimizing the use of opioids.

Peri-acetabular osteotomy (PAO) is a successful surgery for treating hip dysplasia in young adults but is associated with significant post-operative pain. Many centres use in-dwelling epidural catheters for pain control, but there is minimal standardization or evidence regarding post-operative protocols. Our prior standard was to place an epidural (running ropivacaine and fentanyl) prior to surgery to remain until post-operative day (POD) #2 (40-48h). We hypothesized that removing the epidural on POD #1 would allow faster recovery and earlier hospital discharge without negatively impacting pain control.

A retrospective review of cases done 18 months prior to and following this change was performed. Data was examined on length of stay, opioid use, and time to ambulation. Group 1 (60 patients) had surgery with planned epidural removal POD #2 while Group 2 (86 patients) had planned removal POD #1. The two groups did not differ in age, gender, or BMI. Variables were compared using the Mann Whitney U test.

Group 1 had an average length of stay of 4.6 days (2-9) compared to 3.2 days (2-5) in group 2 (p: <0.00001). Group 1 had an average pain score on POD #1 of 2.8, while Group 2 had an average score of 4.6 (p:<0.0001), however, pain score on the day of epidural removal in Group 1 was 5.1 compared to 4.6 in Group 2 (p:0.041). On POD #1, Group 1 used 99 oral morphine equivalents (MME) compared to 134 for Group 2 (p:0.0004), but when comparing the day of epidural removal, Group 1 used 196 MME compared to 134 for Group 2 (p :<0.00001). Total hospitalization MME was 652 for Group 1 and 330 for Group 2 (p:<0.00001). Time to ambulation was inconsistently recorded but was 43 hours in Group 1 and 24 hours in Group 2.

Our study shows that an in-dwelling epidural catheter can be removed early on POD #1 after PAO without an overall increase in pain scores. Early removal led to earlier discharge, lower overall pain scores and less opioid use on the day of removal, less overall opioid usage, and earlier ambulation.
EP1.15 Technique for combined hip arthroscopy and peri-acetabular osteotomy (PAO) with single table/single surgeon and post-free distraction

Dr Brian Lewis¹, Dr Dustin Woyski¹, Dr Robert Kollmorgen², Dr Steven Olson¹
¹Duke University Medical Centre, Durham, United States, ²University of California San Francisco, Fresno, Fresno, USA

Biography:
Dr Lewis is fellowship trained in hip preservation surgery and enjoys combining both open and arthroscopic techniques to continue to improve the outcome of patients.

Periacetabular osteotomy (PAO) is the most commonly performed surgery for the treatment of hip dysplasia. Secondary to high rates of intra-articular pathology at the time of PAO and the potential for iatrogenic impingement the need for hip arthroscopy combined with PAO has been increasingly recognized. Varying techniques have been described including staged procedures and single surgery procedures involving changing tables and even surgeons between the arthroscopic portion and PAO. We present our experiences and novel technique which minimizes surgical times and decreases the risk of pudendal nerve palsy or genital injury.

Since 2012, we have employed simultaneous single surgeon hip arthroscopy and PAO. Starting in 2018, we evolved our technique to include a system of post-less distraction during hip arthroscopy. The patient is placed supine on the traction table (more than one design was utilized). Hip distraction is achieved from the post-less design through body friction and central compartment work completed followed by treatment of the peripheral compartment and PAO while maintaining the patient in the same position on the same table.

Surgical findings were as follows. Labral tears were present in 91.4% of the cases with an average of 2.9 anchors used for repair. Ligamentum teres tears were present in 64% of patients. Beck changes of acetabular cartilage were present in 91% of patients with 26% having Beck Grade 3 changes. No patients had exposed subchondral bone. Femoral head defects were less common, present in only 7% of patients. Cam resection was performed in 90% of patients via open or arthroscopic approach based on surgeon preference. The decision to perform cam resection was determined by pre-op 3-dimensional imaging and/or intra-operative assessment of impingement.

Mean surgical time was 183 minutes (101-285). Blood loss averaged 250cc (100-500). No additional complications were noted as a result of the use of post-less distraction. There were no incidences of pudendal nerve palsy or genital injury. This technique provides a safe and reliable way for a single surgeon, single table, single surgery approach to treatment of intra-articular hip pathology and hip dysplasia without the need for a distraction post.
**Objective**

To describe neurophysiological changes during Ganz osteotomy focusing on the following critical steps:

1. Pubian osteotomy
2. Low isquial osteotomy
3. Postero inferior column osteotomy
4. Iliac osteotomy
5. Postero superior ilioisquial osteotomy
6. Acetabular fragment redirection
7. Fragment fixation

**Material and Methods**

Since January 2018, 52 patients (14 male/38 female, mean age 31.5 years) underwent Ganz osteotomy. Anaesthesia was TIVA and without muscle relaxant. IOM include Somatosensory Evoked potentials (SSEP) from all extremities (RMed, LMed, RPTN, LPTN), Motor Evoked Potentials (MEP) from bilateral abductor pollicis brevis (APB) for upper extremities and for lower extremities: Adductor magnus (obturator nerve at risk), vastus medialis and rectus femoris (femoral nerve at risk), peroneus longus and tibialis anterioris (external popliteal, sciatic nerve at risk), abductor hallucis and lateral gastrocnemius (internal popliteal, sciatic nerve at risk) bilaterally. Also, free EMG was recorded continuously in all muscle mentioned above.

**Results**

No significative changes were observed in 39 cases
Significative changes were observed in 13 patients (25%)
Neuromyotonic discharges (free EMG) in different muscular groups secondary to retractor positioning and manipulation (13 cases)
Decrement in MEP amplitude secondary to retractor positioning and bleeding (7 cases)
Decrement in SSEPs amplitude and increased latency during sciatic nerve manoeuvre secondary to retraction and positioning (3 cases)
The surgeons were informed, and prevention measures were taken (manoeuvre reversion, hardware removal, time, irrigation, blood pressure increment and corticoids). In 12/13 cases the changes were reversible without any postoperative clinical deficit.

Conclusions
IONM changes provide valuable information to the surgeon during Ganz osteotomy, being able to detect and reverse nerve injuries. Appreciation of the mechanisms leading to nerve damage during Ganz osteotomy is the key to reducing the risk of such an event.
EP1.17 Case report: Our first out-patient periacetabular osteotomy

MD Richard Santore1, MD Michael Muldoon2, Research Coordinator Robert Healey2, Research Associate Austin Long2

1Hip Preservation Centre of Excellence, San Diego, United States, 2Sharp Healthcare, San Diego, United States

Biography:
Dr Santore is a Harvard University-trained Orthopaedic Surgeon with Fellowships in Total Hip, Total Knee and Osteotomy surgery from Harvard University and AO of Switzerland. He served as Chief Resident of Orthopaedic Surgery of the Massachusetts General Hospital. He has been affiliated continuously, since completion of post-graduate and fellowship training, with the Orthopaedic Medical Group of San Diego. He is a graduate of the University of Pennsylvania School of Medicine, the first medical school to train doctors in the United States.

He is one of the world’s leading experts in the field of osteotomy and joint-preserving surgery of the hip and knee and an expert in Total Hip and Total Knee surgery.

On February 4, 2019 we achieved our first out-patient periacetabular osteotomy (PAO). The patient was an optimistic 21-year old who had a successful contra-lateral PAO the previous year. She experienced very little pain post-operatively from the first procedure and, from that experience, no longer had “the fear of the unknown.” With the added benefits of having been familiar with do’s and don’ts of rehabilitation, having a very supportive mother and a high pain threshold, she was deemed an ideal candidate for the first out-patient procedure. I (senior author, RFS) disclosed to her and her mother that this had not been done before. They were excited to participate, and agreed to a video documentation pre-op, intra-op and post-op. The surgery was a combined PAO (performed by RFS) and surgical arthroscopy for labral repair (performed by MPM) and the operative time was just under five hours. The procedures were performed with a spinal anaesthetic without intrathecal Duramorph.

She arrived in the PACU and was ambulated there within the first hour. She was transferred to a hospital bed an hour later, walked the hallway with two crutches an hour after that and was discharged to a private car for transfer home by 3.5 hours after the end on the procedure. By seven weeks post-op she was walking normally. Our length of stay has decreased dramatically from 5-7 days ten years ago to 1-2 days currently. We performed the outpatient PAO in the main hospital, with easy access to vascular surgeons, interventional radiology and other specialists in the event of an adverse outcome or operative complication. Surgery on carefully selected patients in a proper hospital setting followed by immediate discharge when appropriate for the circumstances is a formula that places patient safety as the highest priority.
EP1.18 Transfusion rate in periacetabular osteotomy cases reduced to zero percent (0%)

**MD Richard Santore**¹,², Research Coordinator Robert Healey¹,², MD Max Gosey¹, Research Associate Austin Long¹,², MD Michael Muldoon¹,²

¹Hip Preservation Centre of Excellence, San Diego, United States, ²Sharp Healthcare, San Diego, United States

**Biography**

Dr Santore is a Harvard University-trained Orthopaedic Surgeon with Fellowships in Total Hip, Total Knee and Osteotomy surgery from Harvard University and AO of Switzerland. He served as Chief Resident of Orthopaedic Surgery of the Massachusetts General Hospital. He has been affiliated continuously, since completion of post-graduate and fellowship training, with the Orthopaedic Medical Group of San Diego. He is a graduate of the University of Pennsylvania School of Medicine, the first medical school to train doctors in the United States.

**Introduction**

Periacetabular osteotomy (PAO) is a widely used procedure for treating hip dysplasia. The procedure presents the potential for significant blood loss requiring transfusions with the associated health risks. With a scarcity of reports examining blood loss in periacetabular osteotomy, this study was conducted to investigate transfusion rates relative to demographic and laboratory factors in a consecutive series of PAOs by a single surgeon at a single centre.

**Methods**

Under an approved IRB protocol, a retrospective review of 178 PAO procedures over an eight-year period (146 females, 32 male) was performed. All patients received spinal anaesthetic, aminocaproic acid 5 gm pre-op one 1 gm/hr for five hours, and Cell Saver recovery. Over the study period, more aggressive blood conservation approaches were incrementally added, including use of small volume Cell Saver bowls, discontinuation of drains, use of epinephrine injections, aggressive use of plasma blade for coagulation of bleeding sites, a switch to tranexamic acid and adjusting the Hgb threshold to ≤7.0. Categorical associations between demographic data, blood loss, and transfusion risks were assessed using multivariate analysis.

**Results**

A total of 19 (10.7%) subjects received transfusions. There was a significantly greater estimated blood loss for male (864.7cc) versus female (508.7cc) patients (p<0.001). This correlation was not, however, associated with a significant increase in transfusion rate or operative time (p=0.191). The risk of transfusion was associated with a mean “trigger” Hct of 22.9 and Hgb of 8.8. Race did not contribute a significant risk (p=0.785) of transfusion in this population. Over the past four years the transfusion rate was 1.5%. The transfusion rate over the past twenty-seven months (2+ years) has been reduced to zero (0%) in 63 consecutive cases.

**Conclusion**

Improvements in PAO blood management techniques have dramatically improved transfusion-related risks.
Surgical management of adult borderline developmental hip dysplasia - A systematic review

Dr Sam Marsden¹, Mr Jonathan Hutt¹
¹St George's University Hospitals NHS Foundation Trust, London, UK

Biography
Sam Marsden is an Orthopaedic Research Fellow with an interest in hip preservation surgery and lower limb trauma.

Background
Developmental dysplasia of the hip (DDH) describes disorders resulting from abnormal development of the hip joint. DDH can be quantified radiographically using the Lateral Centre Edge Angle (LCEA), which classifies hips as normal (>25°), borderline (20-25°) or dysplastic (<20°), though there is inconsistency in its use. Whilst periacetabular osteotomy (PAO) remains the gold standard treatment of DDH, controversy remains regarding surgical treatment of borderline dysplasia.

The aims of this systematic review were to compare patient reported outcome measures (PROMs) and rates of revision surgery following arthroscopy or PAO in patients with borderline developmental dysplasia (bDDH) and identify current practice in the use of the LCEA.

Methods
Databases were searched from 2003 to 2019. Search terms included ‘osteotomy’ OR ‘arthroscopy’ AND ‘hip dysplasia’ AND ‘treatment outcome’. Studies were selected according to predetermined criteria. Data extracted included demographics, PROMs, reoperation rates and LCEA ranges.

Results
This review identified 13 studies including 971 hips. Eight studies investigated arthroscopy, four PAO and one a combined approach. Mean length of follow-up ranged from 15 to 68.8 months. All studies showed improvements in PROMs. Revision rates varied following arthroscopy, with revision arthroscopy required in 2-25% and THR in 0-32%. PAO revision rates were lower (0-6% requiring THR). Use of the lower LCEA threshold for bDDH varied, with 18 and 20° used interchangeably.

Discussion
Arthroscopy improves PROMs in borderline dysplastic hips but may have a higher revision rate. PAO has a role in the management of borderline dysplastic hips. Considerable equipoise remains between the two treatments.
EP1.20 Dysplasia with retroversion: Prevalence, acetabuloplasty rates, and outcomes from a large hip arthroscopy study group

Dean Matsuda1, Benjamin Kivlan1, Shane Nho3, Andrew Wolff4, Jonathan Salvo5, Jonathan Christoforetti6,7, Thomas Ellis8, Dominic Carreira9

1DISC Sports and Spine, Marina del Rey, United States, 2Dusquene University, Pittsburgh, United States, 3Rush Medical Centre, Chicago, United States, 4Washington Orthopaedics and Sports Medicine, Washington DC, United States, 5Rothman Institute, Marlton, United States, 6Allen Orthopaedics and Sports Medicine, Allen, United States, 7Peachtree Orthopaedics, Pittsburgh, United States, 8Orthopedics ONE, Columbus, United States, 9Peachtree Orthopaedics, Atlanta, United States

Introduction
The radiographic crossover sign (COS) is an indicator of acetabular retroversion, classically representing anterosuperior over coverage often treated with acetabuloplasty which could exacerbate acetabular hypovolemia in dysplasia. No prior study has investigated the prevalence of acetabular retroversion in patients with dysplasia undergoing hip arthroscopy, acetabuloplasty rates, and outcomes in this setting.

Purpose
Report the prevalence of acetabular retroversion in dysplasia, the influence of the COS on arthroscopic acetabuloplasty rates, and relative outcomes compared with control groups.

Methods
A retrospective cohort study was performed from a prospectively collected multi-centre database. Patients undergoing isolated hip arthroscopic surgery were assigned to dysplasia (lateral centre-edge angle (LCEA) ≤ 25°) or one of two control groups: normal (LCEA 26-38°), or pincer femoroacetabular impingement (FAI)(LCEA ≥ 39°). The prevalence of COS and acetabuloplasty rates between and within study and control groups were compared (Chi square analysis). Minimum 2-year outcomes utilizing iHOT-12 were compared (analysis of variance).

Results
Of 401 study patients, 64 (16%) comprised the dysplasia group, 273 (68%) normal group, and 64 (16%) pincer group. Mean LCEAs were 22.3°, 31.5°, and 42.4°, respectively(p<0.001). COS prevalence was similar between groups at 31%, 26%, and 33%, respectively(p=0.873). Acetabuloplasty rates were dependent on the amount of acetabular coverage with lowered rate in the dysplasia group (40%) and increasing rates in the normal (52%) and the pincer (90%) groups (p=0.013). Post-operative iHOT-12 scores improved in all groups (68, 74, and 77, respectively, p=0.222). Patients with a COS plus rendered acetabuloplasty reported similar scores that improved to 77, 74, and 79, respectively, (p=0.949). Patients with dysplasia with COS averaged 73.1(SD 23.3) iHOT-12 score compared to 67.1(SD: 28.7) for the patients with dysplasia without COS (p=0.466). Within the dysplasia with COS subgroup, there was no significant difference in iHOT-12

Biography
Dean K. Matsuda is recognized as a key opinion leader in hip arthroscopy. He has developed numerous procedures including arthroscopic treatment of the most extreme forms of femoroacetabular impingement (FAI), labral reconstruction, arthroscopic treatment of femoral head and acetabular fractures, and endoscopic treatment of athletic pubalgia and has authored the AAOS teaching video on arthroscopic surgery for FAI. Dr Matsuda is past chairman of the AAOS Sports Medicine program committee, current member of the AAOS Adult Reconstruction Hip program committee and the ISHA Educational committee, member of the MASH study group, long-time editorial board member of Orthopaedics Today, and director of the travelling fellowship for Orthopaedics Overseas. He is the director of Hip Arthroscopy at DISC Sports and Spine in Marina del Rey, California with a dedicated focus on non-arthritic hip and groin conditions.
scores between the group with acetabuloplasty (77.0;SD:17.1) and without acetabuloplasty (70.4;SD:27.4, p=0.580).

Conclusions
Acetabular retroversion occurs with similar prevalence in dysplasia compared with non-dysplastic hips undergoing hip arthroscopy but with lower acetabuloplasty rates not influenced by the COS. Arthroscopic outcomes of dysplasia with retroversion are similarly successful and comparable with those of dysplasia and non-dysplastic hips. Although infrequently performed, acetabuloplasty does not compromise outcomes in dysplasia with retroversion.
Is the arthroscopic technique an effective tool in the treatment of borderline dysplasia?

MD CLAUDIO RAFOLS¹, PhD, MD Juan Monckeberg¹, MD Tomas Amenabar¹
¹Meds clinical centre, Santiago, Chile

Arthroscopic surgery in borderline hip dysplasia is controversial. Periacetabular Osteotomies (PAO) is preferred for severe hip cases.

Purpose
The purpose of this study is to evaluate the results of hip arthroscopy in borderline hip dysplasia. Our hypothesis was that hip arthroscopy results would be better to described with CAM femeroacetabular impingement.

Material and methods
This are a prospective case control study. Inclusion criteria was symptomatic patients with borderline hip dysplasia, confirmed with centre-Lateral or Wiber angle (CE) between 20-24° and confirmed by MRI with labral tear and no response to conservative treatment after at least four months of follow up. Exclusion criteria were refusal, previous surgery, sciatica, osteoarthritis and glucocorticoid injection received in the last year. An arthroscopic labrum repair was performed with a longitudinal out-in approach with at least 3 anchors in twenty-five patients (Group I). As a control group (Group II), 25 patients were enrolled with an arthroscopic labrum repair, with a longitudinal out-in approach with at least 3 anchors and with CAM lesion. Capsulorrhaphy were performed in all patients in both groups Patients in both groups were assessed clinically with Hip Outcome Score (HOS) and visual analogue scale for pain (VAS). HOS and VAS were obtained routinely after procedure at 3, 6 and 24 months. Statistical analysis was done with Man Withney test.

Results
Participants had a mean age of 29,1 years, ratio female to male 6:1, and mean duration of symptoms of 9 month (SD 4-14). Average age in group I was 28.4 years versus 30.0 years in Group II, BMI in Group I was 22.7 versus 23.1, In group II. Wiber angle in group I was 22.68° versus 34° in Group II. VAS at 6 months was similar in surgical (group I) 1.8 (SD 1-5) compared to 1.7 (SD 2-6) in control group (p=0.23). HOS at 6 months was 92.1 in group I versus 94.5 in control group (p=0.34). We found no differences between groups in HOS at 24 months.

Conclusion
Arthroscopic hip surgery in borderline dysplasia had comparable results to then described by arthroscopic CAM-type surgery.
EP1.22 Does pain catastrophizing predict age of onset in symptomatic hip dysplasia and femoroacetabular impingement?

Ms Shawn Okpara¹, Dr Paul Nakonezny¹, Dr Joel Wells¹
¹UT Southwestern, Dallas, United States

Introduction

Age of onset in symptomatic hip dysplasia and femoroacetabular impingement varies and can be affected by an individual's mental status. Pain catastrophizing is described as the tendency to magnify a painful experience making it difficult to cope with pain. Anxiety and depression can also lead to an increased reported pain intensity. The purpose of this study was to investigate if pain catastrophizing, anxiety, and depression can predict the age of onset of hip pain in hip dysplasia (DDH) and femoroacetabular impingement (FAI).

Methods

Eighty-four FAI and fifty-six hip dysplasia patients were identified based on a retrospective institutional review board-approved analysis of data that had been prospectively collected at academic orthopaedic centres. Each was diagnosed based on radiographic findings and clinical history. Pain catastrophizing and depression were assessed with the pain catastrophizing scale and hospital anxiety and depression scale respectively. In addition to pain catastrophizing, anxiety, and depression, other potential predictors of age of onset were assessed: Sex, BMI (>30 vs. ≤30 kg/m²), history of hip surgery, laterality, Tonnis grade, Tonnis angle, Anterior Centre Edge Angle, Lateral Centre Edge Angle, Alpha Dunn angle, Alpha Frog angle. Patient reported outcome measures were also utilized, International Hip Outcome Tool, Hip Outcome Score, UCLA activity score, SF12 and WOMAC.

Results

Pain catastrophizing, anxiety and depression did not predict the age of DDH or FAI onset. LASSO-penalized linear regression revealed alpha Dunn angle, Tonnis grade, prior hip surgery, WOMAC pain score, and iHOT total score predicted age of FAI onset (Adjusted R² = 0.3099). Lateral centre edge angle (LCEA), alpha Frog angle, Tonnis grade, SF12 physical functioning, and BMI predicted age of DDH onset (Adjusted R² = 0.3578).

Discussion

Given their ability to negatively modulate an individual’s perception of pain and worsen outcome, it was hypothesized that a higher PCS score and HADS score would lead to a younger age of onset in FAI and DDH. However, in our group of patients we concluded that pain catastrophizing, anxiety, and depression did not influence the age of onset in DDH and FAI. In those that experience symptomatic dysplasia or FAI. It is likely that individuals with higher PCS and HADS scores will exhibit greater pain scores but based on our study they did not affect the age of symptom onset. Notably, severe disease did predict earlier age of onset in both FAI and DDH. Those with increased severity, as measured by LCEA and alpha Dunn, presented symptomatically at younger ages.

Significance/clinical relevance

Our study provides insight into the current understanding of age of onset. More severe disease predicts earlier age of onset in DDH and FAI, whereas a patient’s perception of pain may not influence the age of onset in hip preservation patients. Based on our results, we are able to better understand that mental health is not a significant predictor of age of presentation. This study does reaffirm the utility of
radiographic measures in understanding severity of disease. We can expect that individuals that present at younger ages will have more severe presentations.
EP1.23 Does severity of hip dysplasia predict pain and functional impairment in symptomatic patients?
Shawn Okpara¹, Dr Joel Wells¹, Terrul Ratcliff¹, Avneesh Chhabra¹
¹University of Texas at Southwestern, Dallas, USA

Biography
Born and raised in Houston, Texas. I currently attend UT Southwestern Medical School in Dallas Texas with hopes of becoming an orthopaedic surgeon.

Aims
Developmental dysplasia of the hip (DDH) is a cause of hip morbidity in the young adult population. Although presentation is often similar, the severity of symptoms may be unique. The purpose of this study was to investigate if there is a relationship between the degree of dysplasia and patient-reported pain and function.

Methods
Patients who underwent preoperative investigation for surgical management of DDH were assessed. Forty-five patients were identified, 33 (73%) were female with median age 27 (interquartile range 21.5 to 36.5). The degree of the DDH was assessed by radiographic measurements utilizing plain radiographs and magnetic resonance imaging. Pain and patient reported function were measured by the Hip disability and Osteoarthritis Outcome Score (HOOS). International Hip Outcome Tool (iHOT 12), Hip Outcome Score (HOS), UCLA activity score, and visual analogue scale for pain (VAS) were all measured. Pair-wise Spearman rank correlation analysis was used.

Results
In the analysis of patient questionnaires, no statistically significant relationship was observed between degree of dysplasia and patient reported pain or function. Notably, a significant relationship was observed between femoral torsion and internal rotation in 90° of flexion (IRF). Increasing values of IRF correlated with increasing values of femoral torsion.

Conclusion
Worsening dysplasia did not correlate with severity of pain or function in our patient population. In our study, we found that patient reported pain and function cannot be predicted solely by severity of dysplasia as measured on imaging. It is likely that symptomatic presentation of DDH is of multidimensional nature. Further work is necessary to quantify the complexity of dysplasia with a patient pain and function
EP1.24 Minimal clinically important difference and substantial clinical benefit after a periacetabular osteotomy: are we attaining patient satisfaction and using effective outcome measures?

Jeffrey Peck¹, Stacy Robustelli¹, Ernest Sink¹
¹Hospital For Special Surgery, New York, United States

**Biography**

Jeff Peck is a hip preservation orthopaedic surgery fellow at Hospital for Special Surgery in New York, NY. The previous year he was a paediatric orthopaedic surgery fellow at Texas Scottish Rite Hospital for Children in Dallas, TX. He completed his orthopaedic surgery residency at the Michigan State University/McLaren-Flint program in Flint, MI and attended medical school at The Ohio State University College of Medicine.

**Purpose**

The periacetabular osteotomy (PAO) has become a commonly performed hip preservation procedure. While the minimal clinically important difference (MCID) and substantial clinical benefit (SCB) parameters have been described in hip arthroscopy, these have not been elucidated for the PAO. We seek to define the MCID and SCB for patient reported measures used to evaluate PAO outcomes.

**Methods**

A single-centre, IRB-approved, retrospective analysis of prospectively collected data from consecutive patients who had a PAO was performed. The International Hip Outcome Tool (IHOT) and modified Harris Hip Score (MHHS) were collected pre-operatively and at 1- and 2-year follow-up. A patient acceptable symptom state (PASS) question regarding patient satisfaction and an anchor question regarding improvement in quality-of-life were compared to outcome score changes. MCID and SCB were calculated using an anchor-based method.

**Results**

Eighty-four patients were included, with a mean age of 25.7±8.3 years (93% females). Pre-operative lateral centre-edge angle (LCEA) was 17.3°±8.2° and post-operative LCEA was 34.4°±4.5°. Post-operatively, 81% of patients were satisfied and 88% reported improvement in quality-of-life, though 11% reported only slight improvement. When patients reported any improvement, correlation with satisfaction was good (kappa=0.673). When patients reported “substantial improvement,” the correlation with satisfaction became excellent (kappa=0.872). The MCID (with percentage achieving) for IHOT and MHHS is 15.3 (76%) and 8.5 (77%). The SCB for IHOT and MHHS is 41.3 (45%) and 27.3 (39%).

**Conclusion**

In patients undergoing a PAO, 88% and 81% are improved and satisfied, respectively. A high association was found between patient perceived improvement and patient reported satisfaction. We defined the MCID and SCB in IHOT and MHHS for the PAO. It was found that many patients report satisfaction following the procedure without meeting the SCB threshold, which indicates that attaining the SCB is not imperative in providing meaningful improvement and satisfaction in a patient’s quality-of-life.
The periacetabular osteotomy in the treatment of symptomatic acetabular anteversion provides similar outcomes as in treatment for lateral centre edge defined dysplasia

Jeffrey Peck¹, Stacy Robustelli¹, Ernest Sink¹
¹Hospital for Special Surgery, New York, United State

Biography
Jeff Peck is a hip preservation orthopaedic surgery fellow at Hospital for Special Surgery in New York, NY. The previous year he was a paediatric orthopaedic surgery fellow at Texas Scottish Rite Hospital for Children in Dallas, TX. He completed his orthopaedic surgery residency at the Michigan State University/McLaren-Flint program in Flint, MI and attended medical school at The Ohio State University College of Medicine.

Purpose
The periacetabular osteotomy (PAO) is a commonly performed hip preservation procedure for the treatment of symptomatic acetabular dysplasia. Acetabular dysplasia is traditionally most often defined with the lateral centre edge angle (LCEA). However, in our experience, patients can also become symptomatic due to excessive acetabular anteversion. We sought to determine if patients undergoing a PAO for symptomatic anteversion can expect outcomes similar to those undergoing a PAO for traditional dysplasia.

Methods
A single-centre, IRB-approved, retrospective analysis of prospectively collected data from consecutive patients who had a PAO was performed. Patients who underwent a unilateral PAO for symptomatic acetabular anteversion with a minimum of 1-year follow-up were identified. These patients had a LCEA ≥25° measured on an AP pelvis x-ray and acetabular anteversion at 3 o’clock of ≥20° measured on a computerized tomography scan of the hip. A control group of patients with LCEA<25° and acetabular anteversion between 10°-20° was used as a traditional dysplasia comparative cohort. The International Hip Outcome Tool (iHOT) and modified Harris Hip Score (mHHS) were collected pre-operatively and at 1- and 2-year follow-up.

Results
Ten patients with symptomatic acetabular anteversion were included, with a mean age of 26.8±7.4 years (100% females). Pre-operative LCEA was 27.1°±2.3° and post-operative LCEA was 38.2°±4.2°. Pre-operative acetabular version was 23.9°±2.2° and anterior wall index increased post-operatively from 0.26 to 0.31. Sixty-three control group patients were identified with a pre-operative LCEA of 18.9°±6.8° and post-operative LCEA of 34.9°±5.5° and pre-operative acetabular version of 15.6°±2.8°. Both groups saw significant improvements in both iHOT and mHHS from pre-operatively to post-operatively. The symptomatic anteversion group saw improvements of 40.3±22.3 and 23.1±17.8, for the iHOT and mHHS respectively (both p=0.005). The control group saw improvements of 44.4±24.5 and 30.2±19.0, for the iHOT and mHHS respectively (both p<0.001). These improvements were not significantly different between the groups (mHHS p=0.289 and iHOT p=0.620).

Conclusion
In patients undergoing a PAO for symptomatic acetabular anteversion, a significant improvement in patient reported outcomes. These outcomes are on par with those seen in patients undergoing a PAO for more traditionally defined dysplasia.
EP1.26 Can EOS imaging substitute for conventional radiography in measurement of acetabular morphology in the young dysplastic hip?

Ms. Jenna Powell¹, Dr Romie Gibly², Dr L. Wade Faulk², Mr. Patrick Carry², Dr Stephanie Watson Mayer², Dr Courtney O'Donnell²

¹Children’s Hospital Colorado, Aurora, United States, ²University of Colorado - Anschutz Medical Campus, Aurora, Aurora

Introduction

Young patients followed for hip pathology require serial imaging during childhood, incurring ionizing radiation exposure. EOS imaging offers a low-radiation alternative to conventional radiography (CR). However, EOS images do not have the magnification effects inherent to CR, so it is unclear how measurements of acetabular morphology are affected.

Methods

21 patients (66.67% female; age 14.4 ± 4.7 years old) indicated for hip preservation surgery between 2015-2017 were identified who had both an anterior-posterior (AP) EOS image and a standing AP pelvis (CR) preoperative image. Three orthopaedic surgeons measured the following parameters on the pre-operative hip on both images: Tonnis angle, lateral centre edge angle (LCEA), acetabular depth-width ratio (ADR), and extrusion index (EI). Measurements were taken twice, two weeks apart. Measurement reliability (intra-class correlation coefficient; ICC) and agreement (Bland-Altman analysis) was assessed.

Results

Intra-rater reliability was excellent for all measures on both modalities (ICC values 0.84 – 0.97), except rater 1’s measures of ADR, which were substantial on both modalities (ICC values: 0.68, 0.73). Intra-rater agreement was consistent across modalities for each measure, though limits of agreement (LOA) were wide (Table 1).

Interrater reliability was excellent for all 4 measures on CR, and 3 of the 4 measures on EOS (ICC values: 0.82 – 0.93). ADR measured on EOS had substantial interrater reliability (ICC value 0.74).

LOA of inter-modality agreement were reasonably consistent with LOA of intra-rater agreement (Table 2). However, on average, raters measured Tonnis angle higher on EOS than CR by 2.22°; LCEA lower on EOS than CR by 1.54°; ADR 1.14% lower on EOS than CR; and extrusion index 1.09 ° higher on EOS than CR.

Discussion

Measurements of acetabular morphology taken on EOS images have high intra- and inter-rater reliability, consistent with those taken on CR. Inter-modality agreement was similar to that of intra-rater agreement.

Biography

Courtney O'Donnell is a fellowship-trained pediatric orthopaedic surgeon serving as an attending physician and co-director of the Hip Preservation Program at the Children’s Hospital of Colorado, and Assistant Professor of Orthopaedics at the University of Colorado Denver. She has a vested interest in development of innovative techniques to improve the care of patients in the field of Hip Preservation, with a particular focus on developmental dysplasia of the hip (DDH), Legg-Calve-Perthes Disease, and slipped capital femoral epiphysis (SCFE). It is her primary career goal to advance research within these pathologies for the betterment of quality pediatric patient care. As a newly hired assistant professor at Colorado Children’s Hospital, she plans to devote her life’s work to treating children with pediatric hip conditions and providing meaningful research to improve the field of hip preservation as well as perioperative care for children undergoing orthopaedic surgery.
Inter-modality means differences show that EOS images may portray a slightly more dysplastic presentation on all measurements; however, these biases were below the threshold of clinical significance. EOS imaging may be considered as a reasonable alternative to CR in the interest of minimizing ionizing radiation exposure in young patients.
EP1.27 Obliquity of the supra-acetabular cut and its effects on maximum lateral correction and initial fragment stability after periacetabular osteotomy: A cadaveric model

Ms. Jenna Powell¹, Mr. Todd Baldini², Mr. Tobias Fauser¹, Mr. Matthew Genelin¹, Dr Stephanie Mayer², Dr Courtney O'Donnell²

¹Children's Hospital Colorado, Aurora, United States, ²University of Colorado - Anschutz Medical Campus, Aurora, United States

Biography
Courtney O'Donnell is a fellowship-trained pediatric orthopaedic surgeon serving as an attending physician and co-director of the Hip Preservation Program at the Children’s Hospital of Colorado, and Assistant Professor of Orthopaedics at the University of Colorado Denver. She has a vested interest in development of innovative techniques to improve the care of patients in the field of Hip Preservation, with a particular focus on developmental dysplasia of the hip (DDH), Legg-Calve-Perthes Disease, and slipped capital femoral epiphysis (SCFE). It is her primary career goal to advance research within these pathologies for the betterment of quality pediatric patient care. As a newly hired assistant professor at Colorado Children’s Hospital, she plans to devote her life’s work to treating children with pediatric hip conditions and providing meaningful research to improve the field of hip preservation as well as perioperative care for children undergoing orthopaedic surgery.

Purpose
Increased obliquity of the supra-acetabular (SA) cut of the periacetabular osteotomy (PAO) may allow greater lateral correction. However, this modification may affect proximity to the acetabular roof and fragment stability.

Methods
Bilateral PAOs were performed on 5 cadaveric pelvises (10 hips). Method A was performed on one hip, utilizing the traditional SA cut originating from the ASIS. Method B was performed on the contralateral hip utilizing an oblique SA cut originating 1 cm proximal to the ASIS and ending 5mm distal to the traditional osteotomy. Fragments were fixed in neutral version with maximum lateral displacement. Change in lateral centre edge angle (LCEA) was measured radiographically.

Specimens were loaded in cyclic compression to 20% then 50% of body weight. Fragment stiffness (N/mm) and peak displacement across the osteotomy sites during loading were measured. After loading, lateral displacement of the fragment and distance from the acetabular roof cartilage to the SA osteotomy were measured.

Results
Method B achieved a significantly greater change in LCEA than method A (mean difference 6.7°, p < 0.001), and non-significantly higher lateral displacement at the iliac wing (p = 0.25). Method B had significantly less displacement at the pubic ramus cut during loading cycles (p < 0.05). There were no significant differences in displacement at the other osteotomy sites, and fragments had similar stiffness (p > 0.1). There was no detectable difference in distance from the acetabular roof to the endpoint of the SA cut between methods (mean A 25.4 ± 5.1 mm; mean B 23.1 ± 4.4 mm; p = 0.70). Both methods remained safe from violation of the subchondral bone of the acetabular roof.

Conclusion
This modification allows for additional lateral coverage while maintaining a safe distance from the acetabular roof. It may also offer improved stability at the pubic ramus and does not compromise initial fragment stability with physiologic loading. This modification of SA cut obliquity may offer a safe alternative to achieve maximal lateral coverage when in the PAO for severe acetabular dysplasia. This may afford an opportunity to forgo femoral-sided surgery if maximal correction can be achieved from pelvic osteotomy alone.
It is possible to return to sports after a periacetabular osteotomy in mild dysplastic athletes?

**Biography**

*Completed his training as a specialist via MIR in Traumatology and Orthopaedic Surgery (Hospital Verge de la Cinta, Tortosa, Tarragona, Spain).*

*Extensive experience in primary reconstructive pathology and hip revision. Emphasis on pelvic surgery, as well as hip pathology of the athlete and the young adult.*

*Emphasis on the traumatic pathology of the Pelvis, as well as developmental dysplasia of the Hip and sequelae of Perthes disease through preservation surgery at the Institut Dexeus of Barcelona since 2017.*

*Also, in femoro acetabular impingement, labral tear, as well as other conditions susceptible to treatment with arthroscopic techniques.*

*Continuing research, Winner of a Scholarship by the Spanish Society of the Knee to stay at the International Centre in 2016.*

*Publications in international journals of high impact.*

*Outcome of oscillating saw open osteotomy in two-stage lower extremity bone transport with monolateral frame. Injury Journal, 2017.*

Constant activity as a speaker at conferences. Member of several scientific societies:

- Spanish Society of Orthopaedic Surgery and Traumatology – SECOT
- Catalan Society of Orthopaedic Surgery and Traumatology – SCCOT
- Spanish Society of the Knee (SEROD)
- Spanish Society of Hip Surgery (SECCA)

**Background**

Periacetabular osteotomy (PAO) is an effective and worldwide recognized surgical procedure for the treatment of symptomatic developmental dysplasia of the hip (DDH) in skeletally mature patients. Participation in sports activities can become limited in mild dysplastic athletes. Data regarding return to sports activity or sports participation after PAO are still scarce.

**Objectives**

Assessment of sports activity tolerance and return in mild dysplastic athletes to preoperative levels using minimally invasive approach for PAO.

**Study Design**

A retrospectively review of our institutional database was performed to identify sport players treated with PAO from 2007 to 2016 using minimally invasive technique.

Demographic data was documented. Centre Edge angle (CE), Acetabular Index (AI), and Vertical-Centre-Anterior angle, were measured. UCLA score was used to identify physical activity, whereas pain, range of motion and function were measured by using the Non-Arthritic Hip Score (NAHS). These variables were
obtained preoperatively, and at the latest follow-up. Complications were recorded. Statistical analysis was performed by paired T test to assess variations (Stata, StataCorp, Texas, USA). A p< 0.05 value was considered to be statistically significant.

Results
The cohort consisted on 145 cases. 71 patients (48.97%) were identified as those with preoperative activity levels >7 according to UCLA activity score, whose mean age was 30 years (95% CI 27.92 – 32.43).

Improvement in radiographic angles, CE (19.16 to 37.45), VCA (26.59 to 40.62) and AI (18.65 to 8.27) was found in all cases (p = 0.000). NAHS scores had an improvement from preoperative levels to the latest follow up (60.82 to 90.78, p = 0.000). 44 athletes from 71 cases (63.4%) maintained same levels of high activity (UCLA>7) as in preoperative. 19 cases (26.76%) experimented a shift from high to mild impact activities, and only 7 (9.85%) cases turned from high to low impact activities. No major complications were observed.

Conclusions
According to our results, improvement in clinical and functional outcomes can be expected after minimal invasive PAO in mild-dysplastic athletes in the same way, that 63% sport active patients are mainly able to return to their original preoperative activities after PAO based on sports activity scores.
EP1.29 Assisted treatment of hip congenital dislocation by arthroscopy: Surgical technique description

**MD Leonardo Trujillo**, MD JAIRO RINCON
1Asociacion Medica De Los Andes, Bogota, Colombia

**Biography**

The Doctor Trujillo is an orthopaedist traumatologist of the Pontifical University Javeriana De Bogota. He has studies in reconstructive hip and knee surgery at the university of Birmingham Alabama and hospital for special surgery of the University of New York. I also carry out special training in surgical technique of arthroscopic hip surgery in the Moinhos de Vento hospital and Santa Casa Hospitalario complex in Porto Alegre - Brazil. active member of the Colombian society of orthopaedic surgery, chapter of hip and knee surgery and the international society in arthroscopic surgery of the hip I.S.H.A with deep interests in the investigation to improve the diagnosis and treatment of diseases of the hip and knee.

The treatment reduction for hip congenital dislocation can be assisted by arthroscopy, the patient is placed in supine position, without limb traction, with the hip at 90° flexion and 45° abduction. We identify the anterior border of the Adductor Longus at 2 cm, distal to the Inguinocrural fold we insert a needle guide at 45° in cephalic direction until reaching the joint supervised fluoroscopically; then the joint is infiltrated with 2 cc of Saline Solution making the first portal; then the 2.7 mm 30° arthroscope is put. The infusion pump is not used as the joint is irrigated with Saline Solution by gravity. This first portal allows to visualize the femoral head, the limbus, the acetabulum, the pulvinar and the round and transverse ligaments.

Then under a direct arthroscopic view, the needle guide is introduced using the anterior edge of the Adductor Longus and the Inguinocrural fold (which is in line to the first portal) as a reference, creating the second portal.

With a 2.9 mm shaver, the lower capsule is released, the hypertrophic round ligament is debrided as well as the redundant fibrofatty pulvinar, and the articular edge of the inverted limbus is freed. Finally, well relax the transversal ligament through radial cuts since it is proximal than usual (2). This arthroscopic approach allows us to perform a closed reduction by means of a gentle manoeuvre of traction, flexion and abduction of the hip. In this case, through an iliоinguinal approach, we performed a pelvic osteotomy and immobilization with a Spica cast for 6 weeks.

This arthroscopic technique allows us to treat hip congenital dislocation without the need to open the capsule and thus reduce the risk of avascular necrosis, common in this kind of open procedure.


EP1.30 Is the pelvic tilt in acetabular retroversion different to asymptomatic hips and does it change following anteverting periacetabular osteotomy?

Mr Saif Salih\textsuperscript{1,3}, Mr George Grammatopoulos\textsuperscript{3}, Dr Paul Beaule\textsuperscript{2}, Mr Johan Witt\textsuperscript{3}
\textsuperscript{1}Sheffield Teaching Hospitals, Sheffield, United Kingdom, \textsuperscript{2}The Ottawa Hospital, Ottawa, Canada, \textsuperscript{3}University College London Hospital, London, United Kingdom

**Biography**

Currently a fellow at the Northern General Hospital and Royal Hallamshire Hospital in Sheffield doing revision and complex primary hip and knee arthroplasty. Has completed a year of hip preservation and arthroplasty fellowship at University College London Hospital where part of this work was completed.

**Introduction**

Acetabular retroversion (AR) can cause pain and early osteoarthritis. The sagittal pelvic position or pelvic tilt (PT) has a direct relationship with acetabular orientation. As the pelvis tilts anteriorly, PT reduces and AR increases. Therefore, AR may be a deformity secondary to abnormal PT (functional retroversion) or an anatomical deformity of the acetabulum and/or pelvic ring. This study aims to:

1. Define PT at presentation is in AR patients and whether this is different to controls (volunteers without pain).
2. Assess whether the PT changes following an anteverting periacetabular osteotomy (PAO).

**Methods**

PT was measured for 51 patients who underwent a successful PAO. Mean age at PAO was 29±6 years and 48 were females. PT, pelvic incidence (PI), anterior pelvic plane (APP), and sacral slope (SS) were measured from CT data in 23 patients and compared to 44 (32±7 years old, 4 females) asymptomatic volunteers. Change in pelvic tilt in all 51 patients was measured using the Sacro-Femoral-Pubic angle (SFP), a validated method, from pre- and post-operative radiographs at a mean interval of 2.5(±2) years.

**Results**

In the AR group lateral centre edge angle changed from 30° (SD 8°) to 36° (SD 6°) and sourcil angle changed from 4° (±7°) to -1° (±7°). The cross over sign was present in 96.2% (49/51) pre-PAO (cross-over ratio: 0.42); it remained in 9 hips (17.6%) post-PAO but the crossover ratio reduced (0.16).

Mean PT in the asymptomatic group was 5° (SD 6°) and the same as the symptomatic group (4±4, p=0.256). However, in the symptomatic group, SS (38°(±9°)), APP (11°(±7°)) and PI (42° (±9°)) were different to the asymptomatic group (45° (SD 7°), p=0.002, 7° (±7°), p=0.021, and 50° (±9°), p=0.001 respectively).

The pelvic tilt pre-operatively was 3° (±4°) remained unchanged post-operatively (4°±4°, p=0.676).

**Discussion**

PT is not different in patients with symptomatic AR undergoing PAO when compared to a group of asymptomatic controls, nor does it change following PAO. This argues against the theory that AR is caused by abnormal PT. However, PI, SS and the APP are different suggesting that AR is a true morphological abnormality of the pelvis.
What is the inter and intra-observer reliability of a contemporary classification system for hip dysplasia?

Mr Saif Salih1,2, Miss Sophia Burns2, Mr Mark Roussot2, Mr Christian Merle3, Dr Margaret Hall-Craggs2, Mr George Grammatopoulos2, Mr Johan Witt2

1Sheffield Teaching Hospitals, Sheffield, United Kingdom, 2University College London Hospital, London, UK, 3Centre for Orthopaedics and Trauma Surgery, University of Heidelberg, Germany

Introduction

Acetabular dysplasia is typically diagnosed with an AP pelvic radiograph, and different threshold values for lateral centre edge angle and acetabular index have been suggested. This study set out to evaluate the reproducibility and reliability of a contemporary classification system: Anterior Deficiency (normal lateral centre edge angle (LCEA) but decreased anterior cover), Posterior Deficiency (normal LCEA but decreased posterior wall cover, and features consistent with acetabular retroversion), Anterolateral deficiency (reduced LCEA but decreased cover predominantly anteriorly), Posterolateral deficiency (reduced LCEA but decreased cover predominantly posteriorly), and Global deficiency.

Methods

138 consecutive cases undergoing periacetabular osteotomy between January 2014 and July 2015 with AP pelvic radiographs and 3dCT were classified by six raters: an experienced young adult hip consultant surgeon, a new fellowship trained young adult hip consultant, an experienced consultant musculoskeletal radiologist, an arthroplasty staff surgeon, a post-CCT-fellow in young adult hip and another post-CCT-fellow in arthroplasty.

Fleiss and Cohen's Kappa were used to assess Inter-observer and intra-observer agreement. Acetabular Coverage measurements were taken from 3dCT data and correlated with LCEA.

Results

Agreement between all was fair $\kappa = 0.363$ (95% CI, .325 to .400), $p < .0005$. There was most agreement classifying cases of posterior deficiency (retroversion) ($\kappa=0.569$ (95% CI, .506 to .632), $p<.0005$) and global dysplasia ($\kappa=0.390$ (95% CI, .327 to .453), $p<.0005$). There was very poor agreement classifying an isolated anterior dysplasia ($\kappa=-0.03$).

Intra-observer reliability was moderate ($\kappa=0.507$, $p<.0005$).

Discussion

This classification is comprehensive but is only fairly reliable between. However, those surgeons with a minimum one year’s experience of young adult hip surgery showed better agreement. Identification of anterior dysplasia was poor highlighting the need for 3dCT imaging.
EP1.32 Pre-operative planning modalities for correction of acetabular dysplasia

Alexander Acuña¹, Dr Linsen Samuel², Dr Assem Sultan², Dr Atul Kamath²

¹Case Western Reserve University School of Medicine, Cleveland, United States, ²Cleveland Clinic Foundation, Cleveland, United States

Introduction
Acetabular dysplasia, also known as developmental dysplasia of the hip, has been shown to contribute to the onset of osteoarthritis. Surgical correction involves repositioning the acetabulum in order to improve coverage of the femoral head. However, ideal placement of the acetabular fragment can often be difficult due to inadequate visualization. Therefore, there has been an increased need for pre-operative planning and navigation modalities for this procedure.

Methods
PubMed and EBSCO Host databases were queried using keywords (preoperative, pre-op, preop, before surgery, planning, plan, operation, surgery, surgical, acetabular dysplasia, developmental dysplasia of the hip, and Hip Dislocation, Congenital [Mesh]) from 1974 to March 2019. The search generated 411 results. We included all case-series, English, full-text manuscripts pertaining to pre-operative planning for congenital acetabular dysplasia. Exclusion criteria included: total hip arthroplasty (THA) planning, patient population mean age over 35, and double and single case studies.

Results
A total of 12 manuscripts met our criteria for a total of 186 hips. Preoperative planning modalities described were: Amira (Thermo Fischer Scientific) – 12.9%, OrthoMap (Stryker) – 36.5%, Amira + Biomechanical Guidance System (Johns Hopkins University) – 5.9%, Mills et al. method – 16.1%, Klaue et al. method – 16.1%, Armand et al. method – 6.5%, Tsumura et al. method – 3.8%, and Morrita et al. method – 2.2%).

Virtual implementation of the Amira software yielded increases in femoral head coverage (p<0.05) and a significant decrease in lateral centre edge angle (LCEA) (p<0.05). A significant decrease in post-surgical complications (0.0% navigated group vs. 8.7% non-navigated group, p<0.01) was found with usage of OrthoMap related planning.

Conclusion
There was a notable lack of prospective studies demonstrating the efficacy of these modalities, with decreased post-surgical complications being the only added benefit of their use. Additionally, small sample sizes and lack of commercial availability for many of these programs further diminishes their applicability. Future studies are needed to compare computer assisted planning with traditional radiographic assessment of ideal osteotomy orientation. Furthermore, these programs must be readily accessible rather than be solely available to the researchers who wrote the program.
EP1.33 Is there a role for hip arthroscopy in the treatment of borderline dysplasia?
MD Pablo Slullitel1, MD José Oñativia2, MD Fernando Diaz-Dilernia2, MD Agustin Garcia-Mansilla2, MD Francisco Piccaluga2, MD Gerardo Zanotti2, MD Martin Buttaro2, MD Fernando Comba2
1The Ottawa Hospital, Ottawa, Canada, 2Italian Hospital of Buenos Aires, Buenos Aires, Argentina

Introduction
Since arthroscopy remains as a controversial treatment alternative for hip dysplasia, our objective was to analyse its clinical and radiological results in a cohort of patients with borderline dysplasia and compare them to controls with femoroacetabular impingement (FAI).

Material and methods
We retrospectively analysed a series of patients who underwent hip arthroscopy for the treatment of labral pathology; 29 of them with borderline hip dysplasia and 197 with FAI, comparing reoperations and joint survival. The diagnosis of borderline dysplasia was made with a lateral centre-edge angle (LCEA) greater than 18° but less than 25°. Mean LCEA was 22° in the dysplasia-group and 34° in the FAI-group (p=0.001). The overall prevalence of associated cam-type impingement was 88%, being greater in the dysplasia group (61° vs. 57°; p=0.002). Mean preoperative modified Harris Hip Score (mHHS) was 83 and 85 for the dysplasia- and FAI-groups, respectively (p=0.56). The average follow-up was 43 months, with no differences between both groups (p=0.33). We performed a multivariate regression analysis to evaluate the association of reoperations with different demographic, radiological and intraoperative variables.

Results
At final follow-up, mean mHHS was 98 in both groups (p=0.47). Seven complications were registered in the FAI group (1 medically treated superficial wound infection, 3 pudendal nerve paraesthesia, 1 deep vein thrombosis, and 2 heterotopic ossifications) and none in the dysplasia group. While 5 patients from the FAI group required a new surgery, none of the dysplasia group was reoperated (p=0.38). After adjusting for confounders, reoperation showed a very strong association with the finding of osteochondral lesions during index surgery, with a coefficient of 0.12 (p<0.001, 95%CI=0.06-0.17).

Conclusion
Hip arthroscopy was useful in the treatment of borderline dysplasia, without non-inferior survival to the FAI group. We suggest indicating it carefully in dysplasia cases, whenever the symptoms of femoroacetabular friction prevail over those of instability.
Iliopsoas tendon-related pain following minimally invasive periacetabular osteotomy

Mr Shankar Thiagarajah
Doncaster & Bassetlaw Teaching Hospitals, Doncaster, United Kingdom

Introduction
The periacetabular osteotomy (PAO) improves hip joint mechanics in patients with symptomatic dysplasia. As a consequence of the multi-planar acetabular re-orientation, the course of the iliopsoas tendon over the hip may be affected, potentially resulting in iliopsoas tendon-related pain. At present, little information regarding the incidence of iliopsoas-related pathology following PAO exists.

We aimed to identify the incidence of iliopsoas-related pain following PAO. Secondarily, we aimed to identify any risk factors associated with this pathology.

Methods
We retrospectively reviewed the PAO’s performed from 2014–2017, for symptomatic dysplasia in our unit (single-surgeon, minimum 1-year follow-up). All patients with adequate pelvic radiographs were included. Radiographic parameters of dysplasia were measured from pre- and post-operative AP pelvic radiographs using a validated software. The degree of pubis displacement was classified according to our novel system. Cases were defined as those with evidence of iliopsoas-related pain post PAO (positive response to iliopsoas tendon-sheath steroid/local anaesthetic injection).

Results
A total of 236 patients (260 PAO’s) were included (mean age 28 years). We identified 26 PAO’s (10%) with iliopsoas tendon-related pain post-PAO. Three of these cases required an open iliopsoas tendon release and 1 required a revision of their PAO. This was successful in treating symptoms in all. The remainder required either 1-2 iliopsoas tendon-sheath steroid injections to successfully treat their symptoms.

We found no significantly associated risk factors with regard to demographics, severity or type of dysplasia, and degree of pubis displacement.

Conclusion
The minimally invasive PAO remains a successful technique for treating symptomatic dysplasia. Despite this, we report a 10% incidence of iliopsoas tendon-related pain following surgery. In the vast majority this is successfully treated with an iliopsoas tendon-sheath steroid injection. The ability to identify and treat patients with this pathology early during their post-operative PAO recovery will enable patients to maximise their rehabilitation outcomes.
EP1.35 Concurrent periacetabular osteotomy and femoral osteochondroplasty improves localized joint contact stress abnormalities in patients with head-neck offset deformities
Mrs. Holly Thomas-Aitken¹, Dr Jessica Goetz¹, Mr. Nicholas Bartschat¹, Dr John Clohisy², Dr Michael Willey¹, Dr Robert Westermann¹
¹The University of Iowa, Iowa City, United States, ²Washington University in St. Louis, St. Louis, United States

Biography
Dr Westermann is a staff physician at the University of Iowa Hospitals and Clinics, and the team physician for the Hawkeyes.

Objectives
Periacetabular osteotomy (PAO) reduces pain and improves function in patients with hip dysplasia. The indications for concurrent femoral head neck osteochondroplasty (OCP) remain controversial. This study examined how addition of femoral OCP alters computationally derived intra-articular mechanics in dysplastic hips treated with PAO.

Methods
Ten patients who underwent concurrent PAO and OCP by a single hip surgeon (JCC) were separated into small femoral offset (α-angle ≤ 60°) and large femoral offset (α-angle > 60°) deformity groups. Three sets of computational models were created from patient CT scans: (1) preoperative model; (2) true postoperative model following PAO and OCP; and (3) composite model of the preoperative femur and postoperative pelvis, simulating performing PAO alone. Global and regional peak contact stresses during the stance phase of walking gait were computed using discrete element analysis and compared between offset deformity groups [presented as median(IQR)].

Results
Preoperatively, median peak stress was similar between the large deformity [9.6(8.9-11.9) MPa] and small deformity [9.3(9.3-12.9) MPa] groups (p=0.691). In patients with small offset deformities, PAO reduced median peak stresses in the superolateral peripheral acetabulum, regardless of whether OCP was performed [Preoperative: 10.0(8.1-12.2) MPa; PAO+OCP: 7.6(6.6-10.0) MPa; PAO Alone: 8.5(6.0-10.5) MPa].

PAO in patients with large deformities increased median peak stresses in the superolateral peripheral region, regardless of whether OCP was performed [Preoperative: 9.2(8.9-9.5) MPa; PAO+OCP: 12.5(10.7-12.6) MPa; PAO Alone: 10.9(10.1-11.4) MPa]. However, PAO reduced anterolateral peripheral stress near heel-strike in patients with large offset deformities only when OCP was performed [Preoperative: 4.0(2.9-5.1) MPa; PAO+OCP: 3.2(2.4-5.8) MPa; PAO Alone: 5.3(4.9-6.3) MPa].

Conclusion: While there was no significant reduction in contact stress magnitude after PAO+OCP, peripheral stresses were offloaded anterolaterally and shifted more superiorly after OCP, indicating that addition of OCP may allow the femoral head to seat better in the acetabulum while preventing extra-articular impingement.
Incorporating patient-specific femoral version into computational models of hip dysplasia augments the biomechanical improvement detected after surgical correction

Mrs. Holly Thomas-Aitken¹, Dr Jessica Goetz¹, Mr. Nicholas Bartschat¹, Dr John Clohisy², Dr Michael Willey¹, Dr Robert Westermann¹

¹The University of Iowa, Iowa City, United States, ²Washington University in St. Louis, St. Louis, United States

Biography
Dr Westermann is a staff physician at the University of Iowa Hospitals and Clinics, and the team physician for the Hawkeyes.

Objectives
While computational models can accurately predict joint contact stresses in the altered mechanical environment of hip dysplasia, most modelling studies omit femoral version during model alignment and loading. This study investigated how incorporating patient-specific femoral version into computational models affects computed contact stresses.

Methods
Three-dimensional hip models were created from CT scans of ten hip dysplasia patients who underwent periacetabular osteotomy and femoral osteochondroplasty (PAO+OCP) by a single hip surgeon (JCC). Discrete element analysis (DEA) was used to compute contact stress during walking gait when the models were aligned to a commonly utilized coordinate system defined by Bergmann, et al. and again when the models were oriented to account for patient-specific version by aligning the (1) femoral head centre, (2) axis parallel to the femoral shaft, and (3) axis parallel to the dorsal contour of the femoral condyles of the patient femur to a Bergmann-aligned template femur. Patients were divided into minor (>5° anteversion) or major (<5° anteversion) relative femoral retroversion groups, and the effects of femoral version on the computed contact stresses were compared.

Results
Median preoperative peak stress was not different between Bergmann-aligned and patient-specific models in either the major (p=0.421) or minor (p=0.841) retroversion groups. In patients with minor retroversion, PAO+OCP increased median peak stresses computed using Bergmann-aligned [Preoperative: 11.6(9.6-12.4) MPa; PAO+OCP: 12.6(12.5-13.3) MPa] and patient-specific models [Preoperative: 11.7(11.3-11.9) MPa; PAO+OCP: 13.3(12.7-13.4) MPa]. In the major retroversion group, median peak stress was reduced after PAO+OCP in patient-specific [Preoperative: 8.9(8.7-12.1) MPa; PAO+OCP: 7.6(7.6-9.2) MPa] but not Bergmann-aligned models [Preoperative: 9.3(9.3-12.9) MPa; PAO+OCP: 9.3(8.7-10.0) MPa].

Conclusion: DEA models incorporating patient-specific femoral version indicated that surgical correction was more effective at reducing elevated contact stress than models that used a common coordinate system. Computational studies should carefully incorporate all the functional anatomic considerations informing a surgical procedure.
EP1.37 How effective is peri-acetabular osteotomy in acetabular retroversion?

Dr Jeroen Verhaegen1,2, Mr. Saif Salih1, Mr. Shankar Thiagarajah1, Mr. George Grammatopoulos1, Mr. Johan Witt1

1University College London Hospital (UK), London, United Kingdom, 2University of Antwerp, Antwerp, Belgium

Introduction

Peri-acetabular-osteotomy (PAO) was initially described for the correction of acetabular dysplasia. Anteverting PAO is an established treatment for acetabular retroversion. By reviewing a large cohort, we aimed to (1) Test whether PAO outcome is equivalent in different types of deformity (classic dysplasia vs. retroversion) and (2) Determine whether outcome in acetabular retroversion is different between impinging-only hip and hips with combined pathology (impingement dysplasia).

Methods

A single-centre, retrospective cohort study was performed on a group of patients (n=183) with acetabular retroversion (n=90) or lateral-under-coverage dysplasia (n=93) treated with PAO. Acetabular deformity was defined on pelvic radiographs and 3-D CTs using a number of parameters. Hips with retroversion, were subdivided into combined pathology - retroversion with dysplasia (lateral centre-edge [LCEA] < 25°), or retroversion-only (LCEA≥25°). The mean age at time of the procedure was 29+/−7 years and most hips were in females (n=171). Complication (as per Dindo-Clavien)-, re-operation-, hip preservation rates and patient-reported-outcome measures were measured using the Non-Arthroplasty-Hip-Score (NAHS).

Results

At 2±1 years of follow-up, 5 hips underwent THA (2 dysplastics; 3 retroversion). Major complication rate was 2% for dysplastics and 5% for retroversion (p=0.9). Similar re-operation rates were seen (4% Vs. 8%, p=0.1). Better NAHS was seen in dysplastics compared to retroversion post-operatively (83Vs.73; p=0.001) but not pre-operatively (59 vs 57; p=0.2). ΔNAHS was inferior in retroversion (25 Vs.16, p=0.02). No difference in complications (p=0.1), re-operations (p=0.4) nor post-operative NAHS (76Vs71; p=0.3) were identified between retroversion-only and retroversion-combined pathology cases.

Conclusion

A PAO is as safe for retroversion as it is for dysplasia. This is the case for retroverted acetabula showing either features of combined pathology or impingement-only. However, the pre-operative NAHS was inferior in retroversion and the improvement was not as great as dysplastic hips, illustrating that the impingement process has a detrimental effect on outcome.
EP1.38 Ganz periacetabular osteotomy in neglected developmental dysplasia of the hip: development of hip preservation in Indonesia

MD Anggun Esti Wardani1, MD Andreas M.H Siagian2, MD Dadang Rona Sasetyo1
1RSUP Dr Soeradji Tirtonegoro, Indonesia, Klaten, Indonesia, 2RS Ulin, Banjarmasin, Indonesia

Biography
Education
-Radiology Residency Program : Universitas Airlangga, 2008
-Fellowship Program of Musculoskeletal Radiology : Indonesian Radiology Collegium, 2015

Professional Career
-Education Staff, Department of Radiology, Universitas Airlangga, 2013-2017
-Chief D’ Clinic, Radiology Section, RSUP Soeradji Tirtonegoro, Klaten, 2017-now
-Sport Injury Team, RSUP Soeradji Tirtonegoro, Klaten, 2017-now
-Clinical Teacher, Radiology, Universitas Gadjah Mada, 2019

Training
- Asian International Fellowship of Non-invasive Cardiovascular imaging, 2013
- Sport Injury Imaging, 2018

Background
Indonesia is an archipelago, consist from at least 13,000 islands, taken width of over 3000 miles with only 1000 Orthopaedic surgeon. Challenges have to be answered as Hip preservation surgery had just started to emerge in Indonesia after the completion of one of Indonesian orthopaedic surgeon in ISHA fellowship 2018. Surprisingly Hip dysplasia estimated prevalence reached 0,02% in our regency. This might be related with the culture of tight swaddling of the babies. The neglected cases are common, due to undetected until adolescent or adulthood.

Objective
This case report is one among cases with neglected DDH that underwent Ganz PAO procedure in Indonesia

Case report
Male 13 years old with neglected bilateral DDH came with recent chief complaint difficulty to walk without pain. Patient walks with waddling gait. Prior to painful hips, he still does daily activity without complaining significant disability. The patient felt discomfort in his both hips, but somehow still can-do soccer at school. The history of breech delivery and post-natal swaddling are positive. Parent didn’t seek any medical help, just went to traditional bone setter. From the radiographic examination, there was neglected dislocation and definite DDH parameters of bilateral hip. CT Scan pelvis extended knee taken for parameter quantification and visualisation of socket configuration. Three dimensional reformatted images shown neosocket at the side of interest. Decision then taken according to feasibility of socket reconstruction

Result
The operation performed on the left side first, and contralateral side planned for the next operation. The procedure was successfully done with good post-operative hip measurement

Discussion
The Ganz periacetabular osteotomy has become the procedure of choice for dysplastic hip with closed triradiate cartilage. This procedure is somehow challenging in our country. But attempt must be taken, and successfully accomplished
Keyword
Challenges of Hip preservation, Ganz Periacetabular Osteotomy, Developmental Dysplasia of the Hip, Indonesia
EP1.39 Detailing postoperative pain and opioid utilization after periacetabular osteotomy with automated mobile messaging

Dr Christina Hajewski¹, Dr Christopher Anthony¹, Mr. Edward Rojas¹, Dr Robert Westermann¹, Dr Michael Willey¹

¹University Of Iowa Hospitals and Clinics, Iowa City, United States

Biography
Michael Willey is an orthopaedic surgeon at the University of Iowa that specializes in young adult hip conditions. His research interests include hip biomechanics and clinical outcomes of open hip preservation surgeries.

Purpose
In the setting of periacetabular osteotomy (PAO), this investigation sought to (1) describe patient reported pain scores and opioid utilization in the first six weeks following surgery and (2) evaluate the effectiveness of postoperative communication using a robotic mobile messaging platform.

Methods
Subjects indicated for PAO were enrolled from a young adult hip clinic. For the first two weeks after surgery, subjects received daily mobile messages inquiring about pain level on a 0-10 scale and the number of opioid pain medication tablets they consumed in the previous 24 hours. Messaging frequency decreased to three per week in weeks 3-6. Pain scores, opioid utilization, and response rates with our mobile messaging platform were quantified for the 6-week postoperative period.

Results
Twenty-nine subjects underwent PAO. Twenty-one had concurrent hip arthroscopy. Average daily pain scores decreased over the first four postoperative days. Average pain scores reported were 5.9±1.9, 4.1±3.3, and 3.0±3.5 on day one, day 14, and week six respectively. Reported opioid tablet utilization was 5.0±3.2, 2.2±2.0, and 0.0±0.0 on days one, 14, and at six weeks. Response rate for participants completing the 6-week messaging protocol was 84.1%.

Conclusions
Patient reported pain scores decreased over the first two postoperative weeks following PAO before plateauing in weeks 3-6. Opioid pain medication utilization increased in the first postoperative week before gradually declining to no tabs consumed at six weeks after PAO. Automated mobile messaging is an effective method of perioperative communication for the collection of pain scores and opioid utilization in patients undergoing PAO.
EP1.40 Skeletal muscle mass is maintained after periacetabular osteotomy with standardized rehabilitation protocol

John Davison¹, Dr Robert Westermann¹, Dr Elizabeth Scott¹, Mohammad Kotob¹, Dr Amanda Paulson¹, Dr Jason Wilken¹, Edward Rojas¹, Dr Michael Willey¹

¹University Of Iowa Hospitals and Clinics, Iowa City, United States

Biography
Michael Willey is an orthopaedic surgeon at the University of Iowa that specializes in young adult hip conditions. His research interests include hip biomechanics and clinical outcomes of open hip preservation surgeries.

Background
Periacetabular osteotomy (PAO) is a well-established procedure to treat acetabular dysplasia and global retroversion, but there is a perception to some that PAO is a massive procedure with prolonged immobilization and longer recovery time compared to other surgical interventions. This is likely due to the technical demands of the operation and significant learning curve. Loss of lean muscle mass after knee arthroplasty, ACL reconstruction, and musculoskeletal trauma is well documented. The purpose of this study was to document the changes in body composition: Fat Free Mass (FFM), Body Mass, and Rectus Femoris (RF) Diameter up to 6 months after PAO.

Methods
Changes in FFM among subjects undergoing PAO surgery was measured via A-Mode ultrasound using the Jackson Pollock 3-site method to measure muscle and subcutaneous fat thickness. Body mass was recorded at each clinic visit. Average RF diameter of the operative and non-operative lower extremity was measured via 2D US imaging. Subjects were measured pre-operatively and at 2, 6, 12 weeks and 6-month follow-up visits. Changes in FFM, Body Mass, and RF diameter were assessed using Wilcoxon sum rank test for unequal variances (p < .05).

Results
Twenty subjects (19 female) (mean 26.2 years old, standard deviation 8.8) with acetabular dysplasia or retroversion indicated for PAO were enrolled. Mean changes in FFM were +0.9kg at 2 weeks, +0.7Kg at 6 weeks, +1.3Kg at 3 months, and +2Kg at 6 months from baseline. Average RF diameter in the operative and non-operative respectively changed -2.0 & 0.1 mm at 2 weeks, -1.0 and 1.6 mm at 6 weeks, 0.3 and 0.2 mm at 3 months, and .3 and 1.7mm at 6 months from baseline. Changes in FFM and BM demonstrated an increasing trend from baseline averaging 2kg and 4kg increases at 6 months respectively. No significant changes in FFM, BM, or RF diameter were found up to 6 months after PAO surgery. (all p > .05).

Discussion
This study found insignificant changes in lean muscle mass at multiple visits up 6 months after PAO. Further investigation is needed to assess how body composition is affected by physical rehabilitation and nutrition.
Anterior but not posterior wall deficiency is associated with worse outcomes at two to four-year follow-up in female patients undergoing hip arthroscopy for femoroacetabular impingement

Dr Jennifer Marland, Mrs Brandy Horton, Dr Hugh West, Dr James Wylie

The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

Biography

Dr Marland is a DPT that works in the hip preservation clinic at The Orthopaedic Specialty Hospital at Intermountain Healthcare in Murray, UT. She specializes in the clinical and radiographic evaluation and treatment of patients with non-arthritic hip and pelvic pain.

Background

Female patients have worse outcomes when undergoing hip arthroscopy for femoroacetabular impingement (FAI). This may be due to subtle differences in hip morphology. We hypothesized that anterior wall, but not posterior wall deficiency would be predictive of worse outcome after hip arthroscopy in female patients.

Methods

This was a retrospective review of females undergoing hip arthroscopy with a diagnosis of FAI treated with femoral osteoplasty with or without labral repair. iHOT-12 was collected preoperatively and at 2 to 4-year follow-up. Radiographs were reviewed and anterior wall index (AWI) and posterior wall index (PWI) were recorded in all patients. An AWI of <0.30 and a PWI<0.80 were considered anterior wall deficient (AWD) and posterior wall deficient (PWD), respectively. Differences in means were tested using a student’s t-test or an analysis of variance with a post-hoc toky’s test.

Results

There were 174 Female patients with a mean age of 33 years. Mean follow up was 34.6 months. Mean preoperative iHOT12 was 30.4. Mean postoperative iHOT12 was 74.8. Mean FA was 11.7 (Range 1 to 34) degrees. There were 64 patients with an LCEA≤25, 138 patients had no AWD or PWD, 18 patients with an AWI <0.30 and 18 patients with a PWI <0.80. One patient was excluded from the analysis for having both an AWI<0.30 and a PWI<0.8. Patients with AWD had lower mean iHOT at follow up (54.5 compared with those with no wall deficiency 77.7, p=0.001.) Patients with PWD did not (72.4 compared with those with no wall deficiency 77.7, p=0.669.) Similarly, patients with AWD had lower mean iHOT improvement at follow up (24.2 compared with those with no wall deficiency 47.0, p=0.001). Patients with PWD did not (43.1 compared with those with no wall deficiency 47.0, p=0.808).

Conclusion

Anterior but not posterior wall deficiency is associated with worse outcomes of hip arthroscopy for female patients with femoroacetabular impingement at two to four-year follow-up.
Combined hip arthroscopy with periacetabular osteotomy or periacetabular osteotomy alone for the treatment of developmental dysplasia of the hip?

M.D. Gerardo Zanotti, M.D. Fernando Diaz Dilernia, M.D. Jose Ignacio Oñativia, M.D. Fernando Comba, M.D. Martin Butta, M.D. Eduardo Genovessi, M.D. Francisco Piccaluga

Hospital Italiano De Buenos Aires, Buenos Aires, Argentina

Aim
We sought to analyse the short-term clinical and radiological outcomes of combined arthroscopic and periacetabular osteotomy (PAO), versus PAO solely for the treatment of developmental dysplasia of the hip (DDH).

Methods
Between 2011 and 2015, 22 patients with DDH were surgically treated at our institution. Fifteen of them had undergone combined treatment with hip arthroscopy and PAO due to labral tears diagnosed in preoperative magnetic resonance imaging (group A), and only PAO in 7 cases (group B). Primary symptom was pain associated with instability. Median follow-up was 22 months (IQR, 13-28) for group A, and 14 for group B (IQR, 12–29) (p = 0.67). Median age was 30 years old for group A (IQR, 26-38), and 23 for group B (IQR, 22-31) (p=0.23). Upon preoperative radiographic examination, median lateral centre-edge angle of Wiberg (LCEAW) was 9° in group A (IQR 5-16) and 10° group B (IQR, 8-14) (p=0.52). Acetabular Index (AI) was 20° (IQR, 17-31) and 15° (IQE, 14-17) for groups A and B respectively (p=0.01). Intra-articular findings were computed, and primary outcomes were as follows: radiographic angular correction; time to healing after pelvis osteotomy and functional results according to modified Harris Hip Score (mHHS), UCLA Score and pain according to VAS scale.

Results
Regarding postoperative radiological results, median obtained angular correction for AI and LCEAW were 11° (IQR, 9-15) and 18°(IQR, 15-24) respectively, above the mean pre-operative values (p<0.001). Bone healing was achieved in all cases at 6 months postoperatively. Functional postoperative scores improved in all cases in both groups. Median mHHS and UCLA scores improvement was 24 points (IQR, 21-27) and 1 point (IQR, 0-2) respectively (p <0.001). Median VAS scale improvement was 7 points (IQR 5-8) when compared with the preoperative evaluation (p <0.001). There were no significant differences in the measurement of postoperative improvement between both groups.

Conclusion
Combined treatment of DDH with hip arthroscopy and PAO, or only PAO, yielded good clinical and radiological outcomes at short-term follow-up. Arthroscopy did not improve functional results compared with PAO as unique treatment.
EP1.43 Pelvic osteotomies for acetabular dysplasia: Are there outcomes, survivorship and complication differences between different osteotomy techniques?

Dr Edward Beck2, Dr Katlynn Paul1, Dr Anirudh Gowd2, Dr Jorge Chahla1, Dr Shane Nho1

1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, 2Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US

Biography
Dr Edward Beck is an orthopaedic resident and post-doctorate fellow in the Department of Orthopaedic Surgery at Wake Forest School of Medicine in Winston Salem, NC, USA. His surgical interests include hip arthroscopy and treatment of femoroacetabular impingement. During the past year he was selected as a research fellow for Dr Shane Nho at Rush University, where he published a number of clinical, biomechanical, and transitional science studies. He also collaborated with other hip arthroscopists including Dr Allston Stubbs, Dr Struan Coleman, Dr Olufemi Ayeni, and Dr Josh Harris. He hopes to pursue a career in sports medicine with a focus on hip arthroscopy and hip preservation.

In his time off, Dr Beck enjoys spending time with his fiancé, Kathryn Thayer, who is a dermatological nurse. He is also passionate about basketball, football, and soccer, and cheers for his alma mater, the University of Arizona, where he was a team member of the water polo team.

Purpose
To evaluate the safety and efficacy of 3 open surgical techniques for treating hip dysplasia [periacetabular osteotomies (PAO), rotational acetabular osteotomies (RAO), and eccentric rotational acetabular osteotomies (ERAO)] by assessing complications, comprehensive procedure survivorship, and short and mid-term outcomes after treatment.

Methods
The authors performed a systematic review and meta-analysis of the literature conveying results following pelvic osteotomies for the treatment of hip dysplasia. Data pertaining to patient demographics, surgical technique (PAO, RAO and ERAO), patient reported outcomes including the modified hip harris score (mHHS), complications, reoperation, and conversion to arthroplasty were extracted from each study.

Results
Sixty-five articles were included in the final analysis (35 PAO, 19 RAO, and 11 ERAO studies; 9,099 hips total). Thirty-one articles were available for analysis of complication rate (22 PAO, 9 RAO). Pooled rates for PAO and RAO were 0.09 (95% CI: 0.07 – 0.11, I² = 94.33%) and 0.05 (95% CI: 0.02 – 0.08, I² = 84.15%). Patients undergoing PAO had a statistically greater complication rate (p=0.021). Twenty-seven articles were available for analysis of reoperation rate (3 EROA, 16 PAO, and 8 RAO). Pooled revision rates and THA conversion for EROA, PAO, and RAO were 0.09 (95% CI: 0.02 – 0.17, I² = 86.1%), 0.15 (95% CI: 0.10 – 0.20, I² = 97.1%), and 0.09 (95% CI: 0.04 – 0.14, I² = 91.5%). There was no statistically significant difference between revision rates and THA conversion of each surgical technique. Pooled mHHS improvement were 22.8 (95% CI: 17.4 – 28.2, I² = 91.5%) for EROA, 16.0 (95% CI: 11.4 – 20.6, I² = 95.9%) for PAO, 15.7 (95% CI: 11.0 – 20.4, I² = 90.2%) for RAO. There was no statistically significant difference between mHHS improvement between surgical techniques.

Conclusion
Based on the meta-analysis of this study, patients undergoing PAO have a statistically significant higher rate of complications when compared to patients undergoing RAO. However, there are no significant differences
between revisions, THA conversion rates, or postoperative reported outcomes between PAO, ERAO, and RAO.
Anterior knee pain associated to femoral cam morphology

**Dr Bruno Capurro** is an Orthopaedic Surgeon in the Hip Unit at the Hospital Clinic in Barcelona. He is also working in his doctoral thesis focused on the biomechanical study of labral reconstruction in cadaverous models at the Autonomous University of Barcelona.

Through 2014-2019 Dr Capurro was trained in arthroscopic treatments by Dr Joan Carles Monllau and Dr Marc Tey. During this period, he also did two fellowships, the first in Hip Preservation Surgery with Dr Paulo Rego at Hospital da Luz in Lisbon and the second in Septic Surgery in Orthopaedics with Dr Andrej Trampuz, Dr Carsten Perka and Dr Georgi Wassilew at Charite Hospital in Berlin.

Previously in 2011-2013 he was trained in sports medicine and orthopaedic surgery at MEDS Clinic Sport Centre in Chile with Dr Claudio Rafols, being part of the medical team of the national soccer team of Chile (under 20).

**Introduction**

In previous studies a novel association between anterior knee pain and femoral CAM-type morphology has been identified. The objective is evaluating the prevalence of cam-type morphology and groin pain related to cam-type FAI in patients with anterior knee pain, in which knee pain causes have been discarded (normal knee study). The hypothesis is that patients with anterior knee pain have a higher prevalence of cam-type femoral head morphology and related FAI.

**Methods**

An observational study conducted from October 2016 to October 2018, the inclusion criteria were patients with anterior knee pain who had EVA> 3, 16-50 years, BMI less 35, and normal knee study (Caton Deschamps index 0.8-1.2, biomechanical axis of 5º a -7º, patellar tilt less than 20º, TAGT> 20 mm, absence of CD-grade trochlear dysplasia, dysmetria less than 1.5 cm). Of the patients included, those with associated inguinal pain and Cam-type morphology (Alpha angle> 55º) were analysed. The clinical influence was analysed with the KUJALA, IKDC, HOS and NAHS scores.

**Results**

Forty-four patients with anterior pain and normal knee study were included, of whom 47% had inguinal pain (21) with VAS> 3 and 41% had an alpha angle greater than 55% (18). The average scores obtained in these patients are: KUJALA 55; IKDC 44; HOS daily activities 77 and HOS sports activities 56; NAHS 64.

**Conclusions**

The inguinal pain associated with cam-type morphology is more prevalent in the population with anterior knee pain. These patients present a decrease in the clinical knee and hip scores compared with the normal population.
The role of femoroacetabular impingement in athletic pubalgia: state-of-the-art

EP2.2

Dr Ricardo Marta, Dr João Moura, Dr Luis Maia, Dr Joana Costa, Dr Tiago Barbosa, Dr João Lourenço

Hospital Da Senhora Da Oliveira, Guimarães, Portugal

Inguinal and adductor-related groin pain

Biography
Currently attending the 4th year of orthopaedic residency in Hospital da Senhora da Oliveira, Guimarães, in Portugal

Introduction
Groin injuries in athletes are common and represents up to 6% of all athletic injuries. Athletic pubalgia can occur in isolation but often occurs in the setting of other hip and pelvic pathology. Labral tears, as well as decreased external and internal rotation of the hip joint may be related. Femoroacetabular impingement (FAI) reportedly occurs in a very high percentage of athletes examined for chronic groin and/or hip pain. This suggests that the presence of FAI may be a predisposing factor for developing groin-related sports injuries.

Material and Methods
A search in the PubMed database was performed to identify articles relating to this topic. We reviewed the results to evaluate the prevalence of FAI in case of athletic pubalgia and examine treatment outcomes and evidence for a common underlying pathogenic mechanism between sports hernia and FAI.

Results
FAI has been reported in 12-94% of patients with sports hernias, athletic pubalgia or adductor-related groin pain. Currently, it is assumed that chronic groin injuries result from increased loading and mechanical stress on the pubis symphysis and surrounding structures caused by reduced hip range of motion. It was postulated that the improved hip range of motion and function after FAI correction reduces the stress on extra-articular pelvic structures, thus alleviating the symptoms. Multiple studies have shown that the arthroscopic treatment of FAI, when present in patients with pubalgia that may also need a sports hernia surgery, leads to much better results and higher levels of return to sports.

Discussion
FAI surgery should also be considered if assumed as a contributing issue to the athletic pubalgia. For patients with FAI and sports hernia, surgical treatment of both pathologies appears to be the best option.
EP3.1 Tibial torsion abnormalities in adults presenting with hip pain

Mr Walid Elnahal\textsuperscript{1}, Mr Tom Pollard\textsuperscript{1}, Mr Antonio Andrade\textsuperscript{1}
\textsuperscript{1}Royal Berkshire Hospital, Reading, United Kingdom

Background
Acetabular and femoral version abnormalities are common among adults presenting with hip pain. However, to the best of our knowledge, no study has investigated the prevalence of tibial torsion abnormalities in this group of patients.

Patients and Methods
We retrospectively reviewed the lower limb CT scans of 76 lower limbs in 65 patients who presented to the young adult hip clinic with hip pain between February 2016 and March 2019. Mean age 28 years, range (14-52). 52 of which were females. Routinely, all patients presenting to the clinic are examined by a senior hip surgeon or one of his fellows, and if the clinical examination suggested a possible rotational abnormality, a CT scan of the lower limb was done. Femoral version and tibial torsion were measured using the methods described by Murphy et al. and Kristiansen et al respectively.

Results
The mean Tibial torsion was 41°+/- 10°, Range (4-67°). 19 % had moderately increased tibial torsion (40-50°), 47 % had severely increased tibial torsion (>50°). 60% of the patients had femoral version abnormalities; 8% had severely decreased femoral version (<0°), 9% moderately decreased (0-10°), 25% moderately increased (25-35°), and 18% severely increased femoral version (>35°). 27% had abnormal acetabular version; normal 10-25°. 50% of the patients who had femoral version abnormalities had tibial torsion abnormalities.

Conclusion
The mean tibial torsion in this group of patients was higher than that of the average population, with 66 % showing abnormal tibial torsion. Assessment of the rotational profile in this group of patients should include assessment of the tibial torsion alongside the femoral and acetabular version.
EP3.2 Measurement of femoral neck anteversion: Are CT measurement methods reproducible?
Mr Mohammedabbas Remtulla1, Dr Santosh Rai1, Professor Damian Griffin1, Mr Wael Dandachli1
1University Hospital Coventry And Warwickshire, Coventry, UK

EP3 - Femoral torsion

Biography
I am currently working as a specialist registrar within the Hip preservation service at University Hospital Coventry and Warwickshire. I have an interest in arthroscopic surgery and in managing conditions that affect the Hip and Knee joints.

Introduction
Abnormalities in femoral neck anteversion (FNA) have been implicated in conditions affecting the hip joint. Femoroacetabular impingement for example may be exacerbated by, or occasionally solely related to, low FNA. Moreover, radiological measurement of FNA is useful in planning hip arthroplasty where rotational femoral abnormalities are suspected.

There is debate surrounding the most reliable method of measuring FNA using PACS software. Their reliability is further tested in patients with abnormal morphology.

We hypothesise that the current CT methods for measuring FNA do not have good intra- or inter-observer agreement, and we propose a new method to overcome this problem.

Methods
We conducted a comparative study looking at two current CT methods for measuring FNA. By definition, FNA is measured in relation to the posterior femoral condylar axis. Method 1 involves capturing the femoral head centre and neck in one slice to define the neck axis. Method 2 uses an axial slice at the base of the femoral neck to define the FNA. We propose a new method, Method 3, which uses standard PACS axial reconstructions of the CT scan with an extended overlay of 40mm. CT scans of 16 hips were examined by two independent assessors. For each measurement method the inter- and intra-observer agreements were measured by calculating the intra-class correlation coefficients.

Results
Inter-observer analysis showed a median difference between measurements of 3.1°(0.7°-8.1°) for Method 1, 2.7°(0.1°-11.7°) for Method 2, and 0.7°(0.2°-2.7°) for Method 3. The intraclass correlation coefficients were 0.85, 0.76 and 0.98 respectively. As for intra-observer agreement, the median difference between measurements for Method 1 was 2.5°(0.1°-5.4°), for Method 2 1.6°(0.2°-5.4°), and for Method 3 1.7°(0.3°-3.7°). The respective intraclass correlation coefficients were 0.93, 0.96 and 0.98.

Discussion
CT scans are the gold standard for measuring FNA. Calculating FNA from a single axial slice is challenging given the variations in femoral morphology. We have found that all three methods described here had good intra-observer agreement. However, only the CT overlay method (Method 3) has shown excellent inter-observer reliability as well. Its simplicity allows clinicians to calculate FNA without the need for sophisticated 3D modelling software.
EP4.1 Defining minimal clinically important difference and patient acceptable symptom state after isolated endoscopic gluteus medius repair

Dr Kelechi Okoroha¹, Dr Edward Beck¹, Dr Benedict Nwachukwu¹, Mr. Jonathan Rasio¹, Mr. Kyle Kunze¹, Dr Shane Nho¹

¹Chicago, Chicago, United States

Purpose
To define 1) Minimal Clinically Important Difference (MCID) and Patient Acceptable Symptomatic State (PASS) in patients undergoing endoscopic gluteus medius repair and 2) determine correlations between preoperative patient characteristics and achievement of MCID/PASS.

Methods
A retrospective review was performed of prospectively collected data from all patients undergoing primary endoscopic repair of gluteus medius tears between January 1, 2012 and February 2017 with a minimum two-year follow up. Patient data collected included demographics, radiographic parameters, preoperative clinical function scores, and postoperative patient reported outcomes (PROs). Paired t-test were used to compare the differences in 2-year PROs. The MCID and PASS for each PRO were calculated and Spearman’s coefficient analysis was used to identify correlations between MCID, PASS and preoperative variables.

Results
A total of 60 patients were included in the study. A majority of patients were female (91.7%), with an average age and BMI of 57.9±9.91 and 27.6±6.1, respectively. The MCID of Hip Outcome Score–Activities of Daily Living (HOS-ADL), Sport-Subscale (HOS-SS), and modified Harris Hip Score (mHHS) was calculated to be 15.02, 14.53, and 14.13, respectively. The PASS of HOS-ADL, HOS-SS, and mHHS was calculated to be 77.9, 56.9, and 69.3, respectively. Eighty-eight percent of patients achieved CSO at 2 years postoperatively. No demographic factors were found to correlate with postoperative outcomes.

Biography
Dr Sane Nho is an orthopaedic surgeon specializing in sports medicine at rush university medical centre in Chicago, IL, USA. his surgical interests include hip arthroscopy and treatment of femoroacetabular impingement. during residency at the hospital for special surgery, Dr Nho was introduced to arthroscopic correction of FAI and pao by Dr Buly, at a time when few surgeons were treating the disease. Dr Nho completed his sports medicine fellowship at rush, working with Charles Bush-Joseph who was performing most hip arthroscopy procedures in Chicago. during this time, Dr Nho was selected as a Herodicus traveling fellow, working with Marc Philippon, Thomas Byrd, and Bryan Kelly to develop his arthroscopic surgical technique.

Currently, 80% of his clinical practice is devoted to arthroscopy and hip preservation. he is currently the director of young adult hip surgery at rush university medical centre.

in his time off, Dr Nho enjoys spending time with his wife, Sloan York, an ob-gyn physician at rush, and their 2-year-old boy Connor. he also passionate about hockey, and cheers for his alma mater, north western, where he was captain of the men’s hockey team. he is also the team orthopaedic surgeon for the Chicago fire soccer club.

Background
Endoscopic gluteus medius repair is an increasingly performed procedure to treat patients with gluteus muscle tears. However, clinically significant outcomes (CSO) following the procedure have not been defined.
Conclusion
In patients undergoing endoscopic gluteus repair our study defined MCID and PASS for HOS-ADL, HOS-SS, and mHHS outcomes scores. A large percentage (88%) of patients achieved clinically significant outcomes at 2 years following surgery.
EP4.2 Minimum five-year outcomes of endoscopic gluteus medius repair with concomitant arthroscopic treatment for labral tears

**Dr Itay Perets**, Edwin Chaharbakhshi, Dr Yosif Mansor, Dr Lyall Ashberg, Brian Mu, Dr Benjamin Domb

1Hadassah Hebrew University Hospital, Jerusalem, Israel, 2Loyola Stritch College of Medicine, Maywood, United States, 3Chaim Sheba Medical Centre at Tel Hashomer, Ramat Gan, Israel, 4Atlantis Orthopaedics, Atlantis, United States, 5Rosalind Franklin University of Medicine and Science, North Chicago, United States, 6American Hip Institute, Chicago, United States

**EP4 - Lateral Hip Pain**

**Biography**

Dr Itay Perets is an orthopaedic surgeon at Hadassah Hebrew University Hospital who specializes in joint replacement and hip arthroscopy

**Background**

Short-term outcomes of endoscopic gluteus medius (GM) repair have been satisfactory. However, the effectiveness of this procedure with longer-term follow-up have not been reported.

**Purpose:** To conduct a matched-controlled study comparing outcomes of patients that underwent endoscopic GM repair and concomitant arthroscopy for labral tears to a control group of patients without GM tears.

**Methods**

Data was prospectively collected on patients that underwent hip preservation surgery by the senior author between February 2008 and April 2011. Included were patients that underwent hip arthroscopy for labral tears. Exclusion criteria were as follows: previous ipsilateral hip surgery, previous hip conditions (AVN, SCFE, and severe dysplasia), preoperative Tönnis osteoarthritis grade ≥ 2, and Workman’s Compensation claims. Patients that underwent endoscopic GM repair and arthroscopic labral treatment were matched 1:2 to patients that only underwent arthroscopic treatment using the following matching criteria: age at surgery, BMI, gender, labral treatment type, and capsular treatment type.

**Results**

All eleven GM repair patients eligible for inclusion had minimum five-year outcomes and were matched to 22 patients (81.9% follow-up). Of these 33 patients, 30 (90.9%) were females. Mean ages at surgery were 58.9 years and 56.9 years in the GM repair and control groups, respectively. Both groups demonstrated similar preoperative and latest follow-up outcomes scores, with all improvements being significant. All scores in both groups-maintained durability relative to two-year outcomes. No revisions were reported. Seven patients (31.8%) in the control group converted to arthroplasty (mean 27.9 months), with two conversions to arthroplasty (18.2%) in the GM repair group (mean 28.1 months).

**Conclusions**

Endoscopic GM repair with concomitant arthroscopy for labral tears demonstrates similar, favourable, and durable outcomes at minimum five-year follow-up relative to a control group without GM tear.
EP4.3 Platelet-rich plasma versus surgery for the management of recalcitrant greater trochanteric pain syndrome: A systematic review

Dr Rafael Walker-Santiago¹, Natalia Wojnowski², Dr Ajay Lall¹, Dr David Maldonado¹, Stephanie Rabe¹, Dr Benjamin Domb¹
¹American Hip Institute, Chicago, United States, ²Hinsdale Orthopaedics, Westmont, United States

Purpose
To systematically review the outcomes of platelet-rich plasma (PRP) versus surgical treatment in recalcitrant greater trochanteric pain syndrome (GTPS).

Methods
A systematic search on PubMed/MEDLINE and EMBASE databases was performed in December 2018 following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. Methodological index for nonrandomized studies (MINORS) and Cochrane Risks of Bias analyses were performed accordingly. Baseline patient characteristics, patient-reported outcomes (PROs) and complications were extracted.

Results
Five PRP and five surgery studies were included contributing 99 and 185 patients with a mean age of 54 and 62 years, respectively. Mean MINORS for PRP group was 11.25 and for the surgery group 11.4, and the only randomized trial had low risk of bias. All studies showed comparable improvements in PRO and pain scores. Modified Harris Hip score (mHHS) for PRP ranged from 53.8 to 56.7 pre-intervention, and 74.1 to 74.2 post-intervention. Surgery group preoperative and postoperative Harris Hip Score ranged from 53.0 to 53.3, and 80 to 88, respectively. Three other studies reported Oxford, mHHS and Merle d'Aubergine scores with preoperative scores of 20.4, 54.9 and 10.9 and post-operative 37.3, 76.2 and 16.7, respectively. PRP and an endoscopic treatment subgroup did not report major complications. Two studies utilizing open surgical management reported major complications with one reporting an overall complication rate of 19%.

Conclusions
PRP infiltrations or surgical treatment significantly improved PROs and pain in recalcitrant GTPS. Due to a higher safety profile and avoidance of anaesthesia, PRP infiltrations should precede surgical treatment when managing recalcitrant GTPS. In cases where surgical treatment is indicated, the endoscopic technique is safer than open surgery.
EP4.4 Autologous conditioned serum for the treatment of gluteus medius and minimus tendinopathy: A biological alternative

Dr David Morgensteren1, Dr Tarek Nasrawy1, Dr Adi Friedman1, Dr Leonid Kendel1, Dr Gurion Rivkin1, Dr Itai Perets1

1Hadassa Medical Centre, Mount Scopus, Israel

Introduction
Abductor tendinopathy is generally managed non-operatively. In non-responsive cases, corticosteroid injections may be used with proven short-term effectiveness. Surgical intervention is reserved for failed conservative management or with abductor function insufficiency

Autologous conditioned Serum (ACS) is an adjuvant biological treatment derived from autologous blood incubated for 6-8 hours in containers with crystal beads where white blood cells are induced to produce anti-inflammatory cytokines (IL-1RA, Anti-TNF) and growth factors (TGF-Beta1, FGF-2, HGF).

The purpose of this study is to evaluate the efficacy of ACS in gluteus medius and minimus tendinopathy by comparing the outcomes with conservative treatments.
Methods
We analysed 34 cases with gluteus medius and minimus tendinopathy treated between 2016-18. Nineteen cases (17 patients) were treated with 5-6 consecutive injections of ACS ultrasound guided directly into the injured tendons. The remaining fifteen cases were treated conservatively through physical therapy, NSAIDS and relative rest. Visual analogue scores (VAS) were collected at 0, 3, 6 and 12 months; other clinical parameters (limping, stair climbing, local tenderness, and muscle strength) were noted and compared.

Results
Both groups were not statistically significant regarding age and gender; average age was 58 y/o (range 19-81), one in each group was male; 9 (50%) of the cases in the ACS group had partial tendon tears and 11 (73%) in the conservative group, which was not statistically significant.

The ACS group demonstrated clinically and statistically significant improvement (p value <0.001, t-value 10.74)

Starting VAS 0 was similar for both groups 8.13 in the ACS and 8.03 in the conservative group (p-value 0.76 t-value 0.30); at the latest follow up, the mean VAS was 3 for the ACS group and 6.03 for the conservative group showing a statistically significant improvement in VAS (p value <0.001 t-value -4.208) for the ACS group.

Conclusions
Treatment with ACS is an effective alternative to conservative treatment for this group of tendinopathies with positive outcomes.
EP4.5 Reduction trochanteric osteotomy for GTPS

MD, PhD Marc Tey Pons1,2, MD, PhD Joan Cabello2, MD Xavier Lizano2, MD Mahmoud Tahoun2

1Hospital Universitari Del Mar, Barcelona, Spain, 2iMove Traumatologia, Barcelona, Spain

Objective
Evaluation of one-year result of GTPS without tendon rupture treated with reduction osteotomy of greater trochanter. Evaluation of results and complications

Results
Clinical series of 8 patients with a minimum one year follow up. Function and pain showed improvement in all the patients. Results and complications are evaluated.

Conclusions
This series of clinical cases has allowed us to standardize the technique and clinical results allow us to propose a prospective study to evaluate the goodness of it
EP4.6 Description of a new open surgical technique for repair of chronic full thickness abductor muscle tears and evaluation mid-term results

Dr Jurek Pietrzak\textsuperscript{1}, Dr Wesley Verhoogt\textsuperscript{2}, Sr Kathleen Nortje\textsuperscript{1}, Dr Josip Cakic\textsuperscript{1}
\textsuperscript{1}University of the Witwatersrand, Johannesburg, South Africa, \textsuperscript{2}Gauteng Department of Health, Johannesburg, South Africa

Introduction

Tears of the abductor tendon complex, including the gluteus medius and gluteus minimus, are a distinct source of lateral hip pain and dysfunction. In general, these are recalcitrant to non-operative treatment measures. Optimal surgical technique and management remains controversial.

Materials and Methods

We conducted a retrospective review of the mid-term outcomes of a single surgeon series of chronic full-thickness gluteus medius and gluteus minimus open surgical repair. All patients underwent MRI scans to confirm the presence and size of complete tears. All patients failed a minimum of 3 months non-operative treatment. We describe this novel surgical repair technique which includes excision of bursa, diamond-shaped release of the ilio-tibial band (ITB), microfracture of the greater trochanteric abductor footprint, quadrant-shaped suture anchor repair of gluteus minimus and speed bridge fixation and compression of gluteus medius over gluteus minimus. Platelet-rich plasma augmentation is injected post repair before closure of ITB. All patients were managed for 6 weeks in abductor-brace. Previous greater trochanter PRP and corticosteroid injections were noted. No patients had had previous ipsilateral Total Hip Arthroplasty (THA).

Results

The study included 18 patients (14 females, 4 males) with a mean follow-up of 13.72 months (range 12.1–23.34 months). The average age of patients was 46.2 years (37 – 67 years) and 8 (44.4%) had lower back pathology. The overall patient satisfaction rate was 83.33% (n=15). VAS pain scores improved from 7.92 (6,2 – 10) to 3.54 (2,3 – 7.2). The patient reported outcomes were measured according to the mHHS, HOS-ADL and iHOT-33. The mean improvements from baseline to post-operative follow-up were 48.63 (range 32.80–82.70)–78.57 (range 45.30–93.70) for mHHS, 63.93 (range 25.49–100.00)–82.14 (range 48.53–100.00) for HOS-ADL and 38.85 (range 12.45–71.96)–78.23 (range 25.29–93.80) for iHOT-33. All 4 dissatisfied patients had received >1 PRP and corticosteroid injection within 6 months of surgical repair. There were 2 (11%) patients who complicated with small wound dehiscence.

Conclusion

We present an open surgical technique for repair of chronic, recalcitrant full thickness abductor tears. At a minimum of 1-year follow-up this surgical approach yields both good functional results and satisfaction rates.
EP4.7 Postoperative range of motion protocol following arthroscopic gluteus medius and minimus repair: An anatomic study

Dr Timothy Jackson¹, David Wright², Victor Truong¹, Michelle McGarry¹, Thay Lee¹
¹Orthopaedic Biomechanics Laboratory, Congress Medical Foundation, Pasadena, USA, ²Department of Orthopaedic Surgery, University of California, Irvine, Orange, USA

Biography:
Dr Jackson specializes in arthroscopic surgery of the hip and hip replacement surgery. His post residency training included two fellowships; Sports Medicine and Hip Surgery and serves as the foundation for his approach to the hip. Since 2013, he has been performing a wide range of surgery for the hip and surrounding disorders, including hip arthroplasty through anterior approach, hip arthroscopy, endoscopic tendon repairs around the hip, hip fractures and sciatic neurolysis. He continues to contribute to the growing field of hip arthroscopy by giving lectures and presenting research nationally and internationally, serving as a reviewer for orthopaedic research publications and publishing numerous peer reviewed articles. He currently serves on the Editorial Board for Arthroscopy Journal.

Background
There is limited anatomic data to support current postoperative range of motion protocols following arthroscopic repair of gluteus medius (G.medius) and gluteus minimus (G.minimus) tears. This cadaveric study aimed to define relative tendon excursion of the G.medius and G.minimus across different femoral positions in order to better inform postoperative precautions that may help protect arthroscopic repairs.

Methods
Seven cadaveric hips were dissected to isolate the posterosuperior and lateral insertions of the G.medius, as well as the anterior and posterior insertions of the G.minimus. Each insertion was tagged with a polyethylene suture in a Mason-Allen fashion. Sutures were then passed through drill holes in the iliac wing corresponding to each tendon’s muscular origin. A constant load of 5N was applied to each suture to simulate resting muscle tone. The femur was taken through a range of motion and tendon excursion was measured at -10°, 0°, 45°, and 90° of hip flexion. Excursion was also measured with 5Nm of internal and external rotation torque applied with the hip in 90° flexion. Repeated measures ANOVA was used to compare tendon excursion at each flexion angle as well as with maximum internal and external rotation.

Results
Relative to a hip-neutral position, G.minimus-posterior excursion ranged from +4.2mm in 10° of hip extension to -0.2mm in 90° of hip flexion (p=0.525), while G.minimus-anterior excursion ranged from +5.7mm in 10° of hip extension to -14.7mm in 90° of hip flexion (p<0.001). Concurrently, G.medius-lateral excursion ranged from +2.4mm in 10° of hip extension to +23.0mm in 90° of hip flexion (p<0.001), and G.medius-posterosuperior excursion ranged from +0.9mm in 10° of hip extension to +38.1mm in 90° of hip flexion (p<0.001). G.minimus-anterior demonstrated a 92.6% increase in excursion when moving from maximum internal to maximum external rotation at 90° hip flexion, while the G.minimus-posterior, G.medius-lateral, and G.medius-posterosuperior demonstrated 51.3%, 49.4%, and 23.1% increase in excursion respectively over the same range (p<0.001).

Conclusion
Postoperative range of motion restrictions should seek to limit hip extension and external rotation following G.minimus repairs and hip flexion and external rotation following G.medius repairs.
The Melbourne Hip MRI Score (MHIP Score): Reliability of a novel scoring system for MRI assessment of severity in gluteal tendinopathy

Asst Prof Jane Fitzpatrick1, Mr Chi Kin Nathan Tso1, Dr Hussain Khan2, Prof Richard O’Sullivan3
1University Of Melbourne, Melbourne, Australia, 2Australasian College of Sport and exercise Physicians, Melbourne, Australia, 3Monash University, Clayton, Australia

Biography
Associate Professor Jane Fitzpatrick is a Sport and Exercise Medicine Physician in private practice and at the Graeme Clark Institute for Biomedical Engineering, University of Melbourne. She is a Fellow of the Australasian College of Sports and Exercise Medicine. She was a founding member of the International Olympic Committee – Triathlon Medical Commission and the team doctor for the Australian Triathlon Team for 10 years. Jane is currently the team physician for the Australian Cross-Country ski Team and the Medical Director for the Australian Biathlon Team. Jane was recently part of the leadership group for the Asia Pacific Economic Committee (APEC) project, the Australian Consensus Framework for Ethical Collaboration in the Healthcare Sector. This project is the largest of its kind in the world and brought together over 60 signatories from all sectors of healthcare including consumer organizations, hospitals, medical colleges, universities, pharmaceutical corporations and biotech industry groups. Jane and her colleagues, won the prestigious APEC Business Ethics Lighthouse Award in 2018 which recognises the significant international leadership displayed by Australia in mentoring, supporting and inspiring health leaders across the APEC membership to develop and commit to ethical practice in healthcare. She is currently researching in tendinopathy and osteoarthritis.

Introduction
Gluteal tendinopathy is a common cause of lateral hip pain and is the most common lower limb tendinopathy. The condition is most prevalent in middle aged women. The diagnosis of gluteal tendinopathy is based on the history of localized lateral hip pain, clinical signs and medical imaging. Magnetic Resonance Imaging (MRI) is used to identify gluteal tendinopathy but there has been no accepted validated scoring system to determine severity. The aim of this project was to validate a new scoring system; the MHIP score for gluteal tendinopathy.

Methods
This study included 41 MRI scans from 40 patients (mean baseline age: 57.44±12.63; 4 males, 36 females) diagnosed with gluteal tendinopathy from 2012-2016. Two experienced radiologists, blinded to previous reports, interpreted de-identified scans up to twice within a two-month period. The images were read twice on separate days by the first radiologist and once by the second radiologist. The MHIP Score included 5 variables; extent of tendon pathology, muscle atrophy, trochanteric bursitis, cortical irregularity and marrow edema, with a total score of 17. Statistical analysis using the intra-class correlation coefficient (ICC) was used to determine intra-observer and inter-observer reliability of the scoring system with an ICC >0.75 representing excellent reliability, values between 0.4-0.75 fair-good and ICC <0.4 poor.

Results
The mean MHIP scores were 3.93 (SD 2.24) reflecting a wide variation in grade of tendinopathy across this patient cohort. The MHIP Score was reliable for determining severity of gluteal tendinopathy on MRI. The intra-observer reliability was 0.81 (95% CI 0.67-0.89) when assessed by a single experienced radiologist specialized in MRI. The inter-observer reliability between the two radiologists was 0.78 (95% CI 0.62-0.87).

Conclusion
The intra-observer and inter-observer reliability was excellent for the MHIP score. The MHIP score is a validated scoring system that can be used to compare progress before and after treatment using the same or different radiologists. Used in conjunction with clinical signs and symptoms of gluteal tendinopathy, the tendon pathology can be graded prior to intervention.
EP4.9 Preoperative predictors of achieving clinically significant athletic functional status after hip arthroscopy for femoroacetabular impingement at minimum 2-year follow-up

Dr Austin Stone2, Dr Edward Beck3, Dr Philip Malloy1, Dr Jorge Chahla1, Dr Benedict Nwachukwu1, Dr William Neal1, Dr Shane Nho1

1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, , 2Department of Orthopaedic Surgery, University of Kentucky, Lexington, US, 3Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, US

Purpose
To identify predictors of achieving clinically significant sport function in athletic patients undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS).

Methods
Data was analysed for all patients between 2012 to 2016 treated for FAIS who reported being athletes, including recreational and competitive athletes. All patients had a minimum of 2-year follow-up with patient reported athletic function in the form of the HOS-Sport Specific (HOS-SS), Visual Analog Score (VAS)-Pain and patient satisfaction. Achieving clinically significant sports function was defined as either reaching the Minimally Clinical Important Difference (MCID) or Patient Acceptable Symptomatic State (PASS) for HOS-SS at 2-year follow up. An exploratory factor analysis was used to determine specific domains for the predictor variables and to reduce the redundancy in these variables. A logistic regression analysis was used to identify significant predictors of achieving clinically significant sports function.

Results
Of 780 qualifying patients, 626 completed 2-year minimum follow-up (80%), with a mean age and body mass index (BMI) of 31.6±11.9 years and 24.6±8.6, respectively. A total of 500 patients (86.5%) achieved high functional status, with 77.9% achieving MCID HOS-SS and 68.7% achieving PASS HOS-SS. Logistic regression analysis identified increased alpha angle (OR:0.976; P=0.027), preoperative pain duration (OR:0.729; P=0.011) and BMI (OR:0.919; P=0.018), as well as presence of femoral chondral defects (OR:0.769; P=0.013) as negative predictors for achieving MCID. Negative predictors for achieving PASS HOS-SS included presence of preoperative limp(OR:0.384; P=0.013), anxiety or depression(OR:0.561; P=0.041), and increased BMI (OR:0.945; P=0.018) and preoperative pain duration (OR:0.987; P<0.001).
Conclusion
Several predictors of achieving clinically significant sport function performance exist including a history of anxiety or depression, BMI, preoperative alpha angle, limp, femoral chondral damage, and preoperative symptom duration. Our results suggest there are both modifiable and non-modifiable preoperative factors that have the potential to predict achieving high athletic function after hip arthroscopy for FAIS.
EP5.1 Clinical and radiographic presentation of hip instability

Dr Dillon O'Neill, Mr. Peter Cannamela, Dr Alex Dukas, Dr Stephen Aoki

1University Of Utah, Salt Lake City, United States

Biography
Dr Stephen K. Aoki, Associate Professor, specializes in hip and knee sports medicine. His clinical practice and research focus on both adult and pediatric sports injuries. Current interests include hip preservation/femoroacetabular impingement in the young adult, hip arthroscopy, the pediatric and adolescent athlete, ACL tears in children, patellar dislocations, and ligament/cartilage knee injuries. Dr Aoki serves as team physician for University of Utah Gymnastics. He serves as Chair of the University of Utah Residency Selection Committee. Dr Aoki received his Bachelor of Arts degree through Harvard University. He received his medical doctorate degree from Mount Sinai School of Medicine in New York City and subsequently completed his orthopaedic residency and sports medicine fellowship at the University of Utah.

Purpose
The prevalence of presenting symptoms and associated radiographic imaging findings in patients with iatrogenic hip instability have not been reported. This study was designed to detail the prevalence of clinical and magnetic resonance arthrogram findings in a cohort of patients with isolated hip instability.

Methods
Patients undergoing isolated capsular repair following previous hip arthroscopy from 2014-2016 were retrospectively reviewed. Patients were excluded if they underwent any concomitant procedures such as labral repair, reconstruction, femoral osteoplasty or any other related procedure. Several clinical data points were reviewed including painful activities, mechanical symptoms, subjective instability, Beighton scores, axial distraction manoeuvres (pain, toggle, and apprehension) and distractibility under anaesthesia. Magnetic resonance arthrograms (MRA) were reviewed and evaluated for post-operative capsular changes compared to pre-operative MRIs. Capsular changes were defined as 0- Normal, 1- Capsular redundancy, 2- Focal capsular rent, and 3- Gross extravasation of fluid from the capsule.

Results
31 patients (5 males, 26 female) met inclusion criteria. Average age of patients was 36 years (range: 20-58 years). 87% (27/31) of patients reported hip pain with activities of daily living and 100% (31/31) of patients reported pain with sports or exercise. Axial distraction testing found pain with distraction in 71% (22/31) of hips, toggling in 45% (14/31) of hips, and apprehension in 42% (13/31) of hips. MRA review found 0% of hip capsules with Grade 0, 29% with Grade 1, 48% with Grade 2, and 16% with Grade 3 capsular changes.

Conclusions
A high percentage of patients with hip instability demonstrate positive history, physical exam and radiographic findings. This study may aid clinicians in the diagnosis of hip instability moving forward and may help target future research to further define patient indications that may benefit from a revision capsular repair.
EP5.2 Functional evaluation in lateral step-down test in dancers with hip pain

Ms André Bento¹, Ms Guilherme Falotico¹, Pt Daniel Araujo¹, Pt Klever Fujikawa¹, Md Bruno Scatigna¹, Prof Moisés Cohen¹
¹Unifesp, Sao Paulo, Brazil

Biography
Physical Therapy member of ISHA since 2018, Master's degree in health sciences applied to sports and physical activity, specialist in sports physiotherapy in 2004 by the federal university of Sao Paulo (UNIFESP), physiotherapist responsible for the ambulatory of hip injuries in athletes in the UNIFESP since 2005, member of the national society of sports physiotherapy (Brazil).

Dancers must have a great hip joint range of motion in almost all positions. These involves combinations of extreme flexion, extension, abduction and external rotation of the hip, which may cause increased labral tension or femoroacetabular subluxation and soft tissue looseness. Dynamic stability conferred by the hip muscles (posterolateral complex) in a joint with deficits of static stabilizers are essential for better joint and kinetic chain functioning. The present study aims to ascertain whether dancers with hip pain have worse alignment in the frontal plane during the Lateral Step-Down Test (LSDT) and whether there is a correlation between this test and the sports subscale of the HAGOS functional questionnaire. Thirty-four dancers were evaluated, divided into 2 groups (symptomatic and control), all of them answered the HAGOS questionnaire and performed the LSDT. The results obtained were there was no difference between the control group and the pain group (p = 0.41) in the execution of the LSDT. Additionally, there was no statistically significant correlation between practicing the sport, evaluated by the HAGOS questionnaire, and the hip alignment in the control and pain groups (p = 0.47, p = 0.5 respectively). Therefore, it can be concluded that dancers with pain do not show alterations in the frontal plane in the execution of the LSDT when compared to the control group and the execution of the LSDT does not show any connection with the sport subscale of the HAGOS questionnaire.

Dr Tatiana Charles¹, Dr Marc Jayankura¹, PhD Edgard Engelman¹, Dr Frédéric Laude²

¹University Hospital Erasme, Bruxelles, Belgium, ²Clinique du sport, Paris, France

Biography

The presenting author finished her traineeship as an orthopaedic surgeon in the year 2018 at the Free University of Brussels (ULB). As a trainee in orthopaedic surgery she shows major interests in hip and pelvis surgery with a particular love regarding hip preservation surgery. This work was made for her graduation as orthopaedic surgeon in collaboration with Dr Laude at the Clinique du sport in Paris. Actually, the presenting author works as an orthopaedic surgeons at the Erasme University hospital in Brussels.

Introduction

Hip micro instability has recently been described as an entity comprising hip pain or instability in association with fine anatomical anomalies. In the absence of major anatomic anomalies and after a failed well-conducted conservative treatment, arthroscopic capsular plication has been proposed as a treatment modality. The goal of this study was to determine the efficacy of this procedure with a preliminary series in a specialized centre.

Material and methods

Thirty-one capsular plications were reviewed, of which 26 presented with a follow-up of at least 12 months. All data analysed comprised demographic, radiological and interventional data. A pre- and postoperative WOMAC score has been calculated. Pre- and postoperative sports activities as well as satisfaction were also documented. Following factors were analysed regarding their potential influence on postoperative outcome; the presence of borderline hip dysplasia, early signs of osteoarthritis, an associated CAM-type lesion and whether labral lesions were debrided or sutured.

Results

No major complications were encountered in this series. Mean pre- and postoperative WOMAC score were 62.6 and 24.2 respectively. Postoperative improvement in WOMAC score was statistically significant (p-value = 0.0009). Mean satisfaction rate elevated up to 7.7/10. Due to lack of improvement, 4 patients benefitted postoperatively of a periacetabular osteotomy. All these hips presented with a lateral centre edge angle ≤ 21° and a positive Femoro-Epiphyseal Acetabular Roof (FEAR) index. Statistical analysis showed no influence of previous described factors regarding the postoperative outcomes (p-value > 0.05) probably due to a too small sample size.

Conclusion

Capsular plication shows clinically and statistically significant improvement in function and symptoms in well selected cases of hip micro instability.
Clinical results after arthroscopic capsular plication for hip micro instability: Minimum 5 years follow-up

Doctor Leandro Ejnisman1,2, Katerina Elisman2, Dr Marc Safran2
1Usp, Sao Paulo, Brazil, 2Stanford University, Redwood City, USA

Introduction
Atraumatic micro instability of the hip is increasingly recognized as a cause of hip pain. Hip arthroscopy is effective when initial conservative treatment fails. Labral repair/debridement is often performed in association with a capsular plication and have been shown to yield excellent short-term clinical results. However, because it is a soft tissue procedure, there is concern if clinical results would be maintained after longer follow up.

Methods
After a retrospective review of our institution hip arthroscopy database, 31 patients were identified who underwent hip arthroscopy and suture capsular plication for the treatment of hip instability without concomitant bony resections of the acetabulum and/or proximal femur. Patients with a centre edge angle less than 180 were excluded. Plication was performed using the RICH (rotator interval closure of the hip) technique.

Results
Follow-up was obtained in 24 patients (77.4%). Twenty patients completed the Modified Harris Hip Score (mHHS), 2 patients reported good outcomes but did not complete the mHHS, and 2 patients were excluded because they were submitted to revision surgery by another surgeon. One patient died of unrelated causes. A significant difference was found between the pre-op and 1-year post op mHHS (60.6 + 8.7 vs 88 + 4.9, p<0.05), and no significant difference was found between the 1 and 5 years mHHS (88 + 4.9 vs 90.7 + 9.6, p>0.05). Five patients were available for physical examination. Range of motion comparison between pre-op and 5 years post op demonstrated: flexion increased (116o vs 130o), internal rotation (43o vs 42o) and external rotation were maintained (63o vs 62o).

Discussion/Conclusion
Hip micro instability can be successfully managed with hip arthroscopy and capsular plication (without bony resection) when non-operative management has failed. Hip range of motion is maintained using the RICH technique, and clinical outcomes are maintained at 5 years follow-up.
EP5.6 The predictive value of hip labrum size for clinical symptom and anatomical instability of the hip joint

Dr Shingo Hashimoto1, Dr Shinya Hayashi1, Dr Koji Takayama1, Dr Masanori Tsubosaka1, Dr Tomoyuki Kamenaga1, Dr Yoshinori Takashima1, Dr Tomoyuki Matsumoto1, Prof Ryosuke Kuroda1

1Orthopedic Department, Kobe University Graduate School of Medicine, Kobe, Japan

Biography
Dr Shingo Hashimoto is Assistant Professor at the Department of Orthopaedic Surgery, Kobe University Graduate School of Medicine in Japan. He received his medical degree at the Kobe University School of Medicine and completed his Residency at the Department of Orthopaedic Surgery, Kobe University Hospital and other affiliated hospitals. After finishing Residency, Dr Hashimoto completed PhD course with cartilage metabolism associated with osteoarthritis development in Kobe University Graduate School of Medicine. And then, he had postdoctoral research associate working in Washington University School of Medicine, Department of Orthopaedic Surgery MO, under supervision of Dr Linda J. Sandell. He produced genetic mouse model to investigate cartilage regeneration and osteoarthritis development and evaluated their phenotype. At the same time, he learned the treatment of young hip disorders under supervision of Dr John Clohisy. Dr Hashimoto specializes in the various treatments of hip joint disorders with total hip arthroplasty, osteotomy, hip arthroscopy and other options as the staff surgeon. And he is the basic research expert in the joint degeneration using animal models and translating to human disease.

Objectives
Anatomical abnormalities of the hip joint are often related to soft tissue changes, and sometimes lead to hip joint failure in young adult population. When deciding treatment option including hip arthroscopy and osteotomy, better understanding of hip labral changes related to anatomical variation may be helpful. The purpose of this study is to investigate the labrum size of hip and to evaluate the correlation to anatomical findings.

Methods
Total 136 patients seen at our hip joint clinic between January 2015 and December 2018 were retrospectively analysed. Inclusion criteria was patients diagnosed as hip labral tear, femoroacetabular impingement (FAI), and developmental dysplasia of the hip (DDH) who have magnetic resonance imaging (MRI) examination. Osteonecrosis of the femoral head and other hip disease without osteoarthritis were also included as control cases. The age over 60, osteoarthritis, and the cases with previous hip surgery were excluded. Bilateral labrum size was measured at the centre of hip joint with coronal image of hip joint MRI, and radiographic parameters including LCEA, ARO, shenton line, and acetabular congruency were evaluated.

Results
Labrum size were negatively correlated to LCEA (r=-0.625, p<0.001) and positively related to ARO (r=0.625, p<0.001). When dividing LCEA to definite dysplasia (~19), borderline dysplasia (20~25), normal (26~39), and over coverage (40~), labrum size of definite dysplasia was significantly larger than other group (p<0.001). Borderline dysplasia showed relatively larger labrum, but no significant difference could be found. Irregularity shenton line and acetabular congruency also related to labrum size. Within the cases of hip labral tear, FAI, and DDH, we evaluated the labrum size between symptomatic and asymptomatic hip. Symptomatic hip showed larger labrum size than asymptomatic hip (p=0.016).

Conclusion
Labrum size was significantly larger in dysplastic and irregular congruency hips, potentially indicating a compensatory reaction of bony coverage. Labrum size may be an instability marker and helpful information on clinical decision making when considering joint preservation surgery.
EP5.7 Range of Motion as a Determinant of Hip Micro instability

Dr Justin Hopkins¹, Katia Elisman¹, Nicole Segovia¹, Andrea Finlay¹, Dr Marc Safran¹

¹Stanford University Medical Centre, Redwood City, United States

Introduction
The diagnosis of hip micro instability continues to evolve. We hypothesized that hip ROM will be greater in patients with hip micro instability than in patients with femoroacetabular impingement (FAI) alone.

Methods
After IRB approval, a retrospective chart review was performed. Micro instability was defined as any patient requiring capsular plication for instability based on previously published intra-operative parameters. FAI was defined as alpha angle >55°, centre edge angle >35°, or other radiographic parameter such as crossing sign. ROM including hip flexion, internal rotation (IR), external rotation (ER) and rotation arc were recorded in degrees. Power analysis determined 25 subjects were required in each group for a difference of 5°.

Results
75 patients were included: 25 with isolated hip micro instability, 25 with isolated FAI, and 25 patients had combined micro instability with FAI (CM-FAI). No difference in ROM was found between instability and CM-FAI groups. Isolated instability and CM-FAI groups had significantly greater flexion (128°, 135°) than FAI only (113°, p=0.003, p<0.001). Instability and CM-FAI also had significantly greater flexion plus rotation (218°, 224°) and flexion plus IR (162°, 168°), than FAI only (180°, p=0.015, p=0.004; 131°, p=0.005, p<0.001;). CM-FAI had a greater flexion plus ER (190°) than FAI only (162°, p=0.012). Rotational parameters alone showed no difference. Flexion plus rotation arc greater than 197.5°, represented an 84% sensitivity and 76% specificity that instability was present. Flexion alone, BMI, age and gender can be combined to detect the probability of instability.

Discussion/Conclusion
Micro instability is associated with significant increases in hip flexion. Clinically, rotation may not be as important, and one reason may be variability in femoral version. Flexion plus rotation arc greater than 197.5° may be used as a cut-off for micro instability. Flexion, BMI, age and gender can also be used to predict instability and the need for capsular plication.
The effect of functional movement control on patient reported outcomes in individuals with non-arthritic hip pain

PhD PT Rob Roy Martin1, PhD ATC Ryan McGovern2, PhD PT Benjamin Kivlan1, MD John Christoforetti2
1Duquesne University, Pittsburgh, United States, 2Texas Health Sports Medicine, Allen, United States

Biography
A bachelor degree in Physical Therapy was completed in 1991 at S.U.N.Y. Health Science Centre in Syracuse. A doctoral degree from the School of Health and Rehabilitation Sciences was completed June 2003 at the University of Pittsburgh. Current employment is at Duquesne University as a Professor in the Department of Physical Therapy and as a part-time staff-physical therapist at the Centre for Rehab Services/University of Pittsburgh Medical Centre’s Centre for Sports Medicine. Currently serves as an Editor for the Academy of Orthopaedic Clinical Practice Guidelines. Areas of interest include outcome research related to the lower extremity, specifically the hip, ankle and foot. Over 100 publications, 200 presentations, and 4 grants have been completed related to this research agenda.

Purpose
To determine if individuals with non-arthritic hip pain that improve functional movement control during the single leg squat test (SLST) have better patient-reported outcomes than those that do not improve, following an 8-week physical therapy and standardized home-exercise program.

Subjects
46 individuals (31 females; 15 males) with a mean age of 30 years (SD = 12) were included. All subjects had intra-articular non-arthritic hip pain with initial and follow-up SLST scores available.

Materials/Methods
This was a retrospective review of prospectively collected data maintained in a research registry. The following information was available: demographic, diagnosis, visual analogue scale scores for pain(VAS-P), hip outcome score activities of daily living (HOS-ADL) and sports-related activities (HOS-SRA), percent global rating for activities of daily living (% - ADL) and sports-related activities (% - SRA), and patient satisfaction. Initial and follow-up SLST scores were also available. ANCOVA and Fisher’s exact test were performed on continuous and categorical patient-reported outcome variables, respectively, to assess for differences between individuals that improved and those that did not improve their functional movement control on the SLST.

Results
There was a statistically significant difference (p≤.003) between individuals that improved and those that did not improve their functional control on the SLST for the following measures: VAS-P, HOS-ADL, HOS-SRA, % - ADL, and % - SRA. There was also a statistically significant difference (p<.001) between those individuals that improved and those that did not improve their functional control on the SLST with a categorical rating for patient satisfaction.

Conclusions
Individuals with non-arthritic hip pain who improved their functional movement control following an 8-week physical therapy and standardized home-exercise program are more likely to report less pain, greater functional ability in their daily and sports-related activities and note being more satisfied. This study offers support for conservative management in those with non-arthritic hip pain.
Arthroscopic stabilization of labral tears in patients with hip dysplasia

Dr Jun-ki Moon¹, Dr Chul-Ho Kim¹, Dr Jae-Youn Yoon¹, CNS Mi Yeon Jeong¹, Dr Sun Hyung Lee², Prof. Hee Joong Kim², Prof. Pil Whan Yoon²

¹Asan Medical Centre, Seoul, South Korea, ²Seoul National University Hospital, Seoul, South Korea

Biography
Pil Whan Yoon, M.D., Ph.D. is associate professor of orthopaedic surgery in Asan medical centre in South Korea. He is specialized in surgery for hip and pelvis, including arthroplasty, arthroscopy and hip preservation surgery. Professor Yoon has been making considerable contributions for research of hip and pelvis surgery as an academic editor of Plos One journal, as a member of International Society for Hip Arthroscopy, as a member of American Academy of Orthopaedic Surgeons and as a member of editorial board of Hip and Pelvis journal.

Background
The clinical outcome of arthroscopic treatment for labral tears in hip dysplasia (HD) is controversial. It is important to restore the mechanical stability of the torn labrum, especially in HD. We aimed to evaluate the clinical outcomes of arthroscopic stabilization of labral tears in patients with HD.

Materials and Methods
Between August 2014 and March 2017, the 22 hips of 20 patients with HD underwent hip arthroscopy for labral tears in our institution. There were 3 males and 17 females with the mean age of 42 years. Inclusion criteria were a lateral centre-edge angle (LCEA) ≤20º, Tönnis grade ≤1, and minimum 2-year follow-up. Labral stabilization was performed with a labral base refixation and vertical mattress technique using 2.3 mm suture anchor. Interportal capsulotomy was not performed except for 4 hips, in which capsular plication was done. Modified Harris hip score (mHHS) was obtained preoperatively and at a minimum 2 years postoperatively.

Results
The mean preoperative LCEA was 15.7º (10º to 20º). The mean follow-up was 3.3 years (2 to 5 years). One hip (4.5%) required conversion to total hip arthroplasty due to secondary osteoarthritis 2 years after hip arthroscopy. The mean mHHS of remaining 21 hips increased from 58.5 to 82.5 (P < .001). No surgery-related complication was noted.

Conclusion
Although hip arthroscopy alone cannot normalize structural abnormality in HD, it may provide a favourable short-term outcome by stabilizing torn labrum, using the advanced arthroscopic technique within the carefully selected patient group.
Can high intensity change of the joint capsule ligament on MRI be an indicator of hip joint instability?

MD PhD Seigo Oshima, MD Jiro Nakashiro

1 Matsuyama Red Cross Hospital, Matsuyama city, Japan

Biography

General Information:
Name; Seigo Oshima, M.D., Ph.D.
Office Address; Department of Orthopaedic Surgery, Matsuyama Red Cross Hospital.
1 Bunkyo-cho, Matsuyama city, Ehime 790-8524, Japan
Tel: +81-89-924-1111 Fax: +81-89-922-6892
E-mail; seigo1224oshima@yahoo.co.jp
Birth Date and Place; December 24, 1973 Fukuoka, Japan
Citizenship; Japan
Marital Status; Married, 2003

Educational History:
Apr/2007-Mar/2011 Graduate School of Biomedical Sciences (Doctoral Program),
Ph. D student in the Department of Orthopaedic Surgery,
Graduate School of Biomedical Sciences, Hiroshima University.
Apr/1995-Mar/2001 Faculty of Medicine, Hiroshima University.  M.D.

Professional Background:
Apr/2016-present Medical staff in Matsuyama Red Cross Hospital.
Apr/2011-Mar/2016 Medical staff in Onomichi general Hospital.
Apr/2007-Mar/2011 Medical staff in the Department of Orthopaedic Surgery, Hiroshima University Hospital.
Apr/2006-Mar/2007 Medical staff in Hiroshima Railway Hospital.
Apr/2002-Mar/2004 Medical staff in Matsuyama Red Cross Hospital.
Apr/2001-Mar/2002 Resident in Department of Orthopaedic Surgery, Hiroshima University Hospital.

There is concern in performing hip arthroscopy on patients with hip instability. In cases of borderline dysplasia, it is particularly important to estimate the preoperative instability. At present, the CE angle on an X ray is currently used for this purpose. While this can demonstrate major instability, it cannot predict micro-instability. Thus, the joint capsule ligament was evaluated in patients with hip labral tears using 3 tesla MRI. Seventy-two hips were included in this study (male, n=19; female, n=53). The diagnoses included borderline dysplasia (n=13), femoroacetabular impingement (n=22), and hip labral tear without bone abnormality (n=37). The evaluation of the joint capsule ligament was performed by T2* -weighted MRI with oblique axial and oblique coronal images and the thickness and intensity of preoperative joint capsule ligament in each group were investigated. There was no significant difference in the thickness of the joint capsule ligament in each group; however, the intensity change of the joint capsule ligament was observed in significantly more patients in borderline dysplasia cases. In addition, the joint capsule ligament showing high-intensity change was swollen. With the exception of cases with high-intensity change, the joint capsule ligament was significantly thinner in cases of borderline dysplasia. The joint capsule ligament is important for the stability of the hip joint, and a high-intensity change is considered to indicate a ligament injury. In borderline dysplasia, it is thought that ligament injury is likely to occur because the joint capsule ligament is thin. Thus, in cases with joint capsule ligament injury, micro-instability may occur in addition to the ligament...
injury. The high intensity change of the joint capsule ligament may be an indicator that can be used to evaluate micro-instability of the hip joint.
Dynamic ultrasound and Platelet-Rich Plasma (PRP) to diagnose and treat hip micro instability

Dr Alexander Poor, Dr Johannes Roedl, Dr Adam Zoga, Dr William Meyers, Dr Struan Coleman

1 Vincera Institute, Philadelphia, United States, 2 Thomas Jefferson University Hospital, Philadelphia, United States, 3 Hospital for Special Surgery, New York, United States

Biography
Dr Poor is a board-certified general surgeon specializing in core muscle injuries, hernias, groin, pelvic and abdominal pain. Dr Poor earned his medical degree from Jefferson Medical College and completed his residency in General Surgery at Drexel University College of Medicine and a two-year core medicine fellowship at the Vincera Institute with Dr William C. Meyers. His primary focus of research is studying core anatomy and the pathophysiology of its associated injuries. After completing his fellowship, Dr Poor joined Vincera in 2016 and serves as Director of Research.

Introduction
Micro instability of the hip is defined as extra physiologic hip motion that causes pain with or without symptoms of hip joint unsteadiness and may be the result of bony deficiency and/or soft-tissue laxity or iatrogenic damage. Established treatments for micro instability include strengthening of the surrounding musculature, redirectional osteotomy for inadequate bony coverage, and capsular plication/reconstruction and/or labral reconstruction for those with adequate bony coverage.

We present the case of a 20-year old female collegiate swimmer who had micro instability of the hip treated with a PRP injection onto the anterior joint capsule in the vicinity of the iliofemoral ligament. The patient had two prior hip arthroscopies, the second of which included capsular plication. The diagnosis was based on history, physical exam, x-rays, and MRI.

Methods
We used ultrasound to measure the distance between the anterior margin of the femoral head and the anterior edge of the acetabulum with the hip in extension and the contralateral hip at neutral position. We repeated the measurement with both hips at neutral position. The difference between these values is the femoral head displacement. Measurements were taken prior to the PRP injection and at 3- and 12-months post-injection.

Results
The lateral centre edge angle (CEA) was 45°. The femoral head displacement was 2.5mm prior to the PRP injection and 1.2mm at 3-months and 1.1mm at 12-months post-injection. The patient was able to return to varsity competition for the first time since before the initial hip arthroscopy 4 months after the PRP injection.

Conclusion
This case report replicates previous reports suggesting that ultrasound may be useful in demonstrating hip micro instability and raises the potential for PRP as a treatment option for micro instability due to capsular laxity.
EP5.13 Outcomes of arthroscopic surgery in patients with joint laxity and hypermobility syndromes: a systematic review  
Dr Haitham Shoman1, Prabhvir Marway1, Mr Vikas Khanduja1  
1Cambridge University Hospitals, Addenbrooke’s, Apartment 1, United States

Biography  
Haitham earned his MBBcH from Ain Shams University, Cairo where he started his orthopaedic rotations. In parallel, he founded projects for the disabled community in Egypt for which he has won several awards from the UN and King Abdullah II Award from Jordan and helped develop innovative health education activities. He then got his Diploma and Masters in Public Health from Imperial College London through the UK Government’s Chevening Scholarship award. His global health experience spans across health economics, health policy and strengthening health systems post-emergencies from his published work. He worked for the European Commission’s Joint Research Centre and WHO. As a Paul Farmer Global Surgery Research Fellow at Harvard Medical School he focuses on, global orthopaedic surgery and locally, surgical site infections with mHealth technologies and national surgical planning in Rwanda along with strengthening surgical systems projects in Pakistan. He is also a research fellow at Addenbrooke’s Cambridge University Hospital. His is committed to using cost effective surgery for health systems development through education, innovation and outcomes-based research in low-resource settings. Haitham is also a research associate with Paris Descartes University – Laboratory of applied health economics research (LIRAES) – Sorbonne and a Global Burden of Diseases Collaborator.

Background  
Joint laxity and hypermobility refer to joints with increased range of motion. While they have traditionally been associated with poorer outcomes in open orthopaedic procedures, the picture isn’t so clear with modern arthroscopic procedures. This review aims to assess outcomes of arthroscopic surgery in patients with joint laxity and hypermobility syndromes.

Methods  
To develop the protocol of this study, the PRISMA-P guidelines were followed along with its checklist. The writing of the manuscript will follow the PRISMA guidelines and flowchart. The systematic review of the literature will include articles gathered from a search strategy using the following databases Medline, Embase, Cochrane, AMED and Web of Science Core Collection. The collected articles will then be exported to Mendeley reference manager software and then screened for eligibility. The necessary data will be extracted into a spread sheet based on variables determined from the studies found. This study will include English articles with joints of living human subjects. Case reports, case series, case controls, cohorts, cross sectional studies and randomized control trials were included. The quality and risk of bias of studies will then be evaluated using the Joanna Briggs Institute Critical Appraisal Checklist for Economic Evaluations.

Discussion  
The purpose of this systematic review is to explore the outcomes of arthroscopic procedures on patients with joint laxity and hypermobility syndromes. The major outcomes identified in this study are; 1. Overall joint function 2. Pain 3. Patient Satisfaction 4. Instability 5. Return to surgery, 6. Return to sport. Where possible, these outcomes were compared to the outcomes of patients without joint laxity and hypermobility syndromes in the identified studies. It appears that patients with hypermobility gain a significant improvement from arthroscopic surgery, as measured by outcomes included in this study. This improvement varied depending on the joint, with arthroscopic surgery on the hip tending to show the best outcomes, matching patients without hypermobility. Outcomes for the shoulder with regards to instability and return to surgery tended to be worse for patients with hypermobility, compared to those without.
Registration: This systematic review is registered in (PROSPERO) under the registration number: CRD42018095925
EP5.14 Can the FEAR Index be used to predict micro instability in patients undergoing hip arthroscopy?

Jeremy Truntzer¹, Daniel Hoppe², Lauren Shapiro¹, Marc Safran¹
¹Stanford University, Redwood City, USA, ²McMasters University, Hamilton, Canada

Biography
Dr Truntzer is a broad-eligible Orthopaedic Surgery. He completed his residency at Stanford University followed by a sports fellowship at Stanford University under the guidance of Marc Safran.

Background
Atraumatic hip instability, or micro instability is a challenging diagnosis for clinicians. Several radiographic parameters have been proposed to help identify patients with instability as a means to direct treatment. The Femoro-Epiphysseal Acetabular Roof (FEAR) index was recently offered as a parameter to predict instability in a borderline dysplastic population. The purpose of this study is to evaluate the FEAR index in a series of predominantly non-dysplastic patients undergoing hip arthroscopy to determine if the parameter can accurately predict patients diagnosed with micro instability at time of surgery.

Methods
A consecutive series of 200 patients undergoing hip arthroscopy were evaluated for micro instability intra-operatively. Micro instability was diagnosed based on previously published criteria. Retrospectively, radiographic parameters were measured including lateral centre edge angle of Wiberg (LCEA), Tönnis angle, physical scar to the horizontal, and FEAR index. Patients were excluded if they previously had any type of bony procedures performed, prior open hip surgery or total hip arthroplasty of the ipsilateral hip, osteoarthritis (Tönnis grade >1), as well as any radiographic features of moderate-to-severe acetabular dysplasia including LCEA of <18°.

Results
Following exclusion criteria, 167 hips in 150 patients were analysed. Based on intra-operative assessment, 96 hips (57.5%) were considered stable and 71 (42.5%) had signs of micro instability (unstable group). Patients in the unstable group presented with less radiographic findings of FAI and higher rates of borderline dysplasia. All four measured angles were found to have excellent inter-observer agreement. The FEAR index was significantly more positive in the unstable cohort compared to the stable cohort (-7.8° vs -11.3°, p=.004). A more positive FEAR index was also found in patients meeting intra-operative criteria for instability with the exception of chondral wear pattern. Unstable non-dysplastic patients (LCEA ≥ 25°, Tönnis ≤ 10°) also were found to have higher FEAR index values (-9.0° vs. -12.0°, p=0.012). A FEAR index cut-off of greater than -5.0° is associated with a specificity of 92.4% and accuracy of 69.4% for predicting instability in a non-dysplastic population.

Conclusion
The FEAR index was validated to improve the recognition of unstable patients pre-operatively across a population with both borderline dysplastic and non-dysplastic features.
EP5.15 Generalized joint laxity is not associated with patient-reported outcomes following hip arthroscopic surgery

Dr Lauren Pierpoint¹, Dr Hajime Utsunomiya¹, Mr Patrick Quinn¹, Dr Marc Philippon¹
¹Steadman Philippon Research Institute, Vail, United States

Purpose
To determine if generalized joint laxity (GJL) is associated with clinical outcomes following hip arthroscopy, and whether the relationship between GJL and outcomes depends on centre edge angle.

Methods: Patients
>=18 years who underwent hip arthroscopy from January 2010 through December 2016 with >= 2 years of follow up data were identified. Patients with GJL were defined as having a Beighton score (range 0-9) of >=4.

We compared outcomes scores (modified Harris Hip Score, HOS-SPT, HOS-ADL, SF12-MCS, SF12-PCS, WOMAC) by GJL (yes/no) stratified by those who had a lateral centre edge (LCE) angle <30 vs. >=30 and LCE <25 and >=25.

Results
520 patients (49% female) met inclusion criteria. Mean age of the patients was 37.2±12.8 years. Thirty-four percent of patients had GJL. Mean LCE angle was 32.1±8.0 degrees. Overall, there were no significant differences in outcomes scores among patients with and without GJL and the results did not change when stratifying by LCE <30 and LCE >=30. Conversion to THA was similar between GJL and no GJL patients (3% each, p=0.76); LCE angle did not affect this relationship. GJL was also not associated with revision rates among patients with LCE <30 (GJL=5.8%; no GJL=9.6%; p=0.39) or LCE >=30 (GJL=5.6%, no GJL=4.8%; p=0.77). Among patients with LCE <30, those with GJL had a lower prevalence Outer bridge score defects of grade 3-4 (GJL=33.3%, no GJL=52.9%; p=0.02) while there was no relationship among patients with LCE >=30 (GJL=54.2, no GJL=51.1; p=0.41). Similar results were found when stratified by LCE <25 and LCE >=25. When excluding patients with grade 3 or 4 chondral defects, we still did not observe significant associations between GJL and outcomes, regardless of CE angle.

Conclusion
Patient-reported outcomes, conversion to THA, and revision hip arthroscopy rates did not differ by GJL status. The relationship between GJL status and outcome measures did not depend on LCE angle.
Borderline acetabular dysplasia and increased femoral anteversion is predictive of worse outcomes in females undergoing hip arthroscopy

*Dr Jennifer Marland*, Mrs Brandy Horton, Dr Hugh West, Dr James Wylie

The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

**Biography**
Dr Marland is a DPT that works in the hip preservation clinic at The Orthopaedic Specialty Hospital at Intermountain Healthcare in Murray, UT. She specializes in the clinical and radiographic evaluation and treatment of patients with non-arthritic hip and pelvic pain.

**Background**
Femoral anteversion (FA) can accentuate hip instability in patients with borderline acetabular dysplasia. We hypothesized that borderline acetabular dysplasia alone and in combination with increased FA would be predictive of worse outcome after hip arthroscopy in female patients.

**Methods**
This was a retrospective review of females undergoing hip arthroscopy with a diagnosis of FAI treated with femoral osteoplasty with or without labral repair. iHOT-12 was collected preoperatively and at 2 to 4-year follow-up. Computed tomography was used to quantify femoral version in all patients. Patients with borderline acetabular dysplasia (LCEA≤25) were groups as elevated femoral anteversion (>15 degrees) or not. Differences in means were tested using a student’s t-test or an analysis of variance with a post-hoc tukey’s test.

**Results**
There were 175 Female patients with a mean age of 33 years. Mean follow up was 34.6 months. Mean preoperative iHOT12 was 30.4. Mean postoperative iHOT12 was 74.8. Mean FA was 11.7 (Range 1 to 34) degrees. There were 65 patients with an LCEA≤25. There were 110 patients with LCEA>25, 46 patients with LCEA≤25 and FA <15 degrees and 17 patients with LCEA≤25 and FA≥15 degrees. Patients with LCEA≤25 had worse iHOT12 at follow-up (68.0 points versus 78.9 points, p=0.010) and less improvement in iHOT12 from surgery (36.0 points versus 49.5 points, p=0.001) compared to those with an LCEA>25. Patients with LCEA≤25 and FA≥15 degrees had worse iHOT12 at follow-up (59.5 points versus 78.9 points, p=0.008) and less improvement in iHOT12 from surgery (28.2 points versus 49.5 points, p=0.003) compared to those with an LCEA>25. In addition, patients with LCEA≤25 and FA<15 degrees had less improvement iHOT12 from surgery (38.0 points versus 49.4 points, p=0.026) compared to those with an LCEA>25.

**Conclusion**
Borderline acetabular dysplasia is predictor of worse outcome after hip arthroscopy in female patients and this is worsened by increased femoral anteversion.
EP5.17 Epidemiological profile of dancers with groin pain

Ms André Bento¹, Pt Victor Alves¹, Pt Pedro Henrique Brandão¹, Pt Klever Fujikawa¹, Md Bruno Scatigna¹, Ms Guilherme Falotico¹
¹Unifesp, Sao Paulo, Brazil

Biography

Physical Therapy member of ISHA since 2018, Master's degree in health sciences applied to sports and physical activity, specialist in sports physiotherapy in 2004 by the federal university of são paulo (UNIFESP), physiotherapist responsible for the ambulatory of hip injuries in athletes in the UNIFESP since 2005, member of the national society of sports physiotherapy (Brazil).

Dancers experience considerable stress in the body. These high forces generated during dance combined with movements that frequently exceed physiological limits may potentially result in injury. This often requires extreme ranges of motion, particularly of the hip. Objective: To identify the profile of musculoskeletal injuries in dancers linking mean age, injury side, weekly training frequency, daily training duration and diagnostic hypothesis. Methodology: Cross-sectional study, which medical records were consulted. All diagnostics were realized by physicians via clinical examination, orthopaedic tests and/or imaging exams. Were excluded all medical records that presented any missing data and male population. Statistical analysis was made via SPSS 20 (Statistical Package for the Social Sciences) software. Results: Twenty-eight female dancers were included. The age ranged from 14 to 45 years, mean 25.8 years. Mean weekly train frequency was five days per week and mean daily train duration was four hours. The most prevalent diagnostic hypothesis was syndrome of femoroacetabular impingement (FAIS) secondary to hypermobility, which was found in 16 dancers (57.14%). Others diagnostic hypothesis founds are labral lesions and greater trochanteric pain syndrome. Side related injuries, 12 cases (42.85%) were bilateral; 8 (28.57%) cases were on dominant member and 8 (28.57%) were on non-dominant member. Conclusion: The most common injury found in our population was FAIS secondary to hypermobility, this being aggravated by some Ballet gestures which requires large hip articulation range of motion (ROM). Despite the fact this was not the point of this study. No correlation between injuries and dominant/non-dominant member was found.

Antônio Augusto Guimarães Barros¹, Rafael Baroni Carvalho¹, Cláudio Beling Gonçalves Soares, MD Carlos Cesar Vassalo¹, Eduardo Frois Temponi, Victor Atsushi Kasuya Barbosa¹, Luiz Eduardo Moreira Teixeira¹, George Grammatopoulos²

¹Hospital Madre Teresa, Belo Horizonte, Brazil, ²The Ottawa Hospital, Ottawa, Canada

Biography

Primary pyomyositis is a deep bacterial infection of the skeletal muscle. If undiagnosed and untreated, the infection spreads leading to sepsis, septic shock and even death. We report a 23-year-old female presenting with piriformis pyomyositis during a treatment for Kikuchi-Fujimoto disease. Pyomyositis is a potentially severe but rare infection, which can lead to septic shock. This case shows the need for a high degree of clinical suspicion for patients with compromised immune systems to begin treatment at an early stage. The literature shows that outcomes of the treatment of piriformis pyomyositis are good.

Keywords: Pyomyositis; Staphylococcus aureus; Histiocytic Necrotizing Lymphadenitis
EP6.2 Reliable anatomic landmarks for safe surgical arthroscopic treatment of the deep gluteal space

**MD Bruno Capurro**, MD, PhD Marc Tey, MD, PhD Anna Carrera, MD, PhD Fernando Marqués, MD, PhD Alfonso León, MD, PhD Joan Carles Monllau, MD, PhD Francisco Reina

1Hospital de l Mar, Universitat Autònoma de Barcelona, ., Spain, 2Medical Sciences Department. NEOMA Research Group. Universitat de Girona. . , Spain

**Purpose**

Determine morphometry and anatomical relationships variations relevant to arthroscopic treatment in the deep gluteal space (DGS).

**Methods**

Twenty deep gluteal spaces of cadaveric specimens were dissected. The anatomical relationship between the sciatic nerve and the piriformis muscle was determined according to the Beaton and Anson classification. A morphometric study of the distances in the DGS was carried out to define the area where the arthroscopic decompression of the sciatic nerve should be performed in the piriformis syndrome (GT-SN= Greater trochanter (GT) to sciatic nerve emergency (SN); GT-IT= GT to ischial tuberosity (IT); GT-IGA= GT to inferior gluteal artery emergency (IGA); IT-SN= IT to SN emergency; IT – IGA =IT to IGA).

**Results**

The sciatic nerve and the relation with the piriformis muscle in the DGS followed the typical anatomical pattern (type A of Beaton) in 16 specimens (80%). In 5 specimens of this group (31.25%), the sciatic nerve was divided from its emergence at the level of infrapiriform space. Type B of Beaton was observed in 4 specimens (20%), a pattern in which the common peroneal nerve passes through the piriformis muscle, while the tibial nerve is located at the lower border of the piriformis muscle. The morphometric measurements of the surgical area of study were: GT-SN= 72.23 ± 8.3 mm; B= 85.62 ± 10.9 mm; C= 84.62 ± 9.7 mm; D= 52.86 ± 7.3mm. E= 54.67 ± 7.4 mm.
Conclusions
When planning surgery in adult patients with deep gluteal syndrome, the surgeon must take into account that, in adult, the emergence of the sciatic nerve in the DGS is approximately 7 cm from the greater trochanter and 5 cm from the ischial tuberosity.

Clinical Relevance
Morphometric study to define landmarks to guide the arthroscopic surgeons who plan interventions around the sciatic nerve and its division in the DGS.

Level of evidence
IV - Anatomical descriptive study

Keywords
Surgical Anatomy; Deep Gluteal Space; Sciatic Nerve; Hip Arthroscopy.
EP6.3 Sciatic intraneural PRP injection to treat deep gluteal syndrome; bases in experimental animal model, technique and cases study

MD Nicolas Fiz1, MD Ane Miren Bilbao1, MD Juan Azofra1, MD Jorge Gaudilla1, MD Jaime Orha1, MD Beatriz Aizpurua1, MD Leonor Lopez1, MD Mikel Sanchez1

1Arthroscopiac Surgery Unit (uca), ,

Introduction

Sciatic symptoms in the deep gluteal syndrome occurs due a neural compression or a lack of mobility of the sciatic nerve. Is a big cause of discomfort without a great surgical solution. On the other hand, PRP therapies have shown a positive effect improving the neural symptoms in several locations. We propose the use of PRP as therapy to reduce the symptoms in the deep gluteal syndrome.

Animal model

We used an ovine animal model to check the effect of PRP into the nerve. We reproduce a complete nerve injury at the sciatic nerve of the sheep. We inject PRP three times into the nerve at the level of the injury; the control group was injected with saline. We found significant differences in the electromyography study, histologic study of the nerve and grade of fat degeneration at the target muscle. We did not find any side effect after the injection. We concluded that intraneural PRP improved the healing of neural injuries without side effect.

Injection Technique

We use a 18G needle for intraneural injection. We use ultrasound for guiding the shot. We inject 6cc of activated PRP intraneural and 12-16cc of PRP perineural. The injection is done without anaesthesia. Full weight bearing is allowed after the injection.

Cases Study

We have analysed the clinical results in 10 consecutive patients with clinical diagnose of deep gluteal syndrome. We inject PRP intra and perineural, 2 times with an interval of 2 weeks. We have used mHHS at 2 and 6 months to analyse the response.
Results
We have found a significant improvement of the sciatic symptoms in all the patients. This improvement appears at 2nd month and remains until 6th month. No side effect was found in any patient.

Conclusion
Intraneural PRP injections is a safe and effective solution for deep gluteal syndrome.
EP6.4 Brace immobilization following surgical repair of proximal hamstring tears does not affect post-surgical outcomes

Orthopaedic Surgeon Lionel E. Lazaro¹

¹Miami Orthopaedic and Sports Medicine Institute, Baptist Health South Florida, Miami, United States

Biography
Lionel Lazaro MD, was born and raised in San Juan, Puerto Rico. He received his Bachelor of Science from the University of Puerto Rico, Rio Piedras and his medical degree from Universidad Autonoma de Guadalajara School of Medicine. He attended the Fifth Pathway Program at New York Medical College and completed his orthopaedic surgery residency at the world-renowned Hospital for Special Surgery. He then supplemented his training with an orthopaedic sports medicine fellowship at the prestigious Kerlan-Jobe Orthopaedic Clinic (Cedar-Sinai Kerlan-Jobe Institute) in Los Angeles, California. He recently joined a practice with Miami Orthopaedic and Sports Medicine Institute at Baptist Health South Florida. He focuses in orthopaedic sports medicine, with an emphasis on hip preservation and focal cartilage injury treatment.

Objectives
Braces are commonly used in Orthopaedic to protect repaired tissue from excessive stress that can compromise the healing process. Some of these braces can become a nuisance, especially the ones commonly used following proximal hamstring repairs. This immobilization creates discomfort and limitation during the basic daily needs, possibly compromising patient satisfaction. We hypothesis that proximal hamstring repairs can be safely managed, without brace immobilization and allowing partial weight bearing immediately after surgery.

Methods
We identify 57 patients that underwent surgical repair of proximal hamstring injuries. The repairs were fixed using suture anchors, and the same surgical technique were performed by a single sport medicine fellowship trained Orthopaedic surgeon. During the postoperative period the patient were allowed to bear partial weight with the assistance of crutches for 6 weeks. At the fourth week, light stretches begin with assistance of the physical therapist. Brace immobilization is not utilized at all, instead detail instruction is provided to the patient to avoid simultaneous hip flexion and knee extension. Subjective outcome measures included: the single assessment numeric evaluation (SANE); I-Holt 12 and KJOC hip scores. Clinical data was obtained from the electronic medical record.

Results
Mean patient age was 52 years (range 29-69). The injury was chronic (> 6 weeks) in 55% of the patients. Mean length of follow-up was 32 months (range 14-60). One patient failed repair, requiring revision surgery. The average SANE score was excellent at 97 points and representing 43 points increase from the preoperative assessment. Similarly, the mean score for the I-Holt 12 and KJOC hip scores were very good with 99 and 83 points, respectively. In 68% of the patient the injury was sport related, and they all return to sport at an average of 7 months.

Conclusion
A post-operative protocol that included immediate partial weight bearing and does not utilized immobilization brace can result in excellent subjective outcomes, high rate to return to sport in a timely matter and low failure rates. Based in our findings, brace immobilization following surgical repair of proximal hamstring appear to be excessive and may not provide additional benefit.
EP6.5 Deep gluteal syndrome: Case series of posterior endoscopic treatment
Dr Fernando Leal¹, Dr Jorge Cruz de Melo¹, Enf MAnuel Padin¹, Dr Francisco Alpoim¹
¹Porto Hip Unit, Porto, Portugal

Biography
Consultant in Orthopaedics and Trauma
Founder of Porto Hip Unit
Head of Luz Saude - Arrábida Hip Department
Fidelidade Medical Team Hip Coordinator
Specialized in Hip Surgery

Introduction
Deep gluteal syndrome (DGS) is an entity characterized by pain or paraesthesia’s on the buttock, hip or posterior thigh caused by a non-discogenic, extra-pelvic compression of the sciatic nerve. This compression can have multiple etiologies and is often a difficult and neglected diagnose. An endoscopic approach allows for direct visualization and decompression of the sciatic nerve in the deep gluteal space, with minimal morbidity. We present our results with this technique, technical key points, clinical anatomy, causes for compression and patients results.

Material and Methods
We conducted a retrospective, transversal study, collecting data from patients between January 2013 and December 2016. All patients presented posterior hip pain, thigh paraesthesia and difficulty to remain in a seated position. Lumbar MRI excluded discogenic pain. A minimal 3m conservative periods was trialled. AVS, WOMAC, and subjective satisfaction scales were used. Endoscopic technique was done in lateral decubitus, with sciatic nerve decompression from the sciatic foramen to ischial tuberosity, followed by piriformis tenotomy.

Results
The study included 23 patients, 16 female, 7 males, with a mean age of 41.2y (24 - 67y). Mean duration of symptoms was 2.9y (6m - 8y). Follow up was from 3m up to 28m. Mean AVS improved from 7.4 (6 - 10) to 2.7 (0 - 6). Mean WOMAC improved from 56.4 (47.3 - 77.8) to 84.8 (56.3 - 100). Subjectively, 11 patients were very satisfied, 8 satisfied, 4 indifferent.

Discussion/Conclusion
DGS is an unusual, undiagnosed and neglected pathology. Clinical suspicion is crucial for a correct diagnosis. If conservative treatment fails, and endoscopic procedure, with decompression and piriformis tenotomy is an effective technique with little to no morbidity associated.
EP6.6 Ischiofemoral impingement: Is there any difference in iliopsoas fixation?

Raul Lins¹, Alessandro Cavalcante¹, Gilson Falcão¹, Luis Felipe Elias²

¹Universidade Federal de Pernambuco, Recife, Brazil, ²Hospital Vera Cruz, Campinas, Brazil

Objective
The purpose of this study is to describe a series of eight cases submitted to the iliopsoas’s release and osteocondroplasty of lesser trocanter by endoscopic approach. Besides that, to evaluate the difference between that cases which the fixation of the iliopsoas tendon was done.

Methods
Eight cases were submitted to the endoscopic release of the iliopsoas tendon and lesser trocanter osteocondroplasty. In three of eight cases, the iliopsoas tendon was attached by the insertion of two knot less suture anchor. The patients were followed after one, three and six months in order to evaluate the passive and active range of motion, active flexion of the hip when stand up, hip MRI and the visual analogue scale for the pain.

Results
After one month, the three patients submitted to iliopsoas’s fixation had a hip active flexion higher than others. The MRI showed change of sign in T2 for all of them as well. The mean of visual analogue scale of pain was reduced from 8 to 3 points after one month. After three and 6 months, there was no difference in the active flexion of the hip and all of them reached 90 degrees. The MRI showed changes in T2 sequence and the mean of visual analogue scale of pain was 2. One patient had a visual analogue scale returned to eight after 5 months and still remain under investigation. This patient had not the iliopsoas fixation.

Conclusion
There is some bias for this work, including a few numbers of cases. That’s why the statistics measures could not be used. However, it seems to show that, after 3 months there is no difference in the results between that patients submitted to iliopsoas’s fixation. Randomized Controlled trials must be done in order to define it.
EP6.7 The safe zones for arthroscopic proximal hamstring repair: a cadaveric assessment of standard portal placement and relationship to major neurovascular structures

Dr Charles Su1, Dr Marc Labelle1, Dr Lakshmanan Sivasundaram1, Dr Shane Nho2, Dr Richard Mather III3, Dr Michael Salata1

1University Hospitals Cleveland Medical Centre, Cleveland, United States, 2Rush University Medical Centre, Chicago, United States, 3Duke Sports Science Institute, Durham, United States

Biography

Dr Charles Su is an orthopaedic surgery resident at the University Hospitals Cleveland Medical Centre. He received his undergraduate degrees in biology and psychology from Case Western Reserve University and went on to complete his medical doctorate and PhD through the Medical Scientist Training Program at Case Western Reserve University, completing his PhD thesis in the field of transplantation immunology. He will be applying to sports medicine fellowships with clinical and research focus on the arthroscopic treatment of athletic hip injuries and hip joint preservation surgery.

Purpose

To define the relationship and proximity of major neurovascular structures to standard portals used in arthroscopic hamstring repair.

Methods

We established the 3 standard (lateral, medial, and inferior) portals in 4 cadaveric hips, using Steinmann pins inserted at multiple angles for each portal. Each hip was dissected, and the relation of the pins to the pertinent anatomy was recorded to the nearest 1mm.

Results

The standard lateral portal placed the sciatic and posterior femoral cutaneous (PFC) nerves at greatest risk. Direct trauma to the sciatic nerve was observed in 50% (6/12) of lateral portals that were placed. The lateral portal placed at 60° (most vertical) was the most dangerous, lying at a mean of 0.25mm (range, 0 to 1mm) from the sciatic and 5.75mm (range, 2-12mm) away from the PFC, with direct injury to the sciatic nerve in 75% (3/4) of hips. The lateral portal placed at 30° (most horizontal) was the safest lateral portal, lying at a mean of 2.25mm away from the sciatic nerve and 10.42mm away from the PFC nerve. The nervous structures were at significantly less risk with the inferior and medial standard portals. The 60° (most vertical) medial portal was the safest of all standard portals measured, lying at a mean of 61.58mm away from the sciatic nerve and 55mm away from the PFC nerve.

Conclusion

All currently described techniques for arthroscopic proximal hamstring repair recommend establishment of the standard lateral portal first. However, data from this preliminary study demonstrate the highest risk of injury to the sciatic and PFC nerves with blind placement of this portal, with direct trauma to the sciatic nerve in 50% of lateral portals that were placed. We recommend that a medial arthroscopic portal be established first to minimize neurovascular injury and subsequently create the lateral portal under direct visualization.

Clinical relevance

This novel anatomic data on the dangers associated with portal placement may help to prevent iatrogenic injury in arthroscopic hamstring repair.
A new technique for surgical treatment of proximal hamstring tendinopathy in a triathlon athlete

MD Lincoln Paiva Costa¹, Rafael Baroni Carvalho¹, MD Antônio Augusto Guimarães Barros¹, MD Carlos Vassalo¹, Bertrand Sonnery-Cottet², Eduardo Frois Temponi¹

¹Hospital Madre Teresa, Belo Horizonte, Brazil, ²Hôpital Ramsay-Générale de Santé, Hôpital privé Jean Mermoz; Centre Orthopédique Santy, FIFA Medical Centre of Excellence, Lyon, France

Biography

This report describes a case of 48-year-old man, an amateur triathlete, with left deep gluteal pain in the left hip for 12 months, leading to a decline in sports performance. Magnetic resonance imaging revealed abnormalities that suggested a proximal hamstring tendinopathy. Surgery was indicated following the failure of conservative treatments. Debridement of the conjoint tendon and its reinsertion associated with semimembranosus tenotomy showed good results and is thus an option for the treatment of this pathology after 12 months of follow-up.

Proximal hamstring tendinopathy is the result of chronic overload caused by repetitive eccentric contraction. Surgical treatment becomes an option for patients with chronic symptoms that do not respond to conservative treatment.

Keywords
Proximal hamstrings tendinopathy, musculotendinous lesion, sports injuries, athlete.
Evaluation of the ischiofemoral space: Prospective cohort

MD Antônio Augusto Guimarães Barros, Rafael Baroni Carvalho, Fernanda Bretz Gomes dos Santos, MD Carlos Vassalo, MD Lincoln Paiva Costa, Sérgio Gonçalves Pereira Couto, Karen Dezontini Bernardes, Ana Rita da Glória Soares

Hospital Madre Teresa, Belo Horizonte, Brazil

Purpose
Evaluate prospectively the mean values of ischiofemoral space (IFS) and quadratus femoris space (QFS) found in patients with ischiofemoral impingement (IFI) and control group.

Methods
Prospective study, including all patients submitted to magnetic resonance image (MRI) of the hip joint in an interval of 3 months. Patients with deep gluteal pain, with at least one clinical test positive for IFI and abnormal signal changes in the quadratus femoris muscle in the MRI were grouped as confirmed IFI.

Results
Final sample consists of 50 patients submitted to unilateral MRI of the hip joint. The mean age was 47.3 years (range, 22 to 76; SD 14.0 years) and 33 (66%) were women. The diagnosis of IFI was observed in 6 (12%) patients, all of whom were female. Patients with IFI showed a significant reduction in the IFS and QFS when compared to the control group, 11.1 ± 2.7 mm versus 27.5 ± 6.5 mm and 5.3 ± 1.8 mm versus 18.8 ± 4.8 mm, respectively (p <0.001 for both).

Conclusion
Patients with IFI diagnosis present a significant reduction of IFS and QFS after a prospective analysis based on specific clinical tests and MRI.

Keywords: Hip, Impingement, Extra-Articular, Ischiofemoral space
EP6.10 Endoscopic treatment of Hamstrings Tendinopathy

Dr Fernando Leal¹, Dr Jorge Cruz de Melo¹, Enf Manuel Padin¹, Dr Tiago Pato¹

¹Porto Hip Unit, Porto, Portugal

Introduction
Hamstring tendinopathy (HT) can be a very debilitating condition. Pain in the gluteal and ischial region, while running or seating, is the most common symptom. Sometimes a pseudo-sciatic pain is associated. Followed by clinical examination, MRI confirms the diagnosis. Most cases can be dealt with conservative treatment, but in more reluctant cases, open or endoscopic treatment can be the solution. This work presents the results of endoscopic treatment of HT, focusing on key technique points, its surgical approach and clinical anatomy.

Material and Methods
We performed a retrospective study in patients with HT treated by an endoscopic approach. The patients were in ventral decubitus and two portals were made to approach the ischium, followed by bursectomy, tenotomy of semimembranosus and its tenorrhaphy to semitendinosus, and sciatic neurolysis. All patients were submitted to VAS, WOMAC and subjective evaluation scales.

Results
The study included 3 endoscopies in 2 male patients, with 32 and 47 years old, and a 6m and 4y duration of symptoms, respectively. Follow up of 1 year in both cases. Mean VAS improved from 8.5 (7-10) to 2 (2 - 2), and WOMAC from 46,4 (37,3 - 63,7) to 81.1 (73.6 - 88.7). Subjectively both patients were satisfied with the procedure.

Discussion/Conclusion
In the recent years HT has gained increased recognition. Conservative treatment remains the mainstay approach, but if it fails to resolve the symptoms, surgery is advocated. We believe endoscopic treatment should be considered over the open procedure. It offers the advantage of minimal aggression, low morbidity and equal results, allowing the same surgical gestures: ischial bursectomy, hamstring tenotomy and tenorrhaphy and sciatic neurolysis.
V6.11 A combined endoscopic and open surgical approach for chronic retracted proximal hamstring avulsion
Md ran atzmon\textsuperscript{1}, Md Eyal Amar\textsuperscript{2}, Md Dror Maor\textsuperscript{2}, \textbf{Md Ehud Rath}\textsuperscript{2}
\textsuperscript{1}Assuta Ashdod Medical Centre, Ashdod, Israel, \textsuperscript{2}Sackler Faculty of Medicine and Tel Aviv University, Tel Aviv, Israel

\textbf{Biography}
Head, Minimally Invasive Orthopaedic Surgery Unit, Division of Orthopaedic Surgery, Tel Aviv Medical Centre
Former Chairman, Israeli Society of Sports Medicine
Committee member ISAKOS hip and groin committee
Faculty Member, International society for hip arthroscopy
Senior Lecturer in Orthopaedic Surgery, Tel Aviv University

Proximal hamstring avulsion is an uncommon injury which usually requires surgical intervention. When possible, primary surgical fixation is recommended. In chronic hamstring avulsion with significant retraction of the tendon, hamstring reconstructions using an autograft or allograft is required in order to bridge the gap. This is mainly performed using an open surgical technique. We describe a combined endoscopic and open surgical approach to hamstring reconstruction surgery
EP7.1 Improved clinically meaningful long-term outcomes and higher survivorship after hip arthroscopy with complete vs partial capsular repair for femoroacetabular impingement syndrome

Dr Ian Clapp¹, Dr Edward Beck², Dr Benedict U. Nwachukwu¹, Dr Kyleen Jan¹, Dr Jorge Chahla³, Dr Shane J. Nho¹

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, ²Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US

Biography
Dr Edward Beck is an orthopaedic resident and post-doctorate fellow in the Department of Orthopaedic Surgery at Wake Forest School of Medicine in Winston Salem, NC, USA. His surgical interests include hip arthroscopy and treatment of femoroacetabular impingement. During the past year he was selected as a research fellow for Dr Shane Nho at Rush University, where he published a number of clinical, biomechanical, and transitional science studies. He also collaborated with other hip arthroscopists including Dr Allston Stubbs, Dr Struan Coleman, Dr Olufemi Ayeni, and Dr Josh Harris. He hopes to pursue a career in sports medicine with a focus on hip arthroscopy and hip preservation.

In his time off, Dr Beck enjoys spending time with his fiancé, Kathryn Thayer, who is a dermatological nurse. He is also passionate about basketball, football, and soccer, and cheers for his alma mater, the University of Arizona, where he was a team member of the water polo team.

Purpose
1) To compare the rates of reaching outcome score threshold for achieving the minimal clinically important difference (MCID) between patients who had partial vs complete T-capsulotomy repair, and 2) to identify failure rates in each group 5-years after undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS).

Methods
Outcomes in consecutive patients undergoing hip arthroscopy for FAIS by a single fellowship trained surgeon from January 2011 to April 2014 were prospectively collected and analysed. Baseline data, clinical outcomes including Hip Outcome Score–Activities of Daily Living (HOS-ADL), HOS–Sports Subscale (HOS-SS), modified Harris hip score (mHHS), visual analogue scale (VAS) pain, VAS satisfaction, and clinical failure rates were recorded at 5-years minimum postoperatively. Patients with partial T-capsulotomy repair (vertical limb only) were matched 1:3 by age, BMI, and gender to patients with complete T-capsulotomy repair. Threshold scores for achieving MCID was calculated for each group separately and compared. Additionally, rates of revision hip arthroscopy or total hip arthroplasty (THA) conversion were calculated for each group.

Results
A total of 84 patients were included in the study, with 21 and 63 patients in the partial and complete repair group, respectively. There was no statistically significant difference in age (36.4±11.2 vs 36.6±11.3; p=0.951), body mass index (24.2±3.2 vs 24.3±3.9; p=0.919), and gender (71.4% vs 64.4%) between the two groups. Analysis demonstrated that the complete T-capsulotomy repair group had higher HOS-ADL (93.6±6.5 vs 86.2±13.1; p=0.010) and HOS-SS (90.3±16.5 vs 80.0±22.4; p=0.031) score averages vs the partial T-capsulotomy repair group. A total of 56(96.5%) of complete capsular patients achieved MCID on at least 1 hip-specific outcome measure vs 15(78.9%) of patients with partial repair (p=0.012). Of the 35 total patients identified with partial T-capsulotomy repair, 34.3%(n=12) underwent revision or THA conversion compared to 3.8%(n=10) of the 257 total unmatched patients with complete repair.
Conclusion
Patients with complete capsular closure after hip arthroscopy for FAIS demonstrate both superior long-term clinical outcome scores and achieve higher rates of meaningful clinical success when compared to similar patients with partial capsular closure. Furthermore, there was a significant number of patients with partial repair undergoing revision or conversion to THA.
EP7.2 Two-year patient reported outcomes for patients undergoing revision hip arthroscopy with capsular defects

Dr Jourdan Cancienne¹, Dr Edward Beck¹, Mr. Kyle Kunze¹, Dr Jorge Chahla¹, Dr Sunikom Suppauksorn¹, Katlynn Paul¹, Mr. Jonathan Rasio¹, Dr Shane Nho¹

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

Biography
Dr Shane Nho is an orthopaedic surgeon specializing in sports medicine at Rush University Medical Centre in Chicago, IL, USA. His surgical interests include hip arthroscopy and treatment of femoroacetabular impingement. During residency at the Hospital for Special Surgery, Dr Nho was introduced to arthroscopic correction of FAI and PAO by Dr Buly, at a time when few surgeons were treating the disease. Dr Nho completed his sports medicine fellowship at Rush, working with Charles Bush-Joseph who was performing most hip arthroscopy procedures in Chicago. During this time, Dr Nho was selected as a Herodicus Traveling Fellow, working with Marc Philippon, Thomas Byrd, and Bryan Kelly to develop his arthroscopic surgical technique.

Currently, 80% of his clinical practice is devoted to arthroscopy and hip preservation. He is currently the Director of Young Adult Hip Surgery at Rush University Medical Centre.

In his time off, Dr Nho enjoys spending time with his wife, Sloan York, an OB-GYN physician at Rush, and their 2-year-old boy Connor. He also passionate about hockey, and cheers for his alma mater, North western, where he was captain of the men’s hockey team. He is also the team orthopaedic surgeon for the Chicago Fire Soccer Club.

Purpose
To determine clinical outcomes of patients undergoing revision hip arthroscopy for persistent pain with capsular defects and compare outcomes in these patients to those in non-capsular defect revision and primary hip arthroscopy cases.

Methods
Data from consecutive patients undergoing revision hip arthroscopy due to MRI confirmed capsular defects between January 2012-June 2016 were analysed. Inclusion criteria included failure to improve following primary hip arthroscopy for FAI, MRI confirmed capsular defect, and minimum 2-years clinical follow-up. Outcomes included the hip outcome score (HOS)—activities of daily living (ADL), HOS-sports subscale (SS), modified Harris hip score (mHHS), and visual analogue scales (VAS) for pain and satisfaction. The minimal clinical important difference (MCID) was calculated for HOS-ADL, HOS-SS, and mHHS.

Results
Forty-nine patients (54.4%) out of 90 undergoing revision hip arthroscopy had MRI evidence of a capsular defect. Most of the patients were female (79.6%), with a mean age of 30±10.5 years and a BMI of 25.7±5.5 kg/m2. The difference among pre and postoperative HOS-ADL, HOS-SS, mHHS, and VAS pain were all statistically significant (p<0.05). Analysis of reported outcomes among matched groups demonstrated statistically significant differences, with the group undergoing primary surgery having the highest 2-year outcomes. Only 66.7% of patients undergoing revision surgery with capsular defects achieved MCID, however, there was no significant difference when compared to revision patients without capsular defects. When compared to patients undergoing primary surgery, the difference in frequency was statistically significant (66.7% vs 91.3%; p<0.001).
Conclusion
More than half of patients undergoing revision hip arthroscopy had MRI and intraoperative evidence of capsular defects. Revision arthroscopy for capsular defects results in significantly improved two-year outcome averages. However, both patients undergoing hip arthroscopy for capsular defects and non-capsular defect revision patients report significantly lower outcomes when compared to patients undergoing primary hip arthroscopy for FAIS.
EP7.3 Evaluation of capsular closure versus capsulotomy in patients undergoing hip arthroscopy for femoroacetabular impingement measured by triaxial accelerometry

Dr Marcos Belemmi1, PT Rony Silvester, MD David Dabed, MD Jorge Hechenleitner, MD Cristian Diaz, PT Macarena Soldan, MD Claudio Rafols, MD Orlando Paredes
Clinica Meds, Santiago, Chile

Introduction
In recent years emphasis has been placed on the importance of capsular management in hip arthroscopy. How to evaluate hip instability after this procedure is a problem not yet solved. Triaxial accelerometry is one possible way to measure it.

The purpose of this study is to compare triaxial accelerometry in patients undergoing hip arthroscopy for femoroacetabular impingement treated with capsular closure versus a group leaving the capsulotomy open.

Our hypothesis is that capsulotomy group should have higher acceleration values compared with capsular closure group, indicating excessive micromovement of the hip.

Methods
Prospective case control study. We included 25 patients who underwent hip arthroscopy, 16 (24 hips) with capsular closure and 9 (14 hips) without. Triaxial accelerometry was recorded with sensors on the skin over the greater trochanter on the operated side during walking on a treadmill. Measurements were performed between 6 and 9 months after surgery. Statistical analysis was done with T student test with Prisma 8.0.

Results
Both groups were similar in demographic parameters.
When comparing the triaxial accelerometry in the three axes (x, y, z) and the global component, the results show that:
1. There is a statistically significant difference (p = 0.0023) between the capsular closure group and the capsulotomy group for the global accelerometry. Being the accelerometry of the capsular closure group (1.15 ms²) lower than the capsulotomy group (1.39 ms²)
2. When comparing accelerometry in the anteroposterior axis between the capsular closure group (0.70 ms²) and the capsulotomy group (1.28 ms²) they show significant statistical differences. (P = 0.0013)
Conclusions
In our study we observed that patients who underwent capsular closure had lower values in triaxial accelerometery, with significant decrease in the micromovement of the hip compared to the capsulotomy group. We recommend capsular closure in hip arthroscopy.

Dr Andrea Spiker1, Dr Joseph Mitchell1, Alison Karczewski1, Dr Ryan Degen2, Dr Bryan Kelly3
1University Of Wisconsin - Madison, Madison, United States, 2Schulich School of Medicine and Dentistry, Fowler Kennedy Sports Medicine, London, Canada, 3Hospital for Special Surgery, New York, United States

Purpose
As hip arthroscopy has evolved over the years, we have come to recognize the role of the hip capsule in post-operative stability and improved patient outcomes. While recent publications tend to favor capsule closure, it is not uniformly performed by all hip arthroscopists. The purpose of our study is to assess current trends in capsule management amongst hip arthroscopists, and to better understand the thought process that influences these decisions.

Methods
We conducted our survey via the online platform, Qualtrics. The survey was distributed via email, contacting a list of surgeons compiled from literature searches on “hip arthroscopy” and surgeons self-identified as hip arthroscopists. The survey included 29 questions covering arthroscopy training, experience, practice volume, capsulotomy and closure technique, post-operative protocols, and complications.

Results
65 arthroscopists responded, 80% of which had fellowship training. Surgeon volume and experience ranged from 15 - 500 (median 150) cases each year and 1 - 32 (median 8) years in practice. Interportal capsulotomy was always utilized by 80% of surgeons, sometimes by 8%, and in cases of labral repair by 3%. Only 53% always closed the capsulotomy (average 3 sutures). 31% of surgeons utilize a T - capsulotomy, 78% of which always perform a repair (average 3 sutures). 14 surgeons reported recent changes in capsular management, 62% of which have begun closing more capsules or performing more robust repairs. There were 13 post-operative dislocations in 12 surgeons (18% of surgeons surveyed). The capsule was not repaired in 27% of dislocation cases.

Conclusion
This study suggests that the trends in capsular management amongst hip arthroscopists have reflected the improved outcomes with repair in recently published literature. Nonetheless, there is still a sizable portion of surgeons that elect not to perform capsular repair in their own practice.
V7.5 Anterior capsule reconstruction in native hip instability: A technique guide

Dr Adrian Kurz1, Dr Muzammil Memon1, Dr Dale Williams1, Dr Olufemi Ayeni1

1McMaster University, Hamilton, Canada

Biography

Dr Adrian Kurz is an ISHA member and is a fellowship trained hip arthroscopy and adult reconstruction surgeon. His main focus is hip arthroscopy and anterior approach total hip arthroplasty. He trained at McMaster University in Canada under Dr Olufemi Ayeni who runs a high-volume hip arthroscopy practice and is a world leader in FAI. Dr Kurz is practicing in Vermont USA focusing on hip preservation and reconstruction.

This is a technique guide for anterior capsule reconstruction of a native hip in a 26-year-old female with Ehlers-Danlos Syndrome (EDS). EDS is a connective tissue disease which predisposes the individual to hypermobility of their soft tissues and recurrent subluxations and dislocations of their joints. In this case, the patient has had multiple anterior subluxations of her native left hip with self-reductions and had failed conservative management. The patient was unable to cope due to constant instability and guarding of her left hip. The patient underwent left hip anterior capsule reconstruction using an Achilles tendon allograft performed through a direct anterior approach to the hip. This technique guide outlines in detail the surgical steps required to accomplish this reconstructive procedure. Furthermore, a narrated surgical video is provided which clearly depicts the anticipated result of the increased constrained provided to the left hip from the anterior capsule reconstruction using an Achilles tendon allograft.
EP8.1 Smartphone health data quantifies the impact of Femoroacetabular Impingement syndrome and the post-operative recovery beyond the ceiling of traditional patient related outcomes measures.

Dr Arash Aframian1,2,3, Ms Shirley Tomdio4,5, Dr Scott Faucett*4,5
1MSK Lab, Imperial College, London, UK, 2St George’s, University of London, London, UK, 3Imperial College Healthcare NHS Trust, London, UK, 4George Washington Hospital, Washington, USA, 5The Orthopaedic Care Centre, Washington, USA

Biography
Arash Aframian is an orthopaedic trainee in London, currently at Imperial Hospitals and is now completing a post-doctoral research thesis. He has a passionate interest in the use of disruptive technologies in the diagnosis and management of orthopaedic conditions.

Scott Faucett serves as the Director of The Hip Prevention Centre. He is also the team physician for the U.S. Ski and Snowboard team and The George Washington University Colonials.

Introduction
Recovery and return to previous hip function after hip arthroscopy for femoroacetabular impingement syndrome (FAI) has excellent results. Researchers and care teams are limited by ceiling effects and recall bias of our current patient reported outcomes (PROs) and the growth of hip arthroscopy with promising results has led to increasing need for tracking and outcomes measurement. Most research relies on subjective patient related outcomes scores (PROMS) based on lengthy questionnaires. These measures often suffer from recall and expectation bias. We present instead this passively collected objective outcomes measure of activity before and after surgery.

Method
A mobile application has been developed through which the activity data of patients (with consent) was compared to their pre- and post-operative period and their PROMS. The results of a single-surgeon cohort of 200 patients are presented with patients’ rehabilitation tracked through the software application. PROMS are recorded in the app and related to the objectively measured activity data.

Results
A total of 210 million steps has already been captured and is being analysed and by September 2019 we are targeting the analysis of the remaining data, with a total of one billion steps from 200 patients. Already, important answers are available about expected recovery period post-operatively with many patients returning to their equivalent activity at five weeks post-operatively to how they were five weeks pre-operatively (lines colour coded to show red-amber-green as weeks progress) [Figures 1 & 2] demonstrate the real time activity data for patients in the weeks before and after surgery with return to activity seen to be returning to normal as early as five weeks post-operatively even in this very active cohort.

Conclusion
We present here a few early examples from the cohort, with the remainder of the billion steps being analysed and present the outcomes of treatment for FAI - a truly unique perspective not previously possible, with true outcome data and expected rate of recovery for real patients which can help surgeons advise and guide patient expectations pre-operatively.
EP8.3 A cadaveric study of arthroscopic hip cam impingement treatment: Biomechanical comparison of contact pressures between partial versus complete femoral osteoplasty

Dr Sunikom Suppaksorn1, Dr Edward Beck1, Dr Jourdan Cancienne1, Mrs. Elizabeth Shewman1, Dr Jorge Chahla1, Ms. Laura Krivicich1, Mr. Jonathan Rasio1, Dr Shane Nho1

1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

Purpose
To determine hip biomechanical properties in three conditions including 1) native cam deformity 2) cam deformity with incomplete resection and 3) cam deformity with complete resection.

Methods
A cadaveric study was performed using 8 frozen hemi-pelvises with cam-type deformity (alpha angle >55°) with an intact labrum. Intraarticular pressure maps were produced for each specimen under the following conditions: 1) native cam deformity, 2) cam deformity with incomplete resection and 3) cam deformity with complete resection. A 5.5-mm burr was used to respect the lateral portion of the cam deformity. The specimen was placed in a custom-designed jig in the MTS electromechanical test system to create pressure and area map measurements. In each condition, contact pressure, contact area, and peak force within a region-of-interest (ROI) were obtained. Repeated measurements were performed three times in each condition and the average value of each parameter was used for statistical analysis. Repeated measures ANOVA was used to compare biomechanical parameters between three conditions.

Results
Contact pressures averages of hips with complete resection of cam lesions were significantly lower when compared to averages of hips with incomplete femoral cam lesion and intact cam deformity (2.48±0.56 kg/cm3 vs 2.32±0.50 kg/cm3 vs 2.02±0.54 kg/cm3, respectively; p-value<0.01). Percentage reduction of contact pressure in the complete and incomplete resection groups compared to the native CAM deformity groups were 18.49% and 1.58%, respectively. There was no statistically significant difference in contact pressures between the incomplete resection and unoperated group. Contact area and peak force showed no statistically significant differences across three conditions.
Conclusion
There are lower intraarticular hip contract pressures in complete resection of the cam lesions when compared to an incomplete resection and intact hip without resection. These observations underscore the importance of ensuring complete resection of femoral cam lesions in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome.
**EP8.4 Cadaveric model comparison of cam lesion resection and procedure time using an intraoperative-guide system**

Dr Shane J. Nho¹, Dr Edward Beck¹, Ms. Hayley Taylor², Laura Krivicich¹, Mr Jonathan Rasio⁴, Ruth Godbey², Dr Sunikom Suppauksorn¹, Dr Jourdan M. Cancienne¹, Mr. William Kaiser²

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, ²Stryker, San Jose, USA, ³Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, US, ⁴University of Illinois, Chicago, United States

**Biography:**

Dr Edward Beck is an orthopaedic resident and post-doctorate fellow in the Department of Orthopaedic Surgery at Wake Forest School of Medicine in Winston Salem, NC, USA. His surgical interests include hip arthroscopy and treatment of femoroacetabular impingement. During the past year he was selected as a research fellow for Dr Shane Nho at Rush University, where he published a number of clinical, biomechanical, and transitional science studies. He also collaborated with other hip arthroscopists including Dr Allston Stubbs, Dr Struan Coleman, Dr Olufemi Ayeni, and Dr Josh Harris. He hopes to pursue a career in sports medicine with a focus on hip arthroscopy and hip preservation.

In his time off, Dr Beck enjoys spending time with his fiancé, Kathryn Thayer, who is a dermatological nurse. He is also passionate about basketball, football, and soccer, and cheers for his alma mater, the University of Arizona, where he was a team member of the water polo team.

**Purpose**

To compare the accuracy and operative duration of the Stryker Hip Check System with resection of cam-type deformities vs conventional non intraoperative guided cam resection.

**Methods**

A cadaveric study was performed using 14 frozen, hemi-pelvises with cam-type deformity (alpha angle >55°) measured on AP, lateral, and Dunn view radiographs. Hips were then randomized to arthroscopic femoroplasty by a single fellowship-trained hip arthroscopist with (7 hips) or without (7 hips) the use of the Stryker Hip Check System. Each hip was imaged pre- and post-femoroplasty in 6 different positions using intraoperative fluoroscopy to evaluate the completion of cam resection. An orthopaedic surgeon and trained medical student blinded to the technique utilized measured the pre and post-femoroplasty alpha angles. Pre and postoperative angles were compared between the groups in addition to the time of each procedure. Accuracy was defined as +/- 5° from the post-femoroplasty target alpha angle of 42°.

**Results**

Paired T-test analysis demonstrated that both groups had statistically significant differences in pre and post-op angle (p<0.001). Comparison of pre and postoperative alpha-angles using independent T-test analysis demonstrated no significant differences in either preoperative (54.7+9.7 vs 55.3+13.0; p=0.803) or postoperative (42.1±4.2 vs 42.7±7.8; p=0.668) alpha-angle averages between groups with and without Hip Check assistance. Furthermore, while the average time spent in the procedure was a minute faster with the use of Hip Check, this difference was not statistically significant (28.3±5.6 vs 29.5±6.9, p=0.740).

**Conclusion**

Using a cadaveric model, the Stryker Hip Check is able to provide similar accuracy without additional time during arthroscopic femoroplasty when used by a fellowship-trained orthopaedic surgeon. Further research is needed to evaluate the benefits of the Hip Check system used by training surgeons and more inexperienced surgeons.
EP8.5 Comparing radiographic measures of femoral torsion and acetabular anteversion using X Ray, MRI, CT Scan, and 3D hip map and its correlation to passive range of motion at hip

Dr Drew Ratner1, Dr James Genuario1
1 UC Health Steadman Hawkins Clinic Denver, Denver, United States

Objective
The primary purpose of this study is to determine the accuracy of measuring femoral torsion and acetabular anteversion with MRI and 3D Hip Map (Stryker, Kalamazoo, MI) compared to CT Scan which is currently considered the gold standard. A secondary purpose is to determine the accuracy of measuring acetabular anteversion with radiographs when compared to CT scan, and to correlate radiographic measures of femoral torsion and acetabular anteversion with passive range of motion at hip.

Methods
We are looking at all patients aged 18-65 years who presented to the principal investigator’s clinic for hip pain during the open enrolment period. To be eligible, the patient must have all the appropriate imaging to include radiographs, MRI, CT scan, and 3D Hip Map of the affected hip. For the most part, patients presenting with such imaging are surgical patients for femoracetabular impingement (FAI), but being a surgical patient is not an inclusion criterion. A patient will be excluded if hip arthritis is present (defined as less than 4mm of joint space), or if he/she has undergone previous hip surgery. A total of 20 subjects will be consented for the study. Specifically, we will be measuring passive hip ROM bilaterally with the patient placed in supine position and prone position to include internal and external rotation at 90° hip flexion. Femoral torsion will be measured on the axial CT and MRI images and 3D Hip Map after the central femoral head, lesser trochanter of the femur, and distal femoral condyles have been fused. Femoral torsion will be determined as the angle between the femoral neck axis and the transcondylar axis. Acetabular anteversion will be measured on CT scan, MRI and 3D Hip Map.

Results
We are currently collecting data for this study and will be, but it will be completed by June 2019.
Parameters related to the distribution of stresses on the proximal femur are associated with, but cannot predict cam morphology in adolescent male soccer players: A 5-year follow-up study

MD Pim van Klij¹, MD Rien Heijboer¹, MD, PhD Abida Ginai², MD, PhD Jan Verhaar¹, MD, PhD Erwin Waarsing¹, MD, PhD Rintje Agricola¹

¹Department of Orthopaedics, Erasmus University Medical Centre, Rotterdam, the Netherlands, ²Department of Radiology, Erasmus University Medical Centre, Rotterdam, the Netherlands

Introduction

Cam morphology can develop when repetitive loads are applied to the proximal femur during skeletal growth. Finite element models suggest that the shape and orientation of the proximal femur and growth plate influence the stress distribution in the head-neck junction and thereby the risk of cam morphology development. However, whether this holds in a human setting is not fully unravelled.

Aim

To prospectively and cross-sectionally investigate whether radiographic and clinical parameters, which may influence the stress distribution on the proximal femur, are associated with or predictive for cam morphology.

Methods

Academy young male soccer players participated at baseline (n=89, 12-19 years of age), 2.5-year (n=63) and 5-year follow-up (n=49). Standardized anteroposterior and frog-leg lateral radiographs were obtained at all time-points. Cam morphology was quantified by an alpha angle ≥60° and large cam morphology by an alpha angle ≥78°. The independent variables studied were the neck-shaft angle (NSA), epiphyseal extension (EE), lateral centre-edge angle (LCEA) and hip internal rotation. Cross-sectional associations between the independent variables and cam morphology were studied on each time-point. To study whether these variables are predictive for cam morphology development in time, hips without cam morphology at baseline were prospectively studied.

Results

At baseline, 2.5-year and 5-year follow-up, the NSA, EE and internal rotation were consistently associated with cam morphology. The NSA was lower, EE higher and internal rotation lower in hips with cam morphology. These differences were more pronounced in hips with large cam morphology. The LCEA was not associated with cam morphology. None of the parameters studied predicted/preceded cam morphology development.
Conclusion
Cam morphology in adolescent male soccer players develops simultaneously with a Varus orientation, growth plate extension towards the femoral neck and limited internal hip rotation, but these parameters do not precede cam morphology development. These findings underline the importance of the stress distribution on the proximal femur in relation to cam morphology development, whereas acetabular coverage might be less important.
EP9.2 Hip arthroscopy for femoroacetabular impingement in adolescents is associated with clinically meaningful improvement and low clinical failure: A minimum five-year analysis

Mr Jonathan Rasio, Dr Kyleen Jan, Dr Edward Beck, Dr Benedict U. Nwachukwu, Dr Ian Clapp, Dr Jorge Chahla, Dr Anirudh Gowd, Dr Shane J. Nho

1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, 2Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US

Purpose

1) To define hip-specific survey score thresholds for achieving the minimal clinically important difference (MCID) in the adolescent population, and 2) to identify the rates of clinical success and failure 5-years after undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS)

Methods

Data from consecutive adolescent patients (defined by the American Academy of Pediatrics as age <21 years) who underwent hip arthroscopy with routine capsular closure for the treatment of FAIS between January 2012 and April 2014 by a single, fellowship-trained surgeon was collected. Baseline data, clinical outcomes including Hip Outcome Score–Activities of Daily Living (HOS-ADL), HOS–Sports Subscale (HOS-SS), modified Harris hip score (mHHS), international Hip Outcome Tool (iHOT-12), and clinical failure rates were recorded at 5-years postoperatively. Clinical failure was defined by revision hip arthroscopy or conversion to total hip arthroplasty (THA). Clinical success was defined as achieving MCID on a hip specific outcome measure at five-year follow-up.

Results

A total of 67 patients were included in the final analysis, with an age and BMI average of 17.2(SD+2.2) years and 22.1(SD+3.1) kg/m2 respectively. The majority of the patients were female (80.3%) and participated in sports (86.9%). The HOS-ADL, HOS-SS, mHHS, and iHOT-12 threshold scores for achieving MCID were 9.5, 13.5, 9.6, and 15.1 respectively. There was statistically significant difference between preoperative and postoperative score averages across every reported outcome (p<0.001). Sixty patients (89.6%) had maintained clinically successful outcome at a minimum of five years; five patients had clinical failure, with two (2.9%) undergoing conversion to THA and three undergoing revision (4.5%) due continued pain. Both patients undergoing THA conversion had a history of pediatric hip pathology (Slipped Capital Femoral Epiphysis and Perthes) and underwent conversion due to significant presence of osteoarthritis.

Conclusion

This study demonstrated that a large majority (89.6%) of pediatric patients treated for symptomatic FAIS with hip arthroscopy and routine complete capsular closure achieved MCID. Furthermore, a small number of patients had clinical failure, with 4.5% requiring revision hip arthroscopy due to continued pain and 2.9% undergoing THA conversion due to complications from pre-existing pediatric hip pathology.
EP9.3 Outcomes of hip arthroscopy in adolescents with a sub-analysis on return to sport: A systematic review
Sarah Chen¹, Dr David Maldonado¹, Cammille Go¹, Cynthia Kyin¹, Dr Ajay Lall¹, Dr Benjamin Domb¹
¹American Hip Institute, Chicago, United States

Biography
Dr Ajay C. Lall is a dual fellowship trained orthopaedic surgeon specializing in sports medicine and hip arthroscopy in the Chicago area. His background includes mentorship by world renowned sports medicine physician, Dr James Andrews, at the American Sports Medicine Institute, Birmingham, AL. He has also completed formal hip preservation training under master hip arthroscopist, Dr Benjamin Domb, at the American Hip Institute, Chicago, IL. He is an avid clinical researcher with numerous presentations and publications at international academic meetings and within top peer reviewed journals. Dr Lall has treated collegiate, professional, and elite level athletes, including players for the NCAA, PGA, NFL, and MLB. Dr Lall treats patients from across the country who travel to Chicago for their surgery, and he takes pride in caring for every patient like a professional athlete.

Background
There is a plethora of literature on outcomes following hip arthroscopy in the adult population; however, outcomes in the adolescent population have not been as widely reported. Additionally, as adolescents represent a very active population, it is imperative to understand their athletic activity and return to sport following hip arthroscopy.

Purpose
The purpose of this systematic review was to analyse patient reported outcomes (PROs) following hip arthroscopy in adolescents and present a return to sport analysis in the athletic adolescent subgroup.

Methods
The PubMed, Embase, and Cochrane databases were searched according to the PRISMA guidelines to identify articles that reported PROs following hip arthroscopy in adolescents. The standardized mean difference (SMD) was calculated to compare the effect size of hip arthroscopy on various PROs. For the athletic subgroup, a return to sport summary was also provided.

Results
Ten studies, with 618 adolescent hips and a collective study period of December 2004 to February 2015 were included in this systematic review. Across all studies, the mean age was 15.8 and females composed approximately 56.7% of the entire cohort. The mean follow-up was 34.5 months. The modified Harris Hip Score (mHHS) was reported in nine studies, and at latest follow-up, scores were excellent in four studies, and good in the remaining five studies. All adolescents also showed significant improvement in the Nonarthritic Hip Score (NAHS), the Hip Outcome Score-Activity of Daily Living (HOS-ADL), Hip Outcome Score-Sport Specific Subscale (HOS-SSS), the physical component of the Short Form (SF-12P), a visual analogue pain scale (VAS), and both versions of the International Hip Outcome Tool (iHOT-12 and iHOT-33) at latest follow-up (P<0.05). Further, mean improvements reported in all studies surpassed the literature values for the minimal clinically important difference (MCID) and patient acceptable symptomatic state (PASS) for mHHS, HOS-ADL, HOS-SSS, and iHOT-33. Finally, the collective return to sport rate among athletic adolescents was 84.9%.
Conclusion

In the setting of labral tears and FAI, hip arthroscopy can safely be performed in adolescents and leads to significant functional improvement. Furthermore, athletic adolescents return to sport at high levels following hip arthroscopy.
EP9.4 Multi-centre analysis of sports-related outcomes and return to play of adolescents following hip preservation surgery

Dr Benjamin Kivlan1, Dr Rob Roy Martin1, Dr John Christoforetti2, Dr Andrew Wolff3, Dr Shane Nho4, Dr John Salvo5, Dr Dean Matsuda6, Dr Geoff Van Thiel4, Dr Dominic Carreira7

1Duquesne University, Pittsburgh, USA, 2Texas Health Sports Medicine, Allen, USA, 3Washington Orthopaedics and Sports Medicine, Washington, USA, 4Rush University Medical Centre, Chicago, USA, 5Rothman Institute, Philadelphia, USA, 6DISC Sports and Spine Centre, Marina del Rey, USA, 7Peachtree Orthopaedics, Atlanta, USA

Biography

Dr Kivlan is a graduate of Elon College's Exercise/Sport Science Program, the University of Pittsburgh's Physical Therapy Program, and completed his PhD studies in Rehabilitation Science at Duquesne University. Dr Kivlan serves on the faculty of the Physical Therapy Department at Duquesne University as an assistant professor of Human Anatomy and Orthopaedic Science. Dr Kivlan has published over 20 peer reviewed journal articles and several book chapters on the topic of musculo-skeletal anatomy, functional performance testing, and post-operative rehabilitation and outcomes of the hip joint. Dr Kivlan is also recognized as a Board-Certified Specialist in Sports and Orthopaedic Physical and enjoys treating patients with various sports and orthopaedic injuries.

Purpose

The purpose of this study was to describe the changes of functional and sports related outcomes of adolescents at two years following arthroscopic hip preservation surgery.

Subjects

50 adolescent athletes (14-19 years-old) from a multi-centred hip arthroscopy registry were analysed for the purpose of this study.

Methods

De-identified patient data from a multi-centred hip arthroscopy registry from January 1, 2016 – January 1, 2017 was analysed. The primary outcome measure was the Hip Outcome Score Sports subscale (HOS Sports). The magnitude of change in these outcome measures and the frequency of patients that surpassed Patient Acceptable Symptomatic State (PASS) scores in addition to the rate of return to play was determined for the cohort.

Results

50 adolescent athletes (14 males; 36 female) were included. The common sports were running (28%), lacrosse (6%), baseball (10%), swimming (10%), dance (8%), and cheerleading (8%). HOS Sports Subscale improved (p<0.001) from an average score of 43.7 (SD=21.3) to 90.0 (SD=10.0), with 82% meeting the PASS score. Running was the most commonly reported sport specific skill/activity that was categorized as extremely difficult or unable to do by 46% of athletes prior to surgery. This percentage dropped to 8% of athletes at 2 years post-surgery. The greatest improvements of sports specific activities were noted in jumping, landing, stop/start movements, and cutting/lateral movements in which 88% - 90% of the athletes reported either slight or no difficulty with these activities. Only 4 subjects (8%) reported inability to return to sports participation at the same level.

Conclusions

Sport specific function of adolescent athletes greatly improves and is sustained 2 years following hip preservation surgery. Sport specific skill that showed large improvements after surgery included running, jumping, landing, stopping/starting, and cutting/lateral movements. Despite large improvements, some athletes may report not be able to return to their previous level of sports participation.
Clinical Relevance: This study shows that hip arthroscopy for hip preservation surgery is an effective surgical option to improve athletic function for adolescent athletes with complaints of pain and dysfunction of the hip joint.
EP9.5 Traumatic hip dislocations in the pediatric patient: injury patterns, outcomes, and selective hip arthroscopy

MD Crystal Perkins1, BS Sam Broida2, BS Asahi Murata1, MD S. Clifton Willimon1

1Children’s Healthcare of Atlanta, Atlanta, United States, 2Emory University School of Medicine, Atlanta, United States

Biography

Dr Perkins is an Atlanta native and completed her orthopaedic residency training at Carolinas Medical Centre in Charlotte, N.C., before returning to Atlanta for a pediatric orthopaedic surgery fellowship at Children’s Healthcare of Atlanta. Following her fellowship, Dr Perkins joined the Children’s Physician Group–Orthopaedics and Sports Medicine practice.

In her free time, Dr Perkins enjoys competing in triathlons, spending time with her family and exploring Atlanta restaurants.

Introduction

Traumatic hip dislocations are uncommon injuries in the pediatric population. The purpose of this study is to describe injury patterns, treatment (including hip arthroscopy), and patient reported outcomes of traumatic hip dislocation in pediatric patients.

Methods

A single-centre retrospective review was performed of patients less than 18 years of age treated for a traumatic hip dislocation between 2011 – 2017. Patients were contacted to obtain outcome scores (PROs), including the Harris hip score (HHS) and hip outcome score (HOS).

Results

23 patients with a mean age of 11.3 years (range 4 – 16) were included. The most common mechanisms of injury were motor vehicle crashes (8), football (7), and falls (3). The direction of hip dislocation was most commonly posterior (20, 87%). The majority (83%) were isolated injuries. In addition to radiographs, 20 patients had a CT of the pelvis. 15 of those patients had a posterior wall acetabular fracture and 6 had an incarcerated fragment. 5 patients had MRI and all had a posterior wall fracture and labral tear.

14 patients were treated non-operatively. Mean radiographic follow-up was 12 months. One patient developed avascular necrosis without collapse at 6 months. PROs were obtained in 10 patients (71%). Mean HHS-ADL, HHS-Sport, and HOS were 75 (69 – 76), 32 (18 – 36), and 88 (77 – 92) respectively at a mean of 44 months (20 – 83) after injury.

9 patients were treated operatively, including 5 patients with hip arthroscopy. The indication for hip arthroscopy was an incarcerated fragment. Mean radiographic follow-up was 14 months. One patient developed chondrolysis and another developed an anterior head-neck junction exostosis. PROs were obtained in 7 patients (78%). Mean HHS-ADL, HHS-Sport, and HOS were 69, 30, and 78 respectively at a mean of 34 months after surgery.
Conclusion
Traumatic hip dislocations in pediatric patients occurs most frequently as isolated orthopaedic injuries in association with posterior wall acetabular fractures. Incarcerated fragments occurred in more than 25% of the patients, so CT or MRI should be routinely obtained. Selective hip arthroscopy after traumatic hip dislocations was associated with good long-term outcomes.
EP9.6 What neuromonitoring changes can be expected during hip arthroscopy in the pediatric population?

Dr Trevor Shelton¹, Mr. Akash Patel², Ms. Lauren Agatstein², Dr Brian Haus¹,²
¹Department of Orthopaedic Surgery, University of California, Davis, Sacramento, United States, ²Shriners Hospital for Children, Northern California, Sacramento, United States

Introduction
In adult hip arthroscopy patients, 58% experienced intraoperative nerve dysfunction while 7% sustained clinical nerve damage. However, the rate of sciatic nerve injury during hip arthroscopy in the pediatric population is unknown. To determine the prevalence of sciatic, femoral, and obturator nerve injury during hip arthroscopy in the pediatric population and determine the rate of neuropraxia and whether there were any risk factors for neuropraxia.

Methods
Retrospective review of all pediatric patients who underwent hip arthroscopy with neuromonitoring from January 2013 to October 2018. Neuromonitoring included somatosensory evoked potentials (SSEP) in the peroneal and posterior tibial nerves and electromyography (EMG) signal for obturator, femoral, and peroneal and posterior tibial branch of the sciatic nerves. We recorded total traction time, surgery time, SSEP changes >50% after traction application, and EMG activity. Recorded whether there was a clinical neuropraxia and when nerve function returned. Analysed patient demographics for potential risk factors for neuropraxia.

Results
89 patients had hip arthroscopy (average traction time of 72±38 minutes). SSEP changes >50% occurred in 78% of patients in the peroneal branch and 73% in the posterior tibial branch. EMG activity was observed in 9% of patients in the obturator nerve, 8% in the femoral nerve, 12% in the peroneal nerve, and 8% in the posterior tibial nerve. Clinical neuropraxia was seen in 19% of patients but all had improved by two weeks post-operatively. Those who sustained a neuropraxia had a 57 minute longer surgery and 25 minutes longer traction time.
Conclusion
Neuromonitoring changes are common during hip arthroscopy and nearly 1 in 5 pediatric patients will have some decreased sensation in either the peroneal or posterior tibial nerve that resolves within 1-2 days after surgery. Longer surgery and traction time are associated with a higher rate of neuropraxia in hip arthroscopy in pediatric patients.
EP10.1 Comparing outcomes of elite athletes verse non-athletes undergoing hip arthroscopy for treatment of femoroacetabular impingement syndrome

Ms. Kyleen Jan¹, Mr. Edward Beck¹, Mr. Ian Clapp¹, Dr Benedict Nwachukwu¹, Mr. Jonathan Rasio¹, Dr Shane Nho¹
¹Rush University Medical Centre, Chicago,

Background
Femoroacetabular syndrome (FAIS) is a common cause of hip pain in elite athletes and the general population. The meaningful clinical outcomes following hip arthroscopy for these two patient groups have not been compared.

Purpose
To determine if elite athletes (professional, semi-professional, or collegiate) have better 2-year patient reported outcomes and achieve MCID, PASS, and SCB at higher rates compared to non-athletes undergoing hip arthroscopy for the treatment of FAIS.

Methods
The study was a retrospective analysis of all consecutive patients who identified as either an elite athlete or a non-athlete and had undergone hip arthroscopy for FAIS by a single fellowship trained surgeon between 01/2012 and 04/2017. Patients in the two groups were matched by age and BMI. Patient-reported outcome (PRO) scores were collected preoperatively and at 2 years and were compared between the 2 groups. MCID, PASS, and SCB were calculated for each PRO and were compared between the 2 groups as well.

Results
A total of 59 high end athletes and 118 non-athletes were included in the final analysis. Most of the high-end athletes were soccer players (23.7%), followed by softball players (10.2%), and runners (10.2%). 2-year PRO score average comparison between high-end athletes and non-athletes demonstrated that there was a statistically significant difference in HOS-ADL (92.4+8.8 vs 86.1+14.4; p=0.003), and HOS-SS (84.5+19.0 vs 76.1+23.8; p=0.02). Meaningful outcome analysis demonstrated that athletes had a higher rate of achieving the HOS-SS threshold for MCID (97.4% vs 82.5%; p=0.021) and HOS-ADL threshold for PASS (65% vs 49.6%; p=0.045) when compared to non-athletes. There was no other difference in frequency of achieving the thresholds for any other meaningful clinical outcome between the groups.

Conclusion
Hip arthroscopy for the treatment of FAIS in elite athletes and non-athletes produces clinically meaningful outcomes in both patient groups. However, elite athletes achieve HOS-SS threshold for MCID and HOS-ADL threshold for PASS at higher rates than non-athletes and have superior outcomes 2-year postoperatively according to HOS-ADL and HOS-SS subscales.
EP10.3 FAI in professional basketball players: Return to play, career length, and performance following hip arthroscopy

Dr J.P. Begly1, Dr Marc Philippon1, Dr Patrick Buckley1, Dr Hajime Utsunomiya1, MPH Karen Briggs1
1The Steadman Philippon Research Institute, Vail, United States

Biography
Dr Begly is a fellowship trained orthopaedic sports medicine surgeon, with an expertise in advanced arthroscopic and minimally invasive treatments of the shoulder, hip, and knee, and a dedication and passion for returning his patients to the activities that they love. He is a provider at the Central Vermont Medical Centre’s Orthopaedics & Sports Medicine Department, in Vermont, USA.

Background
Previous studies have demonstrated that hip arthroscopy is an effective treatment for symptomatic femoroacetabular impingement (FAI) in professional athletes across a variety of sports. However, the return-to-play rates and postoperative performance of elite basketball players after hip arthroscopy are currently unknown.

Purpose
To determine return-to-play rates and postoperative performance among professional basketball athletes after hip arthroscopy.

Study Design
Case series; Level of evidence; 3.

Methods
Eighteen professional basketball players underwent hip arthroscopy (24 hips) for symptomatic FAI between 2001 and 2016 by a single surgeon. Return to play was defined as competing in a single professional game of equal level after surgery. Data were retrospectively obtained for each player from basketball-reference.com, ESPN.com, eurobasket.com, and individual team websites. Matched controls were selected from the websites to compare performances.

Results
The mean age at the time of surgery was 25.6 years, and the mean body mass index was 24.4 kg/m2. All players returned to their previous levels of competition, with a mean number of 4 seasons played after surgery (median, 3; range, 1-12). The mean ± SD time between the date of surgery and return to a professional game was 7.1 ± 4.4 months. There was no change in player efficiency rating when pre- and postinjury performance were compared. When compared with controls, players undergoing surgery also had no significant decline in player efficiency rating.

Conclusion
Elite basketball athletes who undergo hip arthroscopy for the treatment of FAI return to their presurgical levels of competition at a high rate. These athletes demonstrate no significant overall decrease in performance upon their return to play.
Morphological changes of the hip are not correlated with rotation range of hip motion in elite soccer athletes

Ms André Bento¹, Ms Guilherme Falótico¹, Ms Ronaldo Cunha¹, Dr Gustavo Arliani¹, Professor Benno Ejinisman¹, Professor Moisés Cohen¹

¹Unifesp, São Paulo, Brazil

Background
Morphological changes characteristic of femoroacetabular impingement (FAI) are common in soccer players. However, the clinical relevance still needs further study.

Objectives
Test the hypothesis that morphological changes in the femur or acetabulum are correlated with the range of motion (ROM) of hip internal (IR) and external (ER) rotation and determine if there is clinical-radiographic differential between dominant (DLL) and non-dominant lower limb (NDLL) in professional soccer players.

Methods
Cross-sectional study with 59 male professional soccer players that were evaluated in the pre-season (average age, 25.5 years, range, 18-38). We evaluated the radiography alpha angle and the acetabular retroversion index (ARI) and hip internal (IR) and external (ER) rotation range of motion (ROM). Results: The measurements taken on DLL and NDLL were compared and a significant difference was found between the sides in the ER (p = 0.027). There were no significant differences between the sides in the measures of internal rotation (IR) (p> 0.999), total range of motion (TRM) (p = 0.0650), alpha angle (p = 0.250) and ARI (p = 0.079). The correlations between the rotation measurements and the alpha angle in each limb were evaluated and the coefficient values showed very weak correlation, as well as the ARI and the rotation measures.

Conclusion
Morphological changes of the femur or acetabulum are not correlated with hip IR and ER range of motion (ROM) in professional soccer players.
EP10.5 Hip pathology identified at screening in professional volleyball players

**MD PhDc Georgios Tsikouris**¹, BS, MS Panagiota Vlaserou¹, MD M PhDc Ioanna Bolia², MPH, MBA Karen Briggs², MD Marc Philippon²

¹Athens Orthopaedic and Sports Medicine Centre, Athens, Greece, ²Steadman Philippon Research Institute, Vail, USA

EP10 - The hip in sport

**Biography**

Dr Georgios Tsikouris is the Director of Athens Kolonaki Orthopaedic and Sports Medicine Centre in Greece. He currently serves as the Head Team Physician for the National Team of Weightlifting in Greece as well as the volleyball team of Olympiakos. During his time as head physician his athletes have won Olympic Medals in Weightlifting but also the National Championship and the European Cup in Volleyball.

**Objective**

To determine the prevalence of cam/pincer FAI and labral tears in professional volleyball players and determine factors associated with their presence.

**Methods**

94 professional level volleyball players (ages 15 to 40; 26 females, 68 males) underwent hip screening and ultrasound (US) examination. All players were competitors in national or international competition and average years of competition was 13.76±6 years. There were 26 blockers, 33 hitters, 17 setters and 18 others. All players had a clinical hip examination consisting of the FABER test, impingement testing, dial test, and range of motion measurements. An US examination of the hip was performed by a certified physician.

**Results**

Ten (11%) of the athletes reported prior hip injuries. Females had significantly more abduction (41 vs 38; p=0.02), adduction (41 vs 38; p<0.01), extension (15 vs 13; p=0.036), external rotation (43 vs 38; p=0.004) and internal rotation (44 vs 34; p<0.01). In addition, females were more likely to have a positive hip dial test (p=0.006). Of the 188 hips examined, cam was identified in 57 (30%) hips, pincer in 42 (22%) hips (1 hip had isolated pincer, 41 had combined cam/pincer) and labral tears in 45 (24%) hips. Athletes with cam were significantly older (median = 23 years) compared to athletes without cam (median = 19) (p=0.041). There was no association between cam and gender, year played, or BMI. Range of motion was not associated with presence of cam/pincer or labral tears on US. The presence of a labral tear was associated with cam (p<0.001). Volleyball players with cam were 16 [95%CI: 7 to 36] times more likely to have a labral tear. Setters were 3.1 [95%CI: 1.2 to 8] times more likely than hitters to have a labral tear (p=0.025) and 3 [95%CI: 1.1 to 8] time more likely than blockers to have a labral tear.

**Conclusion**

Professional level volleyball players report a low level of hip injuries; however, cam impingement was observed in 30% and labral tears in 24%. Range of motion was not associated with cam or labral tears but does differ between gender. Position played also is related to increased risk of cam and labral tears. When developing further screening or prevention programs, gender and position should be considered in volleyball athletes.
Objective
To determine prevalence of hip damage and identify "hips at-risk" through a hip screening protocol using imaging and clinical examination in elite weightlifters.

Methods
85 elite weightlifters (ages 14 to 40; 24 females, 62 males) underwent hip screening and ultrasound (US) examination. All players were medal winners in national or international competition and average years of competition was 10.6±6 years. All players had a clinical hip examination consisting of the FABER test, impingement testing, dial test, Trendelenburg and range of motion measurements. In addition, a bilateral ultrasound examination of the hip was performed by a certified physician, which was used to diagnose labral tears and document the presence of pincer and cam impingement. Correlations between the demographics, imaging and clinical examination findings were made using statistical tests.

Results
23 (27%) of the athletes reported prior hip injuries. Sixteen (70%) of these were reported as sports hernias. Cam, pincer or labral tears were observed in 58 athletes (21 bilaterals, 21 left, 16 right). There was no relationship between previous injury and pathology on US (p=0.873) in the 170 hips examined, 52 had cam on US. Athletes with cam were significantly older (25 vs 21; p<0.001) and in weightlifters, females were more likely to have cam (p=0.001). Positive anterior impingement was associated with cam (p=0.027); however, no other exam tests or ROM was associated with cam on US. The presence of a labral tear was associated with cam (p<0.001). Weightlifters with cam were 9.5 [95%CI: 4.4 to 19.5] times more likely to have a labral tear. There were no significant differences in ROM between those with cam and those without.

Conclusion
Femoroacetabular impingement is prevalent in elite weightlifters. Cam lesion is associated with older age and labral tears on ultrasound. Unlike other sports where FAI pathology is similar in both genders, female weightlifters are at higher risk of developing cam-based FAI compared to males.
Characterizing the prevalence of cam-type hip impingement in women’s professional ice hockey players

Dr Thomas Youm¹, Abigail Campbell¹, Samuel Baron¹, Darryl Whitney¹, Cordelia Carter¹, Guillem Gonzalez-Lomas¹
¹NYU Langone Health, New York, United States

Biography
Dr Thomas Youm is a Board-Certified Orthopaedic Surgeon who specializes in the treatment of athletic injuries and performs arthroscopic and reconstructive surgery of the hip, shoulder, elbow and knee. Dr Youm has published over 50 articles and has over 50 presentations at numerous national meetings on the topics of orthopaedic sports medicine. He is a Clinical Assistant Professor at the NYU School of Medicine where he teaches both medical students and orthopaedic residents. Dr Youm has twice won the Teacher of the Year Award which is voted and determined by the graduating class of orthopaedic chief residents. He is one of the main instructors for the sports medicine fellows at NYU Langone Orthopaedic Hospital. He is currently Director of Hip Arthroscopy and, in this role, he runs the clinical research for hip arthroscopy at NYU. He is a member of the Hip Centre and the Sports Medicine department at the NYU Langone Orthopaedic Hospital.

Introduction
Participation rates for female ice hockey are increasing in North America. Recent studies have demonstrated an increased prevalence of femoroacetabular impingement (FAI) in elite male ice hockey players. The primary purpose of this study was to determine the prevalence of radiographic FAI in National Women’s Hockey League players. The secondary purpose was to analyse the relationship between the presence of cam deformity and 1. hip range of motion (ROM); 2. clinical impingement; and 3. age of menarche.

Methods
In this IRB-approved study, physical examination and demographic data were collected for 27 NWHL players. Alpha angle >55° were defined as cam positive. Players were grouped into those with and without cam impingement and group differences were assessed using the student’s t-test and spearman correlations used for association with menarche. Statistical significance was set at p<0.05.

Results
Twenty-seven athletes were included in the study. Nineteen of the 27 players (70%) had radiologic evidence of cam-type impingement; 14 players (52%) had bilateral cam deformity. Average age of menarche was 13.9±1.5 years. There was a significant association between age of menarche and right alpha angle (p=0.020) and the association between age of menarche and left alpha angle approached statistical significance (p=0.072). There was no statistically significant association between alpha angle and any ROM measurement. There was significant association between cam deformity and clinical impingement.

Discussion
These findings confirm the pervasiveness of cam-type deformity in the hips of elite female hockey players. These findings do not appear to limit range of motion. The positive association between alpha angle and age of menarche supports the etiological hypothesis of the cam lesion resulting from activity-related stress at the proximal femoral physis. Given the increasing popularity of ice hockey for young female athletes and varying time to physeal closure, these findings contribute to the current knowledge of sport mechanics and their effect on bony development of the hip. Professional women’s ice hockey players have a high risk of developing cam-type morphology of the proximal femur, although a player’s age of menarche may mediate each individual’s risk.
EP10.8 Defining the Minimal Clinically Important Difference (MCID) in athletes undergoing arthroscopic correction of Sports-Related Femoro-Aacetabular Impingement (SRFAI). The Percentage of Possible Improvement (POPI)

Mr Patrick Carton¹,², Mr David Filan²
¹The Hip and Groin Clinic, Waterford, Ireland, ²UPMC Whitfield, Waterford, Ireland

EP10 - The hip in sport

Objective
To define MCID at 2 years post-operatively in competitive athletes undergoing hip arthroscopy for symptomatic SRFAI utilising existing anchor- and distribution-based methods. The secondary purpose was to derive a measure of MCID using a percentage of possible improvement (POPI) method and compare against existing techniques.

Methods
Two objective outcome measures (mHHS and SF36) were administered at baseline and 2-years post-operatively. External anchor questions were used to determine MCID through mean change, mean difference and receiver-operated curve (ROC) techniques. Distribution-based calculations consisted 0.5SD, effect size and standard error of measurement techniques. POPI was calculated alongside each technique as an achieved percentage change of maximum available improvement for each athlete relative to baseline score. Impact of pre-operative baseline score on MCID was assessed by assigning athletes to groups determined by baseline percentiles. p<0.05 considered significant

Results
There were 576 athletic cases, average age 25.9(SD 5.7) years. MCID score change (and POPI) for mHHS and SF36 ranged 6.8-16.7 (36.9%-63.6%) and 6.0-24.9 (24%-57.4%) respectively. Pre-operative threshold values of achieving ROC-determined MCID was 83.0 and 96.9 for mHHS and 79.8 and 88.7 for SF36 considering points- and POPI-calculated MCIDs respectively. Through existing mean score change method, 40%(mHHS) and 42.4%(SF36) of cases were unable to achieve MCID due to high baseline scores compared to 0% when the POPI technique is used. A highly significant difference for MCID calculated as an absolute value was observed between baseline subgroups: mHHS(p<0.038) and SF36(p<0.014) while there was no significant difference between subgroups for either mHHS(p>0.291) or SF36(p>0.148) using POPI technique.

Conclusion
MCID defined by an absolute value of improvement is unable to account for post-operative progress in a large proportion of higher functioning athletes. MCID calculated through POPI technique negates associated ceiling effects, is not restricted by baseline score, and may be more appropriate in quantifying clinically important improvement.
Return to sport (RTS) rates in competitive athletes after unilateral hip arthroscopy are high. However, no studies to date have reported on RTS rates after bilateral hip arthroscopy. Purpose: To determine the rate of RTS in high-level athletes undergoing bilateral hip arthroscopy and report minimum 1-year patient-reported outcomes (PROs) for this cohort.

Methods
Data were prospectively collected on all patients undergoing hip arthroscopy at our institution from November 2011 to July 2018. Patients were included if they underwent bilateral hip arthroscopy and were either a high school, collegiate, or professional athlete prior to their first surgery. RTS was defined as a patient’s return to competitive participation in their respective sport. Additional PROs, including mHHS, NAHS, and HOS-SSS, as well as complication rates and future surgeries were documented and compared for all patients.

Results
A total of 87 patients met inclusion criteria, for which follow-up was available for 82 (94.3%). At latest follow-up, 44 (53.7%) patients returned to sport. Of patients returning, 56% did so at the same level or higher. The most common reasons for not returning to sport were due to graduation/lifestyle change (47.4%) and hip symptoms (44.7%). Patients returning to sport had significantly higher PROs at latest follow-up relative to those who did not return, including for mHHS (93.7 vs. 87.5), NAHS (94.4 vs. 88.2), HOS-SSS (90.9 vs. 78.2) (P < 0.05). Rates of achieving PASS and MCID for mHHS were not significantly different. However, for HOS-SSS, patients who returned had significantly higher rates of achieving the MCID and PASS.

Conclusion
Rates of RTS after bilateral hip arthroscopy are lower than those after unilateral hip arthroscopy. When comparing patients that returned to sports and those who did not return, we show that although both groups show a significant improvement in PROs following surgery, those that returned to sport achieved significantly higher scores in all outcome measures. In addition, patients returning to sports showed a significantly higher rate of attaining MCID and PASS scores for the HOS-SSS, possibly attesting to the validity of this score and its thresholds.
EP10.10 Anatomic factors affecting turnout in ballet dancers

Dr Angelina Vera¹, Mr. David Dong¹, Dr Bradley Lambert¹, Dr Kevin Varner¹, Dr Patrick McCulloch¹, Dr Joshua Harris¹
¹Houston Methodist Hospital, Houston, United States

**Biography:**

Dr Joshua Harris is an orthopaedic surgeon who specializes in sports medicine and arthroscopy. Dr Harris obtained his undergraduate degree from Wright State University in Dayton, Ohio, and he completed both his medical degree and orthopaedic residency at Ohio State University College of Medicine in Columbus. He then completed a fellowship in sports medicine at Rush Medical Centre in Chicago where he was assistant team physician for the Chicago Bulls, White Sox, and DePaul University. Dr Harris’ special interests include sports-related injuries including hip arthroscopy, patellofemoral disorders, multiligamentous knee injuries, knee joint preservation, and platelet-rich plasma (PRP).

**Background**

Turnout is the foundation of ballet and all ballet dancers strive to obtain perfect turnout. In theory, decreased femoral anteversion, increased pelvic incidence, higher neck shaft angle, longer femoral neck, and greater femoral offset should have greater turnout due to a greater arch of motion before femoral impingement on the posterior acetabulum occurs. Turnout is a complex movement which is likely determined by multiple bony and soft tissue factors around the hip, knee and ankle.

**Purpose**

This study aims to determine how femoral anteversion, pelvic incidence, neck shaft angle, femoral neck length, and femoral offset contribute to turnout in the professional ballet dancer.

**Methods**

Professional dancers from a large metropolitan ballet company underwent clinical assessment of turnout and radiographic evaluation via EOS imaging. Femoral version, pelvic incidence, neck shaft angle, femoral neck length, and femoral offset were measured in all dancers. Statistical analysis was used to determine the contribution of each measurement to turnout values. Multiple linear regression with stepwise removal was used to determine the best prediction model with the data available. Model selection was based on the highest adjusted R2 with the lowest amount of co-linearity due to variance inflation.

**Results**

Twenty-one (10 male, 11 females; mean age 25.4±4.8) of 52 eligible dancers agreed to participate. Average femoral offset was 38.6mm±5.3, femoral neck length 51.1mm±4.6, neck shaft angle 131.6°±5.2, femoral torsion 12.4°±8.5, and pelvic incidence 46.6°±11.5. Age, body mass index, femoral neck length, femoral offset and femoral torsion were inversely correlated with turnout (p<0.05), and female sex was directly correlated with turnout (p<0.05). All other variables were not found to be predictive of turnout.

**Conclusion**

The model suggests that female sex is predictive of greater turnout while femoral offset, neck length, neck shaft angle and torsion are inversely predictive of turnout.
Femoroacetabular impingement (FAI) is a disorder that causes hip pain and disability in young patients, particularly athletes, and may lead to hip osteoarthritis. Increased stress on the hip due to continued rotational motion, like the egg-beater kick done while treading water, could put an individual at risk of developing FAI anatomy. Water polo and synchronized swimming require extensive eggbeater to effectively participate in these activities. The goal of this study was to use MR imaging to identify whether athletes who tread water have an increased prevalence of FAI.

Methods
With University IRB approval, 20 NCAA Division 1 varsity water polo players and synchronized swimmers (15 females, 5 males), ages 18-23 (mean age 20.7 ± 1.4), underwent non-contrast MRI scans of both hips using a 3T MRI scanner (GE Healthcare) with a 16-channel coil. The presence of cam/pincer morphology and labral tears were identified. An oblique T1 FSE sequence was used to evaluate the alpha angle for cam identification. A coronal 3D ZTE image was fused with a water-only coronal PD IDEAL FSE image to evaluate the centre edge angle for pincer identification.

Results
In our subjects, 70% (14/20) reported pain in their hips yet only 15% (3/20) sought clinical evaluation for hip pain. Cam anatomy was present in 97.5% (39/40) of hips, while 22.5% (9/40) demonstrated pincer anatomy, and 53% (21/40) of hips had a labral tear.

Discussion/Conclusion
The prevalence of cam FAI anatomy in water polo players and synchronized swimmers is greater than that reported for other sports, while pincer FAI anatomy and labral tears were not greater than prior reports in athletes. Cam FAI is often thought to be the result of abnormal forces on the femoral head physics, and this study would suggest that rotational forces associated with treading water may be the cause.
When is it safe to return to sport after hip arthroscopy for femoroacetabular impingement? Implementation of a standardised “return to play” test battery to guide rehabilitation

Dr Robert Lawton\textsuperscript{1}, Anja Hönninger\textsuperscript{1,2}, Christian Zantop\textsuperscript{1,2}, Sozaburo Terai\textsuperscript{1,2}, Dominik Hauner\textsuperscript{1,2}, Jakob Schlachtner\textsuperscript{1,2}, Priv. Doz. Dr Med. Thore Zantop\textsuperscript{1}, Priv. Doz. Dr Med. Stefan Fickert\textsuperscript{1}

\textsuperscript{1}Sporthopaedicum, Straubing, Germany, \textsuperscript{2}Return to Play, Straubing, Germany

Arthroscopic hip surgery for femoroacetabular impingement (FAI) is often performed in patients aspiring to return to sport. Whilst procedure performed and the demands of different sports influence rehabilitation requirements criteria to guide “return to activity, play and competition” are not clearly defined. We implemented a multifactorial test battery to objectively measure function in order to determine rehabilitation needs and guide return to play.

13 patients (12 males, 1 female) were evaluated after hip arthroscopy for FAI with a standardised postoperative rehabilitation protocol. Interval between surgery and evaluation was mean 263 days (8.8 months), median 188 days (6.3 months), range 114 – 719 days). Mean age 25.8 years (14.9 – 28.3). BMI 23.6 (22.4-25.6). Sport: Football 8, Ice hockey 1, Judo 1, Other 3. The test battery was comprised of proprioceptive tests (MFT tests), isokinetic strength measurements (BTE-primus), Hop for distance, Lateral speed chase (Speed Court – Global Speed), Single leg hop ground reaction force (Force Plate Bertec) and 3D-motion analysis (Myomotion, Noraxon) during bilateral drop jumps, single leg hop tests and gait analysis. The results were interpreted using the non-operated limb as a control and expressed as a percentage of the time/distance/forces measured.

In proprioceptive testing patients scored 98.2\% (SD 7.8\%). Isokinetic strength testing scores were: Abduction 93.2\% (SD 12.0\%); Adduction 104.2\% (SD 11.5\%); Internal Rotation 89.9\% (SD 13.4\%); External Rotation 93.6\% (SD 12.1\%). Hop for distance results were 99.2\% (SD 4.5\%) with single leg hop ground reaction force 98\% (SD 13\%). Lateral Speed Chase scores were 97\% (SD18\%). 3D kinematics demonstrated reduced hip flexion and hip abduction of 90\% (SD 12\%) and 95\% (SD 13\%) respectively with increased knee flexion of 117\% (SD 14\%).

Despite near normal proprioception, hop for distance, single leg hop ground reaction force and lateral speed chase results persistent side to side deficits in abduction, internal and external rotation isokinetic strength and 3D kinematics during functional movements were identified (increased knee flexion with reduced hip flexion and abduction). The significance of these deficits is unclear, however use of a multifactorial “return-to-play” test battery postoperatively may ensure that patients do not return to sport prematurely.
EP10.13 Clinical and ultrasound examinations of the dancer's hip
Michaela O'Connor1, Gabrielle K Steinl1, Dr Jamie Confino1, Connor Crutchfield1, Dr Christine Townsend1, Dr Zachary Bailowitz1, Dr Julia Iafrate1, Dr Christopher Visco, Dr T. Sean Lynch1
1Columbia University, New York, United States

Introduction
Seventeen percent of dancers and 27.7% of professional dancers experience hip or groin injuries. The purpose of this study was to evaluate the soft tissue surrounding dancers’ hip joints to assess for any compensatory changes that may place this population at risk for hip injuries.

Methods
Eligible dancers completed a dance-specific survey and Patient-Reported Outcome (PRO) questionnaires. Participants then underwent a thorough clinical and ultrasound examination of both hips.

Results
Forty-five dancers (90 hips, 80% female) were included with an average 17.2 ± 11.4 years of experience. The mean age was 33.2 ± 15.0 years. The average length of rehearsal for those still dancing (43 dancers) was 3.3 ± 1.6 hours. Forty dancers (88.9%) experienced hip pain at some point during their careers with 6 dancers (13.3%) missing a performance due to hip pain. The average Beighton Score was 4.0 ± 2.4. Average flexion with the knee bent, internal rotation, external rotation, and abduction in external rotation (in order to replicate abduction in side développé, making this measurement more applicable to dancers) were 144.5° ± 11.7°, 33.8° ± 12.2°, 49.3° ± 11.0° and 110.2° ± 22.7°, respectively. Thirty-two hips (35.6%) exhibited signs of impingement, while only 29 (32.2%) showed a potential labral tear. Hip joint effusion was present in 11 hips (12.2%). Degenerative changes at the pubic symphysis were seen in 8 patients (18.2%, 44 hips). Seven hips (7.9%, 89 hips) had GT bursa fluid, while 51 (56.7%) and 22 (24.4%) had gluteus medius and gluteus minimus insertion tendinopathy, respectively. Twenty-eight hips (31.1%) displayed signs of hamstring tendon origin tendinopathy.

Conclusion
Dancers are an understudied athletic population. This research adds to the existing literature by providing an in-depth look at the soft tissue surrounding dancers’ hip joints. Notable findings were increased flexion compared to normal and the high incidence of gluteus medius tendinopathy. Dancers should practice a well-balanced hip strengthening program to maintain stability of the hip as this data indicates that dancers may be at risk for labral tears and gluteal tendinopathies.
The demographic characteristics of a large cohort of soccer players undergoing primary hip arthroscopy for femoroacetabular impingement: A gender specific and competitive level specific analysis

Dr Niv Marom\textsuperscript{1}, Mr Matthew Dooley\textsuperscript{1}, Mr Joost Burger\textsuperscript{1}, Dr Anil Ranawat\textsuperscript{1}, Dr Bryan Kelly\textsuperscript{1}, Mr Danyal Nawabi\textsuperscript{1}, \textbf{Dr Struan Coleman}\textsuperscript{1}

\textsuperscript{1}Hospital for Special Surgery (HSS), New York, United States

**Biography**

Danyal H. Nawabi, MD, is an Attending Orthopaedic Surgeon at the Hospital for Special Surgery (HSS) on the Sports Medicine Service and an Assistant Professor of Orthopaedic Surgery at Weill Medical College of Cornell University.

He is fellowship-trained in Sports Medicine and Hip Preservation and has been involved in the care of athletes from Chelsea Football Club in London (English Premier League) and the New York Red Bulls Soccer Team (Major League Soccer). He is currently the Head Team Physician for the New York Cosmos Soccer Club. His research interests include ACL biomechanics and outcomes of hip preservation surgery and he is a co-investigator on two NIH R01 grants. He has authored over 60 peer-reviewed publications and book chapters and delivered over 100 presentations at national and international conferences.

**Objectives**

The primary purpose of this study was to report on demographic characteristics of a large cohort of soccer players who underwent primary hip arthroscopy for femoroacetabular impingement (FAI). The second purpose was to evaluate the demographic and injury characteristics differences between genders and players in different competitive levels.

**Methods**

By use of a hip-preservation centre registry, a retrospective review of patients undergoing primary hip arthroscopy for FAI between March 2010 and January 2016 was performed. Soccer players were identified and categorized to highly competitive (professional and collegiate), competitive (high school and league amateur) and recreational players based on their reporting. Data regarding patient, injury and treatment characteristics were pulled from the registry. A subgroup analysis between males and females as well as comparisons between different levels of competition were performed.

**Results**

A total of 336 soccer players (421 hips) were identified. Out of 421 hips, 257 (61.0\%) were males and 164 (39.0\%) females. One hundred five (24.9\%) were reported as highly competitive, 194 (46.1\%) competitive, 75 (17.8\%) recreational and 47 (11.2\%) didn’t report their level. Overall, the majority of the cohort (231 hips, 55\%) reported on chronic hip pain lasting for more than 6 months with no acute injury in their initial visit. Mean Alpha angle on CT scan measured 65.5°±12, mean coronal central edge angle (CEA) measured 32.3°±9 and mean femoral version was 13.7°±10. Two-hundred thirty (55\%) hips had a type 2 anterior inferior iliac spine (AIIS), 78 (18.5\%) had type 1 AIIS and 19 (4.5\%) had type 3 AIIS. Comparing female vs. male soccer players, females had significantly more hip internal rotation on physical exam (15° vs. 8°, respectively, p<0.001), lower alpha angles (57.5° vs. 68.5°, respectively, p<0.001) and lower grade AIIS morphology (AIIS type 1: 25\% vs. 14.4\%, AIIS type 2: 48.8\% vs. 58.8\%, AIIS type 3: 3\% vs. 5.4\%, respectively, p=0.003). An acute injury as the reason for hip symptoms was higher in the highly competitive group than the competitive and recreational group (27.8\% vs. 18.6\% vs. 5.4\%, respectively, p<0.001).
Conclusion
We present the demographics and injury characteristics of the largest cohort of soccer players undergoing primary hip arthroscopy for FAI reported to date, including both genders and all levels of competition. When compared with male players, female players were more likely to have more hip internal rotation, lower alpha angle and lower grade AIIS morphology. An acute injury as the cause of hip symptoms was more common in highly competitive players, suggesting that in this unique population of high demand athletes, clinicians should be aware of this less common presentation of FAI pathology.
EP10.15 Effect of timing of hip arthroscopy on player return, career length, and competition-based performance for American professional athletes

Michael Schallmo¹, Hunter Yancey¹, Thomas Fitzpatrick¹, T. David Luo¹, Alejandro Marquez-Lara¹, Allston Stubbs¹
¹Wake Forest School of Medicine, Winston-Salem, United States

Introduction
The effects of timing of hip arthroscopy on return rates, career length, and player performance for professional athletes remain uncharacterized. This study assesses these effects after hip arthroscopy for professional athletes. We hypothesized that hip arthroscopy performed earlier in a player’s career would be associated with increased RTP, longer postoperative career, and more stable postoperative performance.

Methods
Major League Baseball (MLB), National Basketball Association (NBA), National Football League (NFL), and National Hockey League (NHL) athletes who underwent hip arthroscopy to treat symptomatic labral pathology, chondral defects, loose bodies, and/or femoroacetabular impingement were identified using a previously established, systematic methodology based on public sources. Successful RTP was defined as returning for at least one professional regular season game after surgery. Performance scores were calculated using previously established scoring systems. Each player served as his own control, with the season prior to surgery defined as index (baseline).

Results
This study identified 227 arthroscopic hip procedures performed on 180 players between 1999-2016. Successful return was achieved in 84.6% of the procedures. The average adjusted preoperative professional career length was 7.4±4.6 years for players who returned and 10.0±5.9 years for players who did not (p=0.004). Players who underwent surgery >9 years into their professional career demonstrated significantly lower RTP rates (72.9% vs. 91.5%, p<0.0001) and shorter average postoperative career lengths (2.3±2.8 years vs. 3.8±3.1 years, p=0.002) compared with all other players. Compared with their index season, players who underwent surgery >9 years into their professional career also demonstrated significantly reduced performance scores during postoperative season 1 (-22.2%, p<0.0001) and an average of postoperative seasons 2 and 3 (-41.4%, p=0.020). For MLB, NBA, and NFL players, total career lengths were similar between players who returned and those in the same sport who did not. Conversely, NHL players who were able to return demonstrated significantly longer total career lengths (11.4 vs. 6.4 years, p=0.028) compared with those who did not return.
Conclusion
This study supports the hypothesis that hip arthroscopy performed earlier in a player’s professional career is associated with higher rates of return, longer postoperative career lengths, and more stable postoperative player performance.
From biomechanics to clinical outcomes: A comprehensive review on hip injuries in ballet dancers

Mr Yash Singh1,4, Ms Rachel Elwood1,4, Mr Osama Elhakeem1,4, Mr Ori Weiss3,4, Mr Vikas Khanduja1,2,4

1University Of Cambridge Clinical School, Addenbrookes., Cambridge, United Kingdom, 2Department of Orthopaedic Surgery, Addenbrookes., Cambridge, United Kingdom, 3Department of Orthopaedic Surgery, Meir medical centre., Kfar-Saba, Israel, 4Young Adult Hip Surgery, Department of Orthopaedics, Addenbrookes, Cambridge, United Kingdom

Biography
Fifth Year Medical Student at Jesus College, University of Cambridge.

Purpose
To examine the existing literature and evidence on hip injuries in ballet dancers. The study aims to provide a comprehensive update on anatomy and biomechanics of injury, the underlying pathophysiology, presentation, investigations, management strategies and clinical outcomes.

Study Design
Review of the Literature.

Methods
A literature search of PubMed, Medline, Cochrane, EMBASE and CINAHL was conducted. Keywords included: “hip” AND “dancer” OR “ballet.”

Results
The hips of ballet dancers are subject to a significant amount of stress resulting in various pathologies and an injury rate of 17.7%. Numerous factors increase a ballet dancers’ vulnerability to pathology including supra-physiological demands, improper technique, soft tissue adaptations, muscular imbalances, abnormal bony anatomy and physical health. Of these, the initial three are most specific to the ballet dancer. The presentation is often non-specific and thus detailed history and examination is essential. Plain radiographs and real time dynamic ultrasound provide immense value in different clinical pictures.

Management should follow a stepwise scale with the goal of minimising the recovery period and potential of further injury. Arthroscopic hip surgery is an effective technique for many pathologies with the benefits of being minimally invasive and having minimal complications. The Bernese peri-acetabular osteotomy is a commonly performed procedure for the dancers with dysplastic hips. Restoration of preoperative ROM is essential and thus concurrent femoral head-neck junction osteochondroplasty is most beneficial. Evidence suggests a high return to dance (73%-97%) following hip arthroscopy.

Conclusions
Despite the vulnerabilities of the hip in ballet dancers, effective management strategies focused on appropriate rehabilitation, an injury prevention programme and judicious surgery can yield good clinical outcomes and high rates of return to dance.

Keywords
Hip, ballet, dancer, anatomy, pathology, presentation, management, outcomes
The effect of an eight-week rhythmic gymnastics-based power-flexibility program on the lower limb flexibility and power of contemporary dancers

Ms Lauren Skopal¹, Associate Professor Lauren Netto², Associate Professor Brad Aisbett¹, Associate Professor Amir Takla³, Mr Troy Castricum¹

¹Deakin University, Melbourne, Australia, ²Curtin University, Perth, Australia, ³University of Melbourne, Melbourne, Australia, ⁴Swinburne University of Technology, Melbourne, Australia

Biography

Lauren Skopal is an Exercise Scientist and specialist in Flexibility Training Methods. She designed this training intervention based on her 12 years of experience in Rhythmic Gymnastics both as a gymnast and accredited coach with Gymnastics Australia. She also has a good understanding of the physical demands of the performing arts industry having performed around the world as an acrobat after retirement from gymnastics. At Deakin University in Australia she is a sessional teacher for the Bachelor of Exercise & Sports Science. Lauren has also worked with Associate Professor and Sports Physiotherapist Amir Takla on hip injury prevention methods and rehab post hip arthroscopy.

Background

There is a low acceptance of supplementary training in the dance community and injury rates amongst dancers are high. The increasing cross-fertilization between the movements in contemporary dance and aesthetic sports such as rhythmic gymnastics, suggest that dancers may benefit from gymnastics training methods. In particular, both contemporary dancers and rhythmic gymnasts require high levels of hip flexibility and lower limb power. Therefore, the aim of this research was to test the effectiveness of a rhythmic gymnastics based supplementary training program on the lower limb flexibility and power of contemporary dancers.

Study Design

Case-Control Study

Methods

Eleven female contemporary dancers were randomly assigned to either a control or intervention group. The intervention group (n=6) participated in an eight-week rhythmic gymnastics-based power-flexibility program comprising two one-hour sessions per week in addition to their usual dance training. The control group (n=5) continued their usual dance training. Pre and post measures of range of motion (ROM) and power were taken via a dance-specific kick test using an isokinetic dynamometer and a customized jete (dance jump) test in a 3D-motion laboratory.

Results

Significant increases in right leg jete ROM (p=0.011) and left leg jete ROM (p=0.035), right leg peak kicking torque (p=0.028) and left leg jete height (p=0.033) were recorded in the intervention group compared to the control group.

Conclusion

The results of this study suggest that rhythmic gymnastics training could provide a viable means for contemporary dancers to target active ROM and power of explosive dance movements such as the dance kick and jete. Future research should include subjective evaluations of dance performance to confirm that training adaptations are transferred to improvements in performance quality. Rhythmic gymnastics supplementary training could be a valuable tool for physiotherapists working with dancers who wish to further enhance their hip flexibility and lower body power.
EP10.18 Vail hip sports test as a measure of functional strength

Dr Matthew Crawford¹, Mr. James Spratt¹, Dr Lauren Pierpoint¹, Mrs. Karen Briggs¹, Dr Marc Philippon¹

¹Steadman Philippon Research Institute, Vail, United States

Summary
Hip sports test as a measure of functional strength.

Biography
Matt grew up in Durham, NC and graduated Phi Beta Kappa with a B.S in biology from the University of North Carolina, Chapel Hill. While at UNC, Matt captained the men's soccer team and won an NCAA soccer championship. After college, he continued his soccer career, playing four years with the Colorado Rapids of Major League Soccer.

Matt then attended medical school at the University of California, San Francisco before returning to Durham to join the orthopaedic surgery residency program at Duke. During residency, he provided physician coverage for Duke and North Carolina Central University football, basketball, and other athletic teams. Matt currently lives in Vail, CO with his wife, Julie, and son, Luke, and is a sports medicine fellow at the Steadman Philippon Research Institute, where he is a team physician for the US Ski Team.

Background
Surgeons face major challenges deciding when athletes are ready to return to sport following hip arthroscopy. Currently, few validated functional tests exist to assess sport readiness. The Vail Hip Sports Test (VHST) was developed to provide a standardized, objective metric for determining readiness to return to sport following hip arthroscopy.

Purpose
To evaluate the association between preoperative VHST scores and hip strength measurements in high level athletes undergoing surgery for femoroacetabular impingement.

Methods
Preoperative VHSTs were performed within one week of strength measurements in 350 patients. The VHST comprises single leg squats, forward box lunges, and lateral and diagonal agility exercises for various periods of time. Scoring is based on the time the activity is performed with proper form. A passing score is ≥18 out of 20 points. Hip flexion, extension, abduction, internal rotation, external rotation, gluteus medius, hamstring, and quadriceps muscle strength was assessed via hand-held dynamometry. Preoperative and postoperative patient reported outcomes including modified Harris Hip Score (mHHS), Western Ontario and McMaster Universities Osteoarthritis Index, and Hip Outcome Score (HOS) were collected. Correlations between VHST, strength, and outcomes were assessed using Pearson’s r.

Results
Athletes were 26.9±6.5 years, with 34% female and 36% professional athletes. Preoperative mean VHST was 11.2±6.3. VHST scores were correlated with all strength measurements (r=0.20-0.34, all p<0.01), with the strongest correlation with hip flexion (r=0.33, p<0.0001) and extension (r=0.34, p<0.0001). VHST was also correlated with pre- and postoperative mHHS (r=0.34, p<0.001; r=0.20, p=0.002; respectively). VHST scores were correlated with pre- and postoperative HOS-sports scores (r=0.31, p<0.0001 ; r=0.19, p=0.0029; respectively).

Conclusion
Higher preoperative VHST scores are associated with greater hip strength and better outcomes. This data supports the use of the VHST as a functional assessment of motion and strength, helping surgeons to determine patients’ readiness to return to sport.
The outcomes and return to sports rate in elite athletes following hip arthroscopic surgery: A systematic review

Rachel Elwood, Dr Ori Weiss, Osama El-Hakeem, Yash Singh, Dr Vikas Khanduja

Department of Trauma and Orthopaedics, Addenbrooke’s Hospital, Cambridge University Hospitals NHS Foundation Trust, Cambridge, England

Background
Elite performance has tremendous physical demands and places elite athletes at an increased risk of sustaining a variety of orthopaedic injuries. Pain around the hip is common in high-level athletes representing up to 6% of all athletic injuries. Expedient diagnosis and effective treatment are paramount for their future sporting careers and to prevent subsequent joint degeneration. The purpose of this systematic review was to evaluate the outcome and the rate of return to play (RTP) following hip arthroscopy in elite athletes.

Methods
A computer-based systematic search followed the PRISMA Guidelines was performed using the 6 most comprehensive databases (CENTRAL, PUBMED, EMBASE, SCOPUS, EBSCO, Google Scholar and Web of Science) and included all published studies from inception until November 1st, 2018. Weighted means were calculated for the rate of RTP and duration and for patient-reported outcome measures (PROMs).

Results
After eligibility screening, 17 articles were included with a total of 736 male and seven female patients, 861 hips and a mean age of 27.9±3.6 years. The mean follow-up period was 35.8±13.4 months and 17.1±12.3% of athletes had undergone bilateral hip arthroscopies. Overall, 93.9% (95% CI: 90.5, 96.6, P < 0.0001) of patients demonstrated return to sport after 6.7±2.5 months post-surgery and all PROMs improved postoperatively. During follow-up, 9.6% (95% CI: 5.2, 15.2, P = 0.025) patients needed further intervention.

Conclusion
A high percentage of elite athletes return to the same level of competition after hip arthroscopy, with a low rate of further interventions. Hip arthroscopy appears to be an efficacious treatment for elite athletes suffering for hip and/or groin pain.
EP10.20 Outcomes of FAI correction in competitive and recreational athletes: Results from a prospective multicentre cohort

Dr Robert Westermann1, Dr Jeff Nepple2, ANCHOR GROUP2, Dr Christopher Larson3

1University Of Iowa, Iowa City, , 2Washington University, St Louis, MO, , 3Twin Cities Orthopaedics, Minneapolis, MN,

Biography
Dr Westermann (Robby) is an Orthopaedic Surgeon and team physician University of Iowa. He went to medical school at the University of Washington in Seattle, WA and completed his residency in Iowa City. He completed a sports medicine fellowship at the Cleveland Clinic and was subsequently awarded the William Harris Award in Hip Preservation and completed a Traveling Fellowship with the ANCHOR Hip Preservation group spending time in St Louis, Michigan and Twin Cities, MN. He practices sports Medicine at the University of Iowa and treats athletic injuries of the knee, hip and shoulder. He is involved in cellular and biomechanics basic science research and Multi-centre clinical outcomes research through the MOON and ANCHOR groups.

Background
Femoroacetabular impingement (FAI) is a well-recognized source of hip pain and dysfunction in athletes. The purpose of the present study was to evaluate the efficacy of FAI correction in an athletic population, collected across multiple centres as part of a prospective cohort study.

Methods
Patients with symptomatic FAI who failed conservative treatments were enrolled in a prospective multicentre cohort study following surgical treatment of FAI. Validated patient-reported outcome instruments were collected preoperatively and at a minimum 1-year follow-up. FAI morphology was assessed with plain radiographs pre and post-operatively, and surgeons documented intra-articular findings immediately following surgery. Groups were compared using ANOVA test and significance was set to p<0.05.

Results
During the study period, 196 patients were identified as athletes and 159/196(81.1%) had minimum 1-year follow-up. Of these 102 were treated arthroscopically and 57 were treated with surgical dislocation. There were 93 competitive athletes (25 collegiate or professional athletes, 68 high school) and 66 recreational athletes. Recreational athletes were older (34.5 vs 18.1 p<0.01) but no differences were observed gender, FAI subtype or alpha angle (p>0.05). Both groups improved significantly (Statistically and meeting MCID) from pre-op to final follow up across all outcome domains. Compared to recreational athletes, competitive athletes saw greater improvements in MHHs (p=0.03), HOOS Pain (p=0.02), HOOS Sports (p=0.02) and HOOS QOL (p=0.02). There was no difference in failure rates between groups p=0.34.

Conclusions
Athletes receiving surgical correction of FAI see significant benefits in hip pain, function and quality of life; improvements in pain, symptoms and sport-specific hip function may be larger in competitive athletic populations.
EP10.21 Non-contact anterior cruciate ligament tears during return to sport following hip arthroscopy for femoroacetabular impingement (FAI)

Dr James Wylie, Mrs Brandy Horton, Dr Hugh West, Dr Jennifer Marland

1The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

Biography
Dr Wylie is a hip and knee preservation surgeon at The Orthopaedic Specialty Hospital and Intermountain Healthcare in Murray, Utah. He performs open and arthroscopic hip preservation surgery and functions as the Director of Orthopaedic Research for Intermountain healthcare.

Background
Little is known about other injuries that might occur following return to sport after femoroacetabular impingement (FAI). Limited hip internal rotation (IR) compared to external rotation (ER) has been reported in individuals with non-contact Anterior Cruciate Ligament (ACL) injuries. The purpose of this report is to describe three athletes who failed to pass their sport test and sustained non-contact ACL injuries after returning to sport after arthroscopy for FAI.

Methods
Retrospective case series of patient who underwent hip arthroscopy for FAI and subsequently suffered noncontact ACL injuries less than one year following surgery. All individuals presented pre-operatively with groin pain present during high level sport, positive impingement exam, hip IR <10 degrees and alpha angles > 65 degrees. Hip arthroscopy was performed to address the patients FAI. They underwent a structured PT program and attempted return to sport functional testing.

Results
Three individuals returned to sport despite not passing a structured return to sport test. All three individuals failed to achieve 90% symmetry on their sport test, returned to sport without full clearance and tore their ACL less than 6 months from their last formal visit. The sport test consisted of the 3PQ leg press assessing maximal force output in each limb, single leg dip for time, single leg hops for distance, and lateral jump with resistance band for time. All failed to achieve a passing score on the single leg hop test as well as an overall passing score. ACL injuries occurred while playing soccer (2) and basketball.

Conclusions
Patients undergoing hip arthroscopy may successfully return to sport; however, incomplete rehab is a potential risk factor for future lower extremity injuries. Passing a return to sport test may help minimize the risk of subsequent lower extremity injury.
Return to basketball after hip arthroscopy: Minimum two-year follow up

Dr Austin Chen1, Brian Mu2, Cammille Go3, Dr Victor Ortiz-Declet4, Dr David Maldonado3, Dr Benjamin Domb3

1BoulderCentre for Orthopaedics, Boulder, United States, 2Rosalind Franklin University of Medicine and Science, North Chicago, United States, 3American Hip Institute, Chicago, United States, 4Kayal Orthopaedics, Westwood, United States

EP10 - The hip in sport

Biograph:
Dr Austin Chen is a board-eligible, dual-fellowship-trained orthopaedic surgeon specializing in hip preservation and reconstruction and sports medicine surgery.

His focus is the treatment of hip pain and injuries, including femoroacetabular impingement (FAI) and hip labral tears. He has also subspecialized in the treatment of knee and shoulder injuries in athletes ranging from weekend warriors to professionals. He is US Ski & Snowboard Sports Medicine Physician and travels all over the world for World Cup event coverage. Dr Chen is currently involved in research and has authored or co-authored numerous research articles and book chapters in the field of hip and sports medicine surgery. He believes evidence/research-based medicine is the foundation of providing optimal patient care.

Dr Chen completed a comprehensive hip fellowship at the American Hip Institute in Chicago, Illinois, under the training of hip specialist and innovator Dr Benjamin Domb in 2017. He also completed a sports medicine fellowship at Taos Orthopaedic Institute in 2016. He completed his orthopaedic surgery residency and received his medical doctorate degree from the University of Illinois College of Medicine in Chicago in 2015 and 2010, respectively. Dr Chen received a Bachelor of Science degree from the University of Notre Dame in 2005.

Background
The hip represents a significant percentage of basketball injuries. Outcomes and return-to-sport (RTS) after hip arthroscopy for femoroacetabular impingement (FAI) have not been clearly established for basketball. Purpose: The purpose of this study is to present minimum two-year PROs and RTS data for a population of professional, amateur, and recreational basketball players.

Hypothesis
Hip arthroscopy in basketball athletes results in a high rate of RTS and significantly improved patient reported outcomes (PROs).

Methods
Demographic and intraoperative data were prospectively collected for all patients that underwent hip preservation surgery from February 2009 to May 2014. Patients who underwent hip arthroscopy with preoperative and minimum two-year postoperative PROs, visual analogue scale (VAS) and satisfaction, regularly played basketball within a year prior to surgery, and attempted to RTS met inclusion criteria. Exclusion criteria were previous ipsilateral hip surgery or conditions such as fracture, dysplasia, or femoral avascular necrosis. RTS rates and subjective ability (higher, same, or lower) were recorded.

Results
Thirty-one patients (81.6%) met inclusion criteria and had complete follow-up at an average of 46.8 months after surgery. Mean age was 30.0, and mean body-mass-index was 26.3. Males (64.5%) outnumbered females (35.5%). Most (54.8%) players identified themselves as recreational athletes; the remainder competed at the high school, collegiate, amateur, or professional level. There was significant improvement in all PRO measures and VAS from baseline to minimum two-year follow-up. At latest follow-up, mean patient satisfaction was 8.1. Three (9.7%) patients with an average age of 47.5 ((p = 0.023) converted to THA
at a mean of 35.9 months after arthroscopy. At latest follow-up, the RTS rate was 83.9%. Subjective ability level was the same or higher in 23 (74.2%) patients.

Conclusion

Hip arthroscopy in all levels of basketball athletes demonstrates a significant increase in PROs, high RTS rate, and low risk of complications. Hip arthroscopy should be considered in basketball players < 40 years that fail non-operative treatment and have significantly limited level of play.
The influence of Cam and Pincer morphology on dynamic postural control in professional soccer athletes: An observational cross-sectional study

Ms André Bento, Ms Guilherme Falótico, Ms Ronaldo Cunha, Pt Klever Fujikawa, Dr Gustavo Arliani, Professor Moisés Cohen

Unifesp, São Paulo, Brazil

Biography
Physical Therapy member of ISHA since 2018, Master's degree in health sciences applied to sports and physical activity, specialist in sports physiotherapy in 2004 by the federal university of são paulo (UNIFESP), physiotherapist responsible for the ambulatory of hip injuries in athletes in the UNIFESP since 2005, member of the national society of sports physiotherapy (Brazil).

Objective
Determine if the morphological changes of the femur or acetabulum presents in soccer athletes influence the dynamic postural control.

Design
Cross-sectional.

Setting
University biomechanics laboratory.

Participants
Fifty-nine male professional soccer players in the pre-season were evaluated (average age, 25.5 years, range, 18-38). Main outcome measures: We evaluated the radiography alpha angle and the acetabular retroversion index (ARI) and dynamic postural control by the Star Excursion Balance Test.

Results
In the relationship between the alpha angle and the SEBT scores independent of the dominance of lower limbs there was no significant result. There were no significant results also in the correlation between the dominant alpha angle with the dominant SEBT and in the correlation between the non-dominant alpha angle with the non-dominant SEBT.

Conclusion
There is a very weak correlation between hip morphological changes and dynamic postural control. There was also very weak correlation between dominant and non-dominant members.
EP11.1 The hip labrum reconstruction: Indications and outcomes - an updated systematic review

Latifah Al Mana¹, Ryan Coughlin¹, Veeral Desai¹, Nicole Simunovic¹, Andrew Duong¹, Associate Professor Olufemi Ayeni¹
¹Mcmaster University, Hamilton, Canada

Biography
Dr Ayeni is an Associate Professor of Orthopaedic Surgery, Adjunct Professor in the Health Research Methodology, Evidence and Impact program, and Director of Orthopaedic Sports Medicine Research at McMaster University. He is also the Medical Director for the Hamilton Tiger Cats Organization. Dr Ayeni is an orthopaedic surgeon that specializes in the treatment of femoroacetabular impingement (FAI, or hip impingement), which is common in the active/athletic adult population. To date, most articles published concerning FAI have been initiated and written by Dr Ayeni and his research team at McMaster University.

Objective
Due to the increasing popularity and recognition the arthroscopic procedure has gained in recent years, the aim was to assess for changes in indications, graft selection, and improvement in outcomes within the last five years.

Methods
All available data from August 2013 to August 2018 were searched using electronic databases EMBASE, MEDLINE, and PubMed. The references of included studies were manually searched. Two reviewers carried out screening and evaluating the included studies for data quality using the Methodological Index for Non-Randomized Studies (MINORS) score in duplicate. Data abstraction was done in duplicate, and descriptive statistics are presented.

Results
A total of nine eligible studies with a total of 234 patients (265 hips), and an average 12/16 (non-comparative studies) and 20/24 (comparative studies) quality on the MINORS score were included in this review. All patients underwent labral reconstruction, whether as primary surgery or revision (76% vs 24% respectively). There were 244 hips assessed at final follow-up with a reported mean range of 12 and 61 months. There were more graft variabilities found in this study compared to the previous review. Recent surgical approaches favoured arthroscopy (86% vs 81.3% previously) compared to open procedures (7.9% vs 18.7% previously). Overall, improvement was observed in the patient-reported outcomes and functional scores, with variability in their statistical significance. The failure rate or conversion to total hip arthroplasty (THA) (3.8% and 5.7%, respectively) decreased compared to the previous (20% vs 9.5%, respectively).

Conclusion
According to recent evidence, hip labrum reconstruction is a new technique that showed short and mid-term improvement in patient-reported outcomes and functional scores postoperatively. The primary indication for reconstruction remained similar over time. The failure rates and/or conversion to THA appear to have decreased over time.
CAM FAI is a disease of the hip joint characterized by a developmental deformity at the head-neck junction (Ganz et al., 2003). The deformity causes painful impingement. To relieve patients of symptoms the cam deformity is resected. However, there is concern that changing the shape of the femoral head may affect the function of the acetabular labrum as it highly depends on its tight seal around the femoral head. The labrum is essential in sealing pressurized fluid within the intra-articular space to provide a low friction environment and reduces the stress, strain and consolidation of articular cartilage (Bsat, Frei, & Beaule, 2016) and in maintaining hip stability (Nepple et al., 2014). Given the role of the labrum in hip joint biomechanics, it is important to investigate the effect of FAI surgical correction on the functionality of the acetabular labrum seal. Six fresh frozen human cadaveric hip joints were dissected of all soft tissue except the acetabular labrum. Using a servo-hydraulic testing machine the hip joints were physiologically loaded in varying degrees of flexion and internal rotation, beginning with the neutral position. The functionality of the acetabular labrum in various positions of flexion and internal rotation was evaluated by its sealing capacity, reported as the peak intra-articular pressure observed under loading. The cadaveric specimens were tested both before and after FAI surgical correction. The greatest pressures measured were positions with flexion and no internal rotation. Our results suggest that loss in pressure is most prevalent in the neutral position and with minimal flexion. This corresponds to standing position as well as part of the swing phase of the gait pattern. Though the function of the labrum in load support is not as significant during the swing phase, its role in the stability of the hip joint may be.
Return to sport and athletic function in an active population following primary arthroscopic labral reconstruction

**Dr David Maldonado**, Sarah Chen, Dr Ajay Lall, Dr Philip Rosinsky, Dr Rafael Walker-Santiago, Dr Jacob Shapira, Dr Benjamin Domb

1American Hip Institute, Chicago, United States

**Biography**

Dr David Maldonado is an orthopaedic surgeon who specializes in joint replacement and hip arthroscopy.

**Background**

Labral reconstruction has been advocated as an alternative to debridement or resection for the treatment of irreparable labral tears, showing favourable short-term results. However, there is a scarcity of literature on outcomes and return to sport in the non-elite athletic population.

**Purpose**

To report 2-year clinical outcomes and the return to sport rate in athletic patients who underwent primary hip arthroscopy with labral reconstruction in the setting of femoroacetabular impingement and labral tears.

**Methods**

Data was prospectively collected and retrospectively analysed for patients who underwent a labral reconstruction between August 2012 and December 2017. Patients were included if they identified as an athlete (high school, college, recreational, or amateur), had follow-up on the following patient-reported outcomes (PROs): modified Harris Hip Score (mHHS), Nonarthritic Hip Score (NAHS), Hip Outcome Score-Sport Specific Subscale (HOS-SSS), visual analogue scale (VAS), and completed a return to sport survey at 1-year postoperatively. Patients were excluded if they underwent any previous surgery or prior conditions on the ipsilateral hip or had dysplasia. The proportion of patients who achieved the minimal clinically important difference (MCID) and patient acceptable symptomatic state (PASS) for mHHS and HOS-SSS was calculated. Significance was set at P=0.05.

**Results**

There were 32 high school, college, recreational, and amateur athletes who underwent primary labral reconstruction. The mean age and body mass index (BMI) of the group was 40.3 years (15.5–58.7 years) and 27.9 kg/m2 (19.6–40.1 kg/m2), respectively. The mean follow-up time was 26 months. All patients demonstrated significant improvement in mHHS, NAHS, HOS-SSS, and VAS (P<0.001) at latest follow-up. Additionally, 84.4% achieved MCID and 81.3% achieved PASS for mHHS, and 87.5% achieved MCID and 75% achieved PASS for HOS-SSS. VAS pain scores decreased from 4.4 to 1.8 and the satisfaction with surgery was 7.9 out of 10. The rate of return to sport was 78%, with 40.6% successfully returning to sport at the same or higher level.

**Conclusions**

At 2-year follow-up, primary arthroscopic labral reconstruction, in the setting of FAI and irreparable labral tear, was associated with significant improvement in PROs in athletic population. The return to sport within 1-year surgery was 78%.
EP11.4 Hip arthroscopy and labral reconstruction: Short-term outcomes with circumferential and segmental labral reconstruction. A systematic review

Dr David Maldonado¹, Cynthia Kyin¹, Dr Rafael Walker-Santiago¹, Dr Jacob Shapira¹, Dr Philip Rosinsky¹, Dr Ajay Lall¹, Dr Benjamin Domb¹

¹American Hip Institute, Chicago, United States

Background
Labral reconstruction has demonstrated short-term benefit for the treatment of irreparable labral tears.

Purpose
To synthesize and report patient-reported outcome scores (PROs) in patients who underwent hip arthroscopy with either segmental or circumferential labral reconstruction in the setting of femoroacetabular impingement (FAI) and labral tears.

Methods
A systematic review of the PubMed/MEDLINE and EMBASE databases was performed in February 2019. Studies were included if they were Level of Evidence I through IV, written in English, included patients with FAI who underwent arthroscopic labral reconstruction, and included PROs. Exclusion criteria were the following: labral treatment without labral reconstruction, included patients who underwent open hip surgery, did not define follow-up, reported a follow-up of fewer than six months, or had overlapping patient populations. Case reports, cadaveric studies, animal studies, technique articles, instructional course lectures, and systematic or concept reviews were also excluded.

Results
 Eleven eligible studies including 406 hips were identified. Seven studies were non-comparative while four were comparative. However, no study directly compared the two labral reconstruction techniques. Nine studies reported outcomes of segmental labral reconstruction with a total of 212 hips. The weighted mean age for the segmental labral reconstruction group was 36.1 years, and the mean follow-up reported was 41.9 months. Two studies reported outcomes of circumferential labral reconstruction with a total of 194 hips. The mean age for the circumferential group was 40.4 years, and the mean follow-up was 26.7 months. Conversion to THA for the segmental and circumferential groups were 13.0% and 7.7% respectively. Overall, patients who underwent segmental reconstruction had 1.68 times the risk of converting to THA than those who underwent circumferential reconstruction. All studies, for both techniques, reported significant improvement in PROs at latest follow-up.

Conclusion
In the setting of symptomatic FAI and labral tears, patients who underwent hip arthroscopy with labral reconstruction demonstrated significant improvement in PROs at short-term follow-up with either segmental or circumferential labral reconstruction. Circumferential labral reconstruction was associated with a lower conversion rate to THA.
EP11.5 Outcomes of hip labral reconstruction versus labral repair: A systematic review.

Dr David Maldonado¹, Sarah Chen¹, Dr Philip Rosinsky¹, Dr Jacob Shapira¹, Dr Rafael Walker-Santiago¹, Dr Ajay Lall¹, Dr Benjamin Domb¹

¹American Hip Institute, Chicago, United States

Introduction

With the evolution in surgical techniques and surgeon experience, hip labral reconstruction has emerged to treat irreparable labra. The purpose of this systematic review was to compare patient reported outcomes (PROs) following hip arthroscopy with labral repair and hip arthroscopy with labral reconstruction.

Methods

The PubMed, Embase, and Cochrane databases were searched according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines to identify articles which compared 2-year outcomes following hip labral repair and hip labral reconstruction.

Results

Five comparative studies, with 149 reconstruction cases and 272 repair cases, were included in this analysis. For the reconstruction group, modified Harris Hip Score (mHHS scores) were good in three studies (range, 80.4-87.8) and fair in one study (72.0 ± 18.3). For the repair group, mHHS scores were good in four studies (range, 84.1-88.0). The repair cohorts (range, 77.9- 83.8) tended to have superior Non-arthritic Hip Score (NAHS) scores compared to the reconstruction group (range, 73.9-92.4). In three of four studies, the repair group reported less pain (VAS) at latest follow-up compared to the reconstruction group. For reconstruction cases, the revision rate ranged from 4.7% to 20.0%, and for repair cases, the revision rate ranged from 4.0% to 11.8%.

Discussion

To our knowledge, this is one of the first systematic reviews to compare outcomes following labral repair and labral reconstruction. Three of four (75%) reconstruction patient populations with mHHS scores demonstrated an improvement that surpassed the literature values for the minimal clinically important difference (MCID) and patient acceptable symptomatic state (PASS).

Conclusion

Both labral repair and reconstruction lead to favourable outcomes at minimum 2-year follow-up, with labral repair exhibiting superior outcomes compared to labral reconstruction. There was also an increasing trend in conversion total hip arthroplasty (THA) in reconstruction cases.
EP11.6 Radiologic and demographics risk factors for labral reconstruction versus repair in primary hip arthroscopy. A predictive model.

Dr David Maldonado1, Jeffrey Chen1, Dr Ajay Lall1, Dr Benjamin Domb1
1American Hip Institute, Chicago, United States

Methods
This retrospective study draws from a prospectively and longitudinally maintained institutional database. Inclusion criteria were patients who underwent primary hip arthroscopy and received either labral reconstruction or simple labral repair by the senior author between October 2010 to November 2018. Exclusion criteria were patients with previous hip conditions. 14 radiographic measurements were reported.

Results
251 hips (237 patients) with primary labral reconstruction and 1147 hips with (1063 patients) primary labral repairs were identified from the institution’s database as having complete sets of radiographic measurements. Radiographically there was a greater prevalence of Tönnis 1 grade in the reconstruction group (0.37 vs 0.15). Patients who underwent reconstruction also had greater degree of acetabular coverage as measured by LCEA (33.25±7.31° vs 30.41±6.22°) and AI (3.45±5.26° vs 4.77±4.79°). Alpha angle (AA) was also higher (65.11±13.21° vs 59.45±12.21°). The average age of patients who underwent reconstruction was 40.99±11.74 years, while that of those who underwent repair was 34.98±13.57 years. The former cohort of patients had BMI of 27.4±5.42 kg/m2, while that of the later was 25.69±5.04 kg/m2. There was a greater proportion of males in the reconstructed group (0.36 vs 0.45). A final logistic regression selected age, BMI and three of the 14 predictive radiographical findings (Tönnis Grade, LCEA, AA). The odds of reconstruction were 2.52 times higher in those with Tönnis Grade 1 vs 0. Every additional degree in LCEA was associated with a 6% increase in the odds of reconstruction and 4% for each additional degree increase in alpha angle. The model accuracy is 70.5% with a ROC area = 0.74.

Conclusion
There is a direct proportional relation between the odds of primary labral reconstruction and age at surgery, BMI, gender, Tönnis grade, LCEA, and AA.
Two-year outcomes of hip arthroscopic surgery with circumferential labral reconstruction

Dr David Maldonado1, Cynthia Kyin1, Dr Rafael Walker1, Dr Jacob Shapira1, Dr Philip Rosinsky1

1American Hip Institute, Chicago, United States

Introduction
The recent literature has described labral reconstruction as a technique for restoring labral function in the setting of an irreparable labrum. However, there is a paucity of literature regarding patient-reported outcomes (PROs) of the circumferential labral reconstruction technique which eliminates the risk for inaccuracies in graft measurement. The purpose of this study was to report short-term outcomes of patients who underwent hip arthroscopy with circumferential labral reconstruction.

Methods
Data was retrospectively reviewed from February 2016 to March 2017. Inclusion criteria were all patients who underwent a circumferential labral reconstruction, with follow-up scores for the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score, Hip Outcome Score-Sports Specific Subscale, Veterans Rand 12 Mental, Veterans Rand 12 Physical, 12-Item Short Form Survey Mental, 12-Item Short Form Survey Physical, along with a visual analogue score for pain and a patient satisfaction score. Exclusion criteria were patients with previous hip conditions or a preoperative Tonnis grade >1. The threshold for significance was set to P = .05.

Results
A total of 42 patients (43 hips) were included (87.8% follow-up) with an average follow-up of 24.1 months. At latest follow-up, all PROs demonstrated significant improvement (P < .05). The Patient Acceptable Symptomatic State for mHHS was achieved in 27 (62.8%) patients, and the minimal clinically important difference for mHHS was met in 29 (67.4%) of patients. Average patient satisfaction at latest follow-up was 7.6. Regarding secondary surgeries, there were no revision arthroscopies, but two patients converted to total hip arthroplasty.

Conclusion
In the setting of an irreparable labrum, circumferential labral reconstruction is a safe procedure with favourable outcomes at 2-year follow-up.
The use of a mini all suture anchor reduces post-operative psoas irritation in patients undergoing hip arthroscopy for femoroacetabular impingement.

Mr Paul Haggis, Mr Tony Andrade
Royal Berkshire Hospital, Reading, United Kingdom

Biography
I am a dual Fellowship trained hip surgeon. After finishing orthopaedic training, I undertook a year-long Fellowship in hip arthroscopy under Tony Andrade and Tom Pollard at the Royal Berkshire Hospital in Reading, performing over 100 hip arthroscopies. I am currently a Fellow in Hip Arthroplasty at the Royal Bournemouth Hospital, where I am on course to perform over 200 hip arthroplasties this year, including periprosthetic hip fracture and revision hip surgery.

Introduction
Failure to address labral pathology within the psoas notch can lead to persistent psoas irritation causing pain post hip arthroscopy for femoroacetabular impingement (FAI). Due to reduced bone stock secondary to the medial rim being thin and the anterior face of the acetabulum having an acute angle, achieving anchor fixation medially can be difficult.

We present the incidence of psoas irritation following hip arthroscopy within a series of primary hip arthroscopies for FAI and compare to a series in which a mini all suture anchor was introduced specifically to address labral pathology within the psoas notch.

Methods
From 2013, all patients undergoing hip arthroscopy for FAI by a single expert surgeon within a single hospital were identified, all treated according to a standardised protocol, including post-operative physiotherapy. A mini all suture anchor was introduced in January 2017 and utilised specifically to address labral pathology in the psoas notch.

If psoas irritation was diagnosed clinically at any follow-up appointment, then a radiologically guided injection was performed. Temporary efficacy was addressed through repeat arthroscopy.

Results
Between January 2013 and December 2016 inclusive, 369 patients underwent hip arthroscopy for FAI. 14 (4%) patients (all female, average age 27, range 18-46) later required a radiologically guided injection to address psoas irritation, 5 of whom underwent repeat arthroscopy including 2 patients undergoing arthroscopic psoas tendon release. Of these 14 patients, all were found intra-operatively to have labral tears at the psoas notch at primary arthroscopy. Repair was made in all using a knotless anchor, placed as medially as bone stock would allow.

From January 2017 to December 2017, and with a minimum of one-year follow-up, a further 85 arthroscopies were carried out. The mini all suture anchor was inserted to repair the labrum at the psoas notch in 17 (20%). None of these 85 have required an injection or repeat arthroscopy to treat psoas irritation.

Conclusion
Addressing labral pathology within the psoas notch through the use of a mini all suture anchor reduces the incidence of psoas tendinitis post-operatively.
The everted native acetabular labrum: Description of patho-anatomy, MRI findings, and surgical treatment

Doctor Matthew Kraeutler¹, Doctor Laura Vogel-Abernathie², Doctor Mary Jesse³, Doctor Corey Ho³, Doctor Omer Mei-Dan²

¹St. Joseph’s University Medical Centre, Paterson, United States, ²University of Colorado School of Medicine, Department of Orthopaedics, Aurora, United States, ³University of Colorado School of Medicine, Department of Radiology, Aurora, United States

EP11 - Labral repair

Background
The purpose of this study is to introduce the concept and the patho-anatomy of the everted acetabular labrum phenomenon, assess the magnetic resonance imaging (MRI) characteristics of this condition, and present the surgical technique which addresses this problem and the associated clinical outcomes.

Methods
The operative reports from all hip arthroscopy procedures performed by the senior author between 2014 and 2018 were retrospectively reviewed. The presence of an everted labrum was determined if the labrum was noted to lie on the capsular side of the acetabular rim away from the femoral head while the hip was off traction. Patient demographics and radiographic parameters were analysed among all patients noted to have an everted labrum. All cases of an everted labrum were treated either with labral repair using an inside-out technique or labral reconstruction/augmentation. All patients underwent 3T MRI prior to surgery. The labrum-to-femoral head distance was measured, amongst other parameters, in all MRIs at the 1:00-2:00 position. A random selection of 12 hips without an intra-operative diagnosis of everted labrum were used as a control group to compare radiographic parameters.

Results
A total of 54 hips were noted to have an everted labrum during the study period (mean age 28 years). Mean labral length was significantly shorter than that of controls (3.6 mm versus 5.2 mm, p = 0.027). Seven hips underwent labral reconstruction at the time of surgery in order to obtain anatomical suction seal function. The everted labrum was noted to have a triangular shape in 23% of hips on MRI and a blunted or round shape in 77% of hips, which differed significantly from the control group (p = 0.004). The average labrum-to-femoral head distance on MRI was 1.6 mm, which was significantly greater than that among patients without an everted labrum (0.0 mm, p < 0.0001).

Conclusion
The everted acetabular labrum is a rare finding during hip arthroscopy which should be treated with labral repair versus reconstruction/augmentation. The size and shape of the everted labrum may differ from that of the normal labrum and in most cases this pathology can be visualized on preoperative MRI.
EP11.10 Mechanical properties of tensile strength of ITB graft, a promising graft for labral reconstruction of the hip

Dr Fajar Mahda Spot Fajar Mahda¹, Dr D R Sasetyo²
¹Indonesia Hip and Knee Society (IHKS), Jl. Angsana 1 No.9 Rt/rw 003 Pejaten Timur, Pasar Minggu, Jakarta Selatan, Indonesia, ²Dr. Soeradji Tirtonegoro Hospital, Klaten, Indonesia

Introduction
Labral repair gives good results on damage in the labral area of the hip, but in cases with extensive labral damage, labral repair is less effective, reconstruction of labral is needed, recently labral reconstruction has been done using the iliobibial band (ITB), but no one has measured the tensile strength of the ITB. this study intends to measure the ITB tensile strength based on diameter.

Method
His is an experimental research, the sample was taken from 8 cadaveric, consisted of 6 cadaveric male sex and 2 cadaveric female sex, the youngest cadaveric age was 25 years and the oldest 63 years with an average age of 47 years. Each cadaver was treated by taking ITB, The ITB were then measured by applying the Hydraulic Servo Pulsar tensile test apparatus. ITB was rolled oval and tied with an unabsorbed polyester suture, the ITB which was oval shaped and had been tied with an unabsorbed polyester suture then measured its diameter from 4mm, 5mm, 6mm, 7mm, to 8mm. Samples that have been prepared are measured using a tensile strength gauge to assess ITB tensile strength ranging from 4mm, 5mm, 6mm, 7mm, to 8mm.

Biography
Name: Fajar Mahda
Date of Birth: December 12, 1981
Place of Birth: Cilegon
Nationality: Indonesia
Home Address: Jl. Angsana I No.9 RT/RW 003, Pejaten Timur, Pasar Minggu, Jakarta Selatan
Office Address: Jl. MH. Thamrin Kav. 57 Sentul City, Bogor, Indonesia
Marriage status: Married
Email: Jufrizafathoni@yahoo.com
Phone: +628161457430

Educational background and Post Graduated career:
7. Sport Injury Fellow : Maharaj Nangkorn Chiang Mai University (2015)
8. Sport Injury Fellow : Singapore General Hospital (2016)
9. Pain intervention fellow : Geldrop, Nederland 2017
10. Indonesia Hip&knee fellowship (2018)
Results
ITB's tensile strength curve is sigmoid shape, the average tensile strength for all samples is 647 Psi. The larger the sample diameter, the greater the tensile strength it has. The largest tensile strength is obtained in 8 mm diameter, and the smallest tensile strength is obtained in 4 mm diameter.

Conclusion
ITB is a promising autograft and can be used as an ingredient for the reconstruction of labral.

Keywords
ITB, tensile strength, reconstruction
EP11.11 Outcomes following arthroscopic hip labral reconstruction: A systematic review and meta-analysis

Mr Michael Rahl¹, Mr Collin LaPorte¹, Ms Gabrielle Steinl², Ms Michaela O’Connor², Dr T. Sean Lynch², Dr Travis Menge¹

¹Michigan State University/Spectrum Health, Grand Rapids, United States; ²Columbia University, New York, United States

Introduction

The acetabular labrum is critical to the maintenance of hip stability and has been found to play a key role in preservation of the hip fluid seal. Various arthroscopic techniques and graft solutions have been developed to treat labral damage. For irreparable labral damage, labral reconstruction has been indicated to restore joint function. The purpose of this study was to provide a comprehensive review of the current state of labral reconstruction with a focus on determining if superior outcomes are generated by autograft or allograft reconstruction.

Methods

Two online databases, PubMed and Scopus, were searched using the key terms “hip,” “labrum,” “reconstruction,” and “graft” in varying combinations. Procedures performed, complications, failures, and functional outcome measures were included in this analysis. The inverse variance method was used to calculate pooled estimates and 95% confidence intervals.

Results

Eight studies with 537 hips were included. The pooled mean age was 37.4 years (95% CI 34.5-40.4) with an average follow-up of 29 months (95% CI 26-33). Survivorship following autograft reconstruction ranged from 75.7-100%, whereas this value ranged from 87.1-90.0% in the allograft cohort. In the autograft cohort, failures included 0%-13.2% conversion to total hip arthroplasty (THA) and 0%-11.0% revision hip arthroscopy. Failures in the allograft cohort included 0%-12.9% THA conversion, 0%-10.0% revision arthroscopy and 0%-0.8% open revision. The random effects pooled mean difference in the modified Harris Hip Score, based on 6 studies and 315 hips, was an improvement of 29.0 points (p<0.0001) from baseline to final follow-up.

Conclusion

Arthroscopic labral reconstruction results in significant improvements in patient-reported outcomes. Our analysis indicates that there are no significant differences in outcomes based on graft type alone. There are a number of factors that may determine graft choice, including patient preference, surgeon experience, operative time, morbidity, and cost. Proper patient selection based on age and severity of degenerative joint disease will also optimize outcomes following labral reconstruction.
EP11.12 Tensor fascia lata autograft for labral reconstruction: How much is too much?

MD Ginanjar B. Prathama\textsuperscript{1}, \textbf{MD Dadang Rona Sasetyo}\textsuperscript{2}

\textsuperscript{1}Indonesian Hip and Knee Fellowship Program, South Jakarta, Indonesia, \textsuperscript{2}Dr. Soeradji Tirtonegoro General Hospital, Klaten, Indonesia

\textbf{Biography}

Dr Dadang R. Sasetyo is a consultant orthopaedic surgeon specializes in sport medicine of hip and knee, he served as lecturer of Indonesian hip and knee society fellowship. He is graduated and also as lecturer at faculty of medicine Airlangga University Indonesia.

After finishing ISHA (International Society of Hip Arthroscopy) travelling fellowship in USA and Australia, Dr Dadang pioneered the first hip arthroscopy surgery on FAI in 2017, He is also developed hip preservation study group in Indonesia with multidisciplinary approach.

Treatment options of failed labral repair is of a difficult pathway, especially in our country. Excision will lead to failed suction cup mechanism provided by the functional labrum. Labral reconstruction seems to be a more promising option, but the difficulty of obtaining allograft in Indonesia caused by religious issue and unavailability of tissue bank that can process source of graft force us to choose autograft with its consideration. Harvesting too much of tensor fascia lata will cause donor site morbidity, but inadequate graft will lead to a less functional result. We measure the ideal size of tensor fascia lata to be harvested that will create the most optimum graft size.

Eight specimens were obtained from cadaver. From each specimen we dissect graft width into 5 groups (10, 15, 20, 25 and 30mm). Graft was then prepared using standard graft preparation technique. Afterwards we measure diameter of produced tubular graft. Our result showed that graft with width of 10, 15, 20, 25 and 30 mm produce tubular diameter of 1,5; 3,2; 4,3; 5,1; 6,8 and 8,3 mm (respectively). Based on that result we conclude that 20mm of graft harvest to produce 5,1 mm tubular shape (2 mm of labral tissue and 3 mm of docking site ) is the ideal size of harvest size.
EP11.13 Circumferential labral reconstruction for femoroacetabular impingement in athletes: Return to sport and technique

MD John Scanaliato1, Jesse Chasteen3, Catherine Salfiti2, MD Andrew Wolff2
1Texas Tech University of The Health Sciences, El Paso, United States, 2Washington Orthopaedics and Sports Medicine, Washington, United States, 3Uniformed Services University School of Medicine, Bethesda, United States

Biography
Dr Wolff is a board-certified, fellowship-trained orthopaedic surgeon who specializes in hip arthroscopy, hip preservation and sports medicine. He has been in practice in the Washington, DC area since 2008 and joined Washington Orthopaedics and Sports Medicine in the fall of 2013. He is widely recognized as an expert in the field of hip arthroscopy and preservation.

As a leader in the field of orthopaedic surgery, Dr Wolff served as the president of the Washington Orthopaedic Society in 2012-2013. He also served as the organization’s vice president and treasurer. He co-chaired the 2012 Virginia Orthopaedic Society meeting and is an active member of the International Society for Hip Arthroscopy, the Arthroscopy Association of North America, the American Orthopaedic Society for Sports Medicine and a fellow of American Academy of Orthopaedic Surgeons. He is the Washington, DC representative of the Medicare Carrier Advisory Committee.

Dr Wolff is a graduate of Amherst College and Washington University School of Medicine in Saint Louis. He went on to complete his Orthopaedic Surgery residency training at Yale University and a Sports Medicine and Hip, Knee and Shoulder fellowship at the Steadman Clinic in Vail, Colorado.

Objectives
To investigate outcomes in athlete hips treated with circumferential labral reconstruction

Methods
All consecutive patients over a one-year period that underwent circumferential labral reconstruction with ITB allograft by the senior surgeon with complete two-year outcome scores were identified. Non-athlete hips were excluded from analysis. The International Hip Outcome Tool (iHot-12) and visual analogue scales (VASs) were completed by patients within one week prior to surgery and between 22 and 26 months postoperatively.

Results
30 hips in 30 unique patients met the inclusion criteria for this study. Seven hips were varsity level high-school or collegiate athletes, 7 were competitive recreational athletes, 1 was a professional athlete, and the remaining 15 were dedicated recreational athletes. All hips had MRI-arthrogram-confirmed labral tears and had failed conservative measures. The average patient age was 30.4 years old. The mean preoperative iHot12 was 24.33 and the mean postoperative iHot12 was 86.45 (p-value < 0.001). Mean preoperative pain VAS was 5.10 and the mean postoperative pain VAS was 1.21 (p-value < 0.001). Mean satisfaction VAS at two years was 8.49/10. Twenty-six out of thirty (86.67%) hips were able to return to play. Overall, only 1/30 (3.33%) of patients did not return to play due to operative-sided hip pain. Mean time to return to play was 6.19 months. At 2 years post-operatively, all patients exceeded criteria for Patient Acceptable Symptomatic State (PASS) as well as Substantial Clinical Benefit (SCB). No patients demonstrated signs or symptoms of treatment failure at time of publication (3.81 years).

Conclusion
Two-year outcomes in this heterogeneous population of athletes demonstrate a statistically and clinically significant improvement in patient-reported outcomes, a statistically significant decrease in pain, high-levels
of patient satisfaction and an overall return to play rate of 86.67%. The principle reason for an inability to return to play was contralateral hip pain. Circumferential labral reconstruction is a viable treatment option for athletes with labral tears and intraarticular hip pain and should be considered in the treatment algorithm for all levels of athletes with intraarticular hip pain.
EP11.14 Outcomes following labral augmentation using ITB allograft versus autograft

Dr Travis Dekker¹, Dr Lauren Pierpoint¹, Mr. James Spratt¹, Dr William Grantham¹, Dr Marc Philippon¹
¹Steadman Philippon Research Institute, Vail, United States

Background
Iliotibial band (ITB) grafts for labral augmentation are preferred by many surgeons due to their biomechanical properties and metaplastic capabilities. It is still unclear if ITB allograft or autograft is preferable. Allografts carry downsides including increased cost and risk of disease transmission. Autograft harvesting can lead to donor site morbidity and increased operative time.

Purpose
To compare clinical outcomes and patient satisfaction between patients who underwent labral augmentation with ITB autograft vs. ITB allograft.

Methods
From January 2005 to December 2016, patients who were ≥18 years and underwent labral augmentation during hip arthroscopy with ≥ one year of follow up were identified. Patients undergoing augmentation with ITB autograft or ITB autograft were compared. Both grafts were used for augmentation with the same operative technique. Other pathologies addressed included femoroacetabular impingement and cartilage damage. Clinical outcome scores including modified Harris Hip Score (mHHS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Hip Outcome Score (HOS)-Activities of Daily Living (ADL), HOS-Sports, and SF-12-MCS were compared between groups using independent t-tests, Wilcoxon rank sum, of Chi square, depending on the distribution.

Results
Fifty-two patients (36 females, 16 male) met inclusion criteria. Twenty-four patients were in the allograft group (mean age=37.5±13.1 years); 28 were in the autograft group (mean age=34.6±8.4 years). There were no significant differences in patient demographics. At follow up, no significant differences were observed in mHHS (p=0.08), WOMAC (p=0.16), HOS-ADL (p=0.05), and SF-12-MCS (p=0.51). Patient satisfaction for autograft and allograft augmentation was similar (7.3±3 vs.7.3±2.7, p=0.77, respectively). ITB autograft was associated with a significantly higher HOS-sport than allograft (66.8±29.1 vs. 49.3±33.3, p=0.04, respectively).
Conclusion
At minimum one year follow up, labral augmentation with ITB allograft and ITB autograft may show comparable results when evaluating select patient reported functional outcome scores.
Alterations in mechanics of cartilage in the hip are known to contribute to the initiation and progression of osteoarthritis. Specifically, degradation of the cartilage influences the mechanics of the tissue through altered fluid pressurization and fluid load support (FLS). Experimental studies demonstrate the labrum helps seal fluid within the hip joint through prevention of fluid exudation from the joint space. However, the role of the labrum in sustaining fluid pressure and FLS within the cartilage layers of the hip is unknown. Additionally, the influence of the labrum on stress and strain within the solid phase of the cartilage has not been studied. The objective of this study was to examine the role of the labrum in maintaining FLS and determine the effect of its presence on the solid phase of the adjacent cartilage during simulated activities of daily living using finite element analysis. To obtain a computationally efficient model that represented a normal population of hips, an idealized finite element model was created based on the cartilage geometry of a representative normal hip (31-year-old female, BMI 22 kg/m², CEA 29.2°, AI 9.7°). The baseline model was compared to one with the labrum removed during simulated activities of daily living. The resulting surface at the edge of the articular cartilage was assigned a free-draining boundary condition to assess the effect of the labrum on the fluid phase in the cartilage and influence on the adjacent solid phase. This removes any contribution from the labrum as a seal or mechanical boundary; fluid can flow out of the edge of the cartilage and deformation may occur at the edge without being restricted by the labrum. We found that the removal of the labrum did not increase the loss of FLS within the articular cartilage (<1% difference between intact vs removed labrum after 600 s single-leg stance). However, removal of the labrum increased deformation of the articular cartilage at its periphery, causing higher stress and strain (8% and 48% increase in tensile strain and shear stress, respectively). These results motivate the evaluation of labral reattachment strategies to preserve the labrum as a mechanical boundary.
EP11.16 Indications and outcomes of arthroscopic labral reconstruction of the hip - a systematic review

Dr Nikunj Trivedi1, Dr Lakshmanan Sivasundaram1, Dr Charles Su1, Dr Derrick Knapik1, Dr Chad Mather III2, Dr Shane Nho3, Dr Michael Salata1

1University Hospitals, Cleveland Medical Centre, Cleveland, United States, 2Duke University Medical Centre, Durham, United States, 3Rush University Medical Centre, Chicago, United States

Purpose

The primary purpose of our investigation was to systematically evaluate the literature for the current indications and outcomes following arthroscopic labral reconstruction of the hip. Our secondary purpose was to evaluate the role of arthroscopic labral reconstruction in the management of reparable labral tears.

Methods

A systematic review was conducted according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines using a PRISMA checklist. Studies published between June 2009 and June 2018 that evaluated outcomes following arthroscopic labral reconstruction with a minimum of one year of follow up were included.

Results

Eleven studies met inclusion and exclusion criteria. A total of 373 patients were identified. Nine of the 11 studies reported that an irreparable labrum was their indication for reconstruction, with eight reporting that this was ultimately determined intraoperatively. There was substantial variability in surgeon, technique, graft choice, and concurrent pathology. All 11 studies employed at least one validated functional outcome metric to evaluate surgical outcome, with all studies reporting improvement greater than the minimally clinically important difference. Donor site pain was the most common complication, although only reported in two studies. Reported rates of revision surgery and conversion to arthroplasty were low (range 0-9.1% for both).

Conclusions

All 11 included in this systematic review reported clinically significant functional improvements following arthroscopic labral reconstruction and low rates of complications, revision surgery, and progression of arthritis, although graft type and concomitant procedures confound the results. The most common indication for reconstruction was intraoperative evaluation of a deficient labrum. The six studies that evaluated patient satisfaction reported favourable results, with a range of 6.73 to 8.7.
Background
Labral pathology has been clinically identified as a potential contributor to hip micro instability. However, its effects on the biomechanics of the hip joint have not been quantitatively defined.

Purpose
The purpose of this study was to measure hip kinematics during range of motion and impingement tests in gradually increasing labral pathology models using a 6-degrees of freedom robotic system.

Methods
Four male and four female unpaired full-femur cadaveric hip specimens were tested. A 6-degrees-of-freedom robotic system was used to assess range of motion (ROM) and femoral head translation (FHT) throughout eight tests: flexion, extension, internal rotation, external rotation, abduction, adduction, abduction at 45° of flexion, and anterior impingement. All tests were run under 60N of superior joint compression and minimized forces on the anterior and lateral axes. Tested states included: 1) Native, 2) Sham arthroscopy, 3) Separation of chondrolabral junction, 4) Labral resection, and 5) Capsular laxity model obtained by stretching the iliofemoral ligament (IFL) for one hour under extension torque of 25 Nm for females, 35 Nm for males. Labral pathologies were created arthroscopically through two portals. Random-intercepts linear mixed-effects models were used to compare consecutive states.

Results
No significant differences (P<0.05) were found in FHT between states. Eight significant differences in ROM were observed. Labral resection: abduction at 45° flexion (0.51°); capsular laxity model: extension (4.00°); internal rotation (1.85°), external rotation (2.20°), abduction (1.64°), adduction (0.90°), abduction at 45° flexion (0.63°), and anterior impingement (1.74°).

Conclusion
While labral deficiency alone did not significantly increase hip range of motion, the addition of capsular laxity led to a significant increase in all but one test. These results indicate that isolated labral pathology has a minimal impact on hip range of motion but may be important in the presence of concomitant capsular pathology.
The hip suction seal: The effect of pincer resection, chondrolabral junction separation, and labral repair/refixation on hip distractive stability

Dr Hajime Utsunomiya¹, Mr Hunter Storaci¹, Mr Samuel Rosenberg¹, Mr Bryson Kemler¹, Mr Grant Dornan¹, Mr Alex Brady¹, Dr Marc Philippon¹

¹Steadman Philippon Research Institute, Vail, United States

Background
An unstable labrum can result from chondrolabral junction (CLJ) separation, especially in association with pincer-type FAI, and is thought to lead to pain caused by free nerve endings in the labrum.

Purpose: To evaluate the hip suction seal biomechanics of the labrum in labral states associated with pincer-type FAI.

Hypothesis
CLJ separation changes hip suction seal biomechanics relative to the native state, while repair restores these biomechanics.

Methods
Twelve fresh-frozen hips were dissected, leaving only the labrum and ligamentum teres intact, and mounted to a saline bath on a dynamic tensile testing machine. The joint was distracted at a rate of 0.5 mm/s while a recording force, displacement and intraarticular pressure. Hips were randomly allocated into two groups: (1) CLJ Cut and (2) CLJ Intact. The following labral states were tested: (1) Native, (2) Pincer resection, (3) Separated CLJ (CLJ Cut group, only) and (4) Labral repair. A linear mixed-effects model was used to compare biomechanics between states.

Results
Pincer resection did not affect any suction seal parameters relative to the native state. In both groups, maximum distraction force and magnitude of peak negative pressure were significantly lower in the labral repair state than the native state (p < 0.05). In the CLJ Intact group only, the distance to suction seal rupture was significantly decreased in the labral repair state (1.8 mm) compared to the native state (5.6 mm, p = 0.002).

Conclusion
Labral repair resulted in a shorter distance to suction seal rupture when the CLJ remained intact, indicating reduced labral mobility, which may be beneficial in postoperative pain relief and healing. New strategies, such as the utilization of an absorbable suture, should be utilized to address the observed decrease in maximum distractive force and restore the native biomechanics of the labrum in the long term.
Clinical relevance

The labral repair reduced labral mobility, which could be beneficial for both pain relief and labral healing to the acetabulum following pincer-type FAI resection.
The hip suction seal: The role of acetabular labral height on hip distractive stability

Mr Hunter Storaci1, Dr Hajime Utsunomiya1, Mr Bryson Kemler1, Mr Samuel Rosenberg1, Mr Grant Dornan1, Mr Alex Brady1, Dr Marc Philippon1

1Steadman Philippon Research Institute, Vail, United States

EP11 - Labral repair

Background
The acetabular labrum is recognized as a significant contributor to the distractive stability of the hip.

Purpose
To evaluate the biomechanics of the native hip suction seal and its relationship to labral height.

Hypothesis
Decreased labral height is associated with decreased distractive stability.

Methods
12 fresh-frozen cadaveric hemi-pelvises were dissected, leaving only the labrum and ligamentum teres intact, and mounted to a saline bath in a dynamic tensile testing machine. The joint was distracted at a rate of 0.5 mm/s while recording distraction force, displacement and intraarticular pressure. Labral size was measured using a digital calliper. Correlation between factors was analysed by Spearman method, and difference between groups was detected by Mann-Whitney U-test.

Results
Mean labral height was 6.48 mm (SD 2.65, range 2.62-11.90). Maximum distraction force and peak negative pressure were observed simultaneously and significantly correlated (rho = 0.83, p = 0.001). Labral height was moderately to strongly correlated with all suction seal parameters (maximum distraction force, R = 0.69, p = 0.013; distance to suction seal rupture, R = 0.55, p = 0.063; peak negative pressure, R = -0.62, p = 0.031). Hips with smaller labra (< 6 mm) had significantly shorter distance to suction seal rupture (median, 2.3 v 7.2 mm, p = 0.010) and significantly decreased peak negative pressure (median, -59.3 v -66.9 kPa, p = 0.048) compared to hips with larger labra (> 6 mm).

Conclusion
Labral height was observed to be moderately to strongly correlated with suction seal biomechanics. Smaller height (< 6 mm) of the acetabular labrum was significantly associated with decreased distance to suction seal rupture and decreased peak negative pressure. A new strategy to increase the size of the labrum, such as labral augmentation, could be justified for patients with smaller labra to optimize the hip suction seal.
Clinical relevance
The height of the acetabular labrum is correlated with hip suction seal biomechanics. Further studies are required to identify the clinical effects of labral height on hip stability.
EP11.20 Clinical outcomes of arthroscopic repair of acetabular labral tears

MD Carlos Vassalo¹, Rafael Baroni Carvalho³, MD Antônio Augusto Guimarães Barros³, MD Lincoln Paiva Costa³, MD Euler de Carvalho Guedes¹, MD, PhD Marco Antônio Percope de Andrade²
¹Hospital Madre Teresa, Belo Horizonte, Brazil, ²Departamento do Aparelho Locomotor da Faculdade de Medicina da UFMG, Belo Horizonte, Brazil

Purpose
To evaluate the primary clinical outcomes of arthroscopic labral repair.

Methods
All patients who underwent arthroscopic repair of the acetabular labrum performed by the senior surgeon between October 2010 and December 2013 were invited to participate in this prospective study. Patients included were those who have a pre-operative diagnosis of labral tears, a lateral centre edge greater than 25° and labral tear believed to be suturable during the intra-operative evaluation. Patients with Tönnis grade-2 or grade-3 hip osteoarthritis, those who had undergone a previous hip surgery, and those who refused to sign the informed consent were excluded. All patients were evaluated using the modified Harris Hip Score (mHHS) during the final appointment before surgery, 4 months after surgery, and at the final evaluation. Interviews were conducted by the senior surgeon.

Results
Eighty-four patients (90 hips) underwent arthroscopic repair during the study. The mean age was 44.2 years and the mean follow-up period was 42.9 months (minimum of 25 months and maximum of 59 months). The mean mHHS was 80.44 preoperatively, 94.96 at 4 months postoperatively, and 96.60 at final evaluation. A statistically significant difference existed among these scores (p < 0.001).

Conclusions
Arthroscopic labral repair resulted in a clinically significant improvement in mHHS after short-term (4 months) and medium-term (43 months) follow-up.

Level of Evidence
Level IV, therapeutic case series.

Keywords
Arthroscopy, Hip, Recovery, Sporting injuries, Treatment.
EP12.1 Intraoperative monitoring and intra-abdominal fluid extravasation during hip arthroscopy

Dr Bernardo Aguilera-Bohórquez1, Ms Erika Cantor1, Dr Orlando Ramos-Cardozo1,2, Dr Mauricio Pachón-Vasquez1
1Centro Medico Imbanaco De Cali S.a, Cali, Colombia, 2Universidad Javeriana de Cali, Cali, Colombia

EP12 - Communicating risk and managing complications

Biography
Dr Bernardo Aguilera is an orthopaedic surgeon from Universidad del Valle. He has a Fellowship in Reconstructive Orthopaedics from University of Alabama and his work is focused on hip arthroscopy. He is the founder of the hip preservation unit (UPRECA) at Centro Medico Imbanaco located in Cali, Colombia. Dr Aguilera is professor and director of the hip preservation arthroscopic surgery fellowship at Universidad Javeriana and since its creation in 2011, he has trained 14 fellows in hip arthroscopy.

Background
The extravasation of fluid to the intra-abdominal space is recognized as a possible complication of hip arthroscopy.

Objective
To evaluate the relationship between the intraoperative monitoring factors with intra-abdominal fluid extravasation (IAFE) in patients who underwent hip arthroscopy.

Methods
We carried out a prospective observational study of 106 hip arthroscopies between June 2017 and June 2018. Ultrasound was performed by a trained anaesthesiologist before and after the surgery to identify the presence of fluid. The hepatorenal (Morison’s pouch), splenorenal, retro aortic, suprapubic (longitudinal and transverse) and pleural spaces were examined. During hip arthroscopy, mean blood pressure (MBP), heart rate (HR), temperature (T), peak inspiratory pressure (PIP), oxygen saturation (SaO2), end-tidal carbon dioxide (ETCO2), and pulmonary compliance values were recorded every 15 min.

Results
A total of 106 patients were included, with an average age of 47.3 ± 14.3 years, 66.0% were women; 80.2% (85) had femoroacetabular impingement (FAI) and 50.9% (54) deep gluteal syndrome. The incidence of IAFE was 31.1% (33/106) [95% Confidence Interval-CI: 23.0%-40.5%]. Fluid pump pressure during surgery was similar between groups, with a maximum pressure of 65.8±18.8 mm Hg. No statistically significant relationship was found in BP, HR, Temperature, SaO2, ETCO2, and pulmonary compliance between cases with and without IAFE. Maximum values of PIP pressure greater than 20 mm Hg were associated with fluid extravasation (Odds Ratio: 3.22 [95% CI: 1.07-9.68]).

Conclusion
IAFE is a frequent event during hip arthroscopy. PIP could be considered a useful intraoperative monitoring parameter for identification of patients with IAFE.
EP12.2 Traction related complications using a post in hip arthroscopy. What alternatives do we have? A systematic review

Mr. Carlos R. Arriaza1, Mr. Carlos Suarez-Ahedo2, Mr. Luis Perez-Carro3
1Hospital Herrera Llerandi, Guatemala City, Guatemala, 2Instituto Nacional de Rehabilitacion, Tlalpan, Mexico, 3Hospital Clinica Mompia, Mompia, España

Purpose
The primary objective is to determine the rate of complications in hip arthroscopy using a post for distraction of the joint. Secondary objective is to provide alternatives of distraction without a post and report their complications.

Methods
A systematic review of the PubMed database was made in March 2019. All clinical studies that reported the complications caused by the post during the traction in hip arthroscopy were eligible for inclusion. Additionally, all clinical studies that reported different alternatives of distraction without a post were also included. Data pertaining to patients’ demographics characteristics, surgical position and a detailed complication of the nerve or groin soft tissue injury related to traction were extracted from each study.

Results
A total of 24 studies (6134 hips) using a post for distraction were included. The total complications in hip arthroscopy was 6.93%. Traction related complication consisted of 30% of the total complications. The most common was neurologic (95.2%). The pudendal neuropraxia consisted of 60.5%, sciatic neuropraxia 20.9% and peroneal neuropraxia 13.7% of the cases. The soft tissue complication was mainly vulvar injury (4.9%). Three studies (1193 hips) using an alternative technique for distraction were included. Two studies used a shape conforming foam and Trendelenburg position to generate enough friction with the bed and one study used a distractor pinned to the acetabulum and femur. No groin related soft tissue or nerve complication were documented.

Conclusion
Traction related complication utilizing a post for distraction consisted of 30% of the total complications. The neurologic complication was predominant and is considered a minor complication that usually resolves in weeks, but catastrophic nerve damage can occur. The major risk factor for this type complication is using a post. Distraction without a post has been well described and despite the small amount of studies, they all reported 0% of neurologic and soft tissue complication. To avoid this type of complication care should be done during positioning of the patient, traction time and traction force or search for an alternative. In our experience we started using a post less technique and have zero complications related to distraction.
Preoperative duration of symptoms is associated with outcomes five years after hip arthroscopy for femoroacetabular impingement syndrome

Dr Benedict Nwachukwu¹, Dr Edward Beck¹, Mr. Ian Clapp¹, Mr. Kyle Kunze¹, Dr Jorge Chahla¹, Mr. Jonathan Rasio¹, Dr Shane Nho¹
¹Rush University Medical Centre, Chicago,

Background
Preoperative symptom duration greater than two years prior to hip arthroscopy for femoroacetabular impingement syndrome (FAIS) is associated with worse short-term outcome postoperatively. However, the effect of symptom duration on medium to long term outcomes after hip arthroscopy for FAIS is not well understood.

Purpose
To determine the effect of preoperative duration of FAIS-associated symptoms on clinical outcomes at a minimum of five years after hip arthroscopy.

Methods
FAIS patients who underwent primary hip arthroscopy between January 2012 and January 2014 and had a minimum of five-year follow-up were identified. Patient demographics and clinical outcomes Hip Outcome Score- Activities of Daily Living (HOS-ADL), HOS – Sports Subscale (HOS-SS), modified Harris hip score (mHHS), pain, and satisfaction were analysed. The minimal clinically important difference (MCID), patient acceptable symptomatic state (PASS), and substantial clinical benefit (SCB) were calculated. Patients were stratified based on preoperative duration of symptoms greater than or equal to two years. Multivariate regressions were constructed to determine the association between preoperative symptom duration and clinical outcomes at five years after hip arthroscopy.

Results
A total of 310 patients were included with a mean (± standard deviation) age of 34.1±11.9 years and BMI of 25.3±5.1 kg/m². All patients demonstrated statistically significant improvements in mean HOS-ADL, HOS-SS, mHHS, pain and satisfaction scores (p<0.001 all). Preoperative duration of symptoms greater than two years was an independent predictor of worse HOS-ADL (β=-5.5, p=0.041), HOS-SS (β=-12.1, p=0.006), mHHS (β=-9.6, p=0.011), and pain (β=-9.6, p=0.023) scores. Furthermore, a longer duration of symptoms was associated with a lower likelihood of achieving the MCID for the HOS-ADL (Odds ratio [OR] = 0.53, p=0.037), HOS-SS (OR=0.38, p=0.003), and mHHS (OR=0.43, p=0.009); the PASS for the HOS-SS (OR=0.44, p=0.006) and mHHS (OR=0.46, p=0.006), but not the HOS-ADL despite trending towards significance (OR=0.59, p=0.098); and the SCB for the HOS-ADL (OR=0.50, p=0.011), HOS-SS (OR=0.52, p=0.020) and mHHS (OR=0.47, p=0.007).

Conclusion
Patients with a preoperative duration of FAIS-associated symptoms greater than two years prior to hip arthroscopy experience worse outcomes and a lower frequency of clinically significant outcome improvement at medium to long term follow-up.
EP12.4 Factors associated with primary hip arthroscopy failure in the young female population

Dr Ioanna Bolia¹, Dr Ashley Payne¹, Ms Karen Briggs¹, Dr Marc Philippon¹

¹Steadman Philippon Research Institute, Vail, United States

Biography
Dr Bolia completed medical school in Greece, followed by a research fellowship at the Steadman Philippon Research Institute. She has completed a one-year surgical residency at Wake Forest.

Recent studies have shown that female patients are more likely to require revision hip arthroscopy. While most revisions are due to post-operative adhesions, it is unclear what factors may increase the risk of revision in this population. The aim of this study was to identify risk factors which may lead to treatment failure following primary hip arthroscopy in young females.

Methods
Following IRB approval, 200 females between the ages of 15 and 25 who underwent hip arthroscopy were identified. The average age was 19.7±2.5 and average BMI was 21.9±3. Twenty-three patients had a BMI <19. Patient characteristics, surgical variables, and patient reported outcomes were collected. Outcomes were collected preoperatively and postoperatively. Outcomes scores included HOS-ADL, HOS-Sport, mHHS, WOMAC, and patient satisfaction (1 to 10 with 10 being very satisfied). Failure was defined at the need for revision arthroscopy or symptomatic failure defined as HOS-ADL score less than 50 or patient satisfaction less than 5 at follow-up.

Results
Thirty (15%) required revision arthroscopy and 15 (7.5%) had symptomatic failure. There was no difference in age or BMI between the non-failures and failures; however, patients with BMI <19 were 4.6 times more likely to fail [95% CI, 1.8 to 12.3] (p=0.002). Patients who participated in “at-risk” sports (dance, ice hockey, ice skating, softball, tennis) were 3.5 times more likely to fail [95% CI, 1.7 to 7] (p=0.001). There were no significant differences in radiographic measurements or surgical variables between the groups. Preoperatively, the failures had lower SF-12PCS (38.2 vs; 43; p=0.015), lower mHHS (55 vs 61; p=0.033), lower HOS ADL (61 vs 68, p=0.019) and higher disability on WOMAC (38 vs. 25; p=0.004).

Conclusion
Young females who fail hip arthroscopy are more likely to be under weight and participate in sports that put the hip at risk. In addition, their preoperative outcomes scores are lower than patients who do not fail. Nutrition education and modifications of the patients’ sport training may reduce failures and rehabilitation may improve their preoperative scores and result in fewer failures.
EP12.5 Multimodal intra-operative monitoring (IOM) of sciatic and femoral nerves during periacetabular osteotomy (PAO): a novel method

Dr Federico De Meo1, Dr Alejandra Climent2, Dr Carломagno Cardenas3, Dr Vittorio Bellotti1, Dr Emanuele Astarita3, Dr Gabriel Chacon3, Dr Luis Ramirez3, Dr Pietro Cavaliere1, Dr Manuel Ribas3

1Istituto Ortopedico del Mezzogiorno Franco Scalabrino, Messina, Italy, 2Intraoperative Neurophysiology Unit Department of Pediatric Neurology, Hospital Sant Joan de Deu, Barcelona, Spain, 3Hip Unit iCATME, Quiron Dexeus, Barcelona, Spain

Biograph:
Dr Federico De Meo is dedicated full time to the treatment of lower limb pathology with special attention to Hip Surgery. He works in the development of procedures, surgical techniques and the incorporation of new technologies in the care of the musculoskeletal system. He completed his training as a specialist in Traumatology and Orthopaedic Surgery, iCATME Dexeus Barcelona) he accumulates extensive experience in reconstructive surgery of the hip and knee with emphasis on the pathology of the athlete and the young adult.

Periacetabular osteotomy (PAO) is a worldwide accepted procedure, which provides a powerful three-dimensional redirection of the acetabulum, maintaining hyaline to hyaline contact and congruency. Posterior column preservation enables early postoperative assisted deambulation. It’s a high demanding technique with intra-operative mayor complications estimated between 6 to 30%. Multimodal IOM using evoked potential and other methods during PAO surgery to assess sciatic and femoral nerves functional integrity has not been described yet.

The aim of this study is to analyse the femoral and sciatic nerve behaviour during the different steps of the surgery in a group of patients with residual hip dysplasia treated by PAO under a novel multimodal IOM. 40 patients treated with PAO between 2010 and 2012 were analysed. The sample was divided by sex, age and severity of disease with preoperative evaluation criteria represented by measurement of Wiberg angle and acetabular index (in coronal and sagittal projection). The multimodal IOM techniques include motor evoked potential (MEP), somatosensory evoked potential (SEP), free-running EMG, posterior root muscle reflex (PRMR) and anterior root muscle response (ARMR). The effectiveness of multimodal IOM as prevention of nerve injury was examined. After a mean follow-up time of 15 months (range 6 – 24 months), the subjective rating scales that were Western Ontario and McMaster Universities Arthritis Index (WOMAC) and the nonarthritic hip score (NAHS) were obtained.

Detection of significant changes occurred in 11 patients (11/40, 27,5 %) in one or more parameters of multimodal evoked potentials. In 8 cases (8/40, 20%) changes were reversible after warning the surgeon and taking appropriate manoeuvres. In 3 cases (3/40, 7,5 %) the changes were irreversible correlating with the postoperative neurological deficit.

Multimodal IOM during a mini invasive trans-sartorius PAO is a valid method for nerve injury prevention. Association of multimodal IOM techniques allows identifying the moment and the manoeuvre which may damage nerves before irreversible injury.

PRMR and ARMR could emerge as new IOM techniques to assess the functional integrity of lumbosacral plexus and nerves. These techniques have the potential to give more specific information of the integrity of lumbosacral roots and nerves than MEPs and SEPs alone.
EP12.6 Identifying the most successful procedures in hip arthroscopy: A multivariate analysis of 1,000 surgeries to assess which procedures work best, and which procedures need improvement

Dr Jon Hammarstedt1, Joseph Laseter2, Dr Asheesh Gupta3, Dr John Christoforetti4, Dr Ajay Lall5, Dr Benjamin Domb5

1Allegheny General Hospital, Pittsburgh, United States, 2Case Western Reserve University School of Medicine, Cleveland, United States, 3Nova Orthopaedic & Spine Care, Woodbridge, United States, 4Texas Health Sports Medicine at Allen, Allen, United States, 5American Hip Institute, Chicago, United States

Biography
Dr Jon Hammarstedt is an orthopaedic surgery resident at Allegheny General Hospital.

Hip arthroscopy has increased dramatically in recent years as a treatment methodology for femoral and acetabular pathologies. However, there is little existing literature analysing which procedures are predictors of revision arthroscopy or total hip arthroplasty.

From February 2008 and November 2015, data was collected prospectively and retrospectively reviewed. Inclusion criteria were patients undergoing hip arthroscopy for a labral tear with minimum two-year follow-up and between eighteen and sixty years old. Exclusion criteria were previous surgeries, Tönnis grade >1, and previous hip conditions.

There were 1,521 eligible hips with follow-up for 1,118 patients (1,249 hips) (81.7%). The cohort had a mean age of 38.7 years (range:18.0, 60.0) and mean BMI of 26.4 (range 16.3, 48.9), with a mean follow up was 50.2 months (24.0 – 111.9). 122(9.8%) patients converted to THA at a mean of 35.3 months (1.4, 95.2). Multivariate analysis for predictors of THA found age at surgery (HR=1.064/yr,p<.05), BMI (non-linear, p<.05), labral debridement (HR=1.558,p=0.03), trochanteric bursectomy (HR=0.367,p<.05), and notchplasty (HR=2.128,p<.05) as significant. 124(9.9%) patients underwent revision hip arthroscopy with a mean time to revision of 21.7 months (0.10, 83.3). Multivariate analysis for predictors of revision surgery found age at date of surgery (HR=0.973/yr,p<.05), worker’s compensation(HR=3.352,p<.05), capsular repair (HR=1.950,p<.05), femoral head chondroplasty (HR=0.241,p=0.05), and femoral head microfracture (HR=2.844,p=0.04) to be significant.

For 20 procedural variables, our multivariate model found notchplasty, labral debridement, and trochanteric bursectomy to be predictive for THA, while capsular repair, femoral head microfracture, and absence of femoral head chondroplasty to be predictive of revision arthroscopy. Numerous factors affect hip arthroscopy and understanding risk factors for conversion to THA or revision is paramount during discussions with patients.
EP12.7 Unplanned readmissions following hip arthroscopy: Incidence and risk factors

Dr Jerry Du\textsuperscript{1}, Dr Derrick Knapik\textsuperscript{1}, Dr Nikunj Trivedi\textsuperscript{1}, Dr Lakshmanan Sivasundaram\textsuperscript{1}, Dr Richard Mather III\textsuperscript{1}, Dr Shane Nho\textsuperscript{4}, Dr Michael Salata\textsuperscript{1}

\textsuperscript{1}University Hospitals Cleveland Medical Centre/ Case Western Reserve University, Cleveland, United States of America, \textsuperscript{2}MetroHealth Medical Centre, Cleveland, United States of America, \textsuperscript{3}Duke University School of Medicine, Durham, United States of America, \textsuperscript{4}Section of Young Adult Hip Surgery, Division of Sports Medicine, Department of Orthopaedic Surgery, Rush Medical College of Rush University, Rush University Medical Centre , Chicago, United States of America

Purpose
The purpose of this study was to determine the rate of and risk factors for 30-day unplanned readmissions following hip arthroscopy in a United States population.

Methods
Patients undergoing hip arthroscopy were identified in the American College of Surgeons NSQIP database using validated current procedural terminology (CPT) and International Classification of Diseases, Ninth Revision and Tenth Revision (ICD-9 and ICD-10) codes. Patient demographics, comorbidities, pre-operative laboratory values, surgical details, and post-operative outcomes were compared between patients with unplanned readmissions and those without. Univariate analysis comparing study cohorts was performed using two-tailed student’s t-tests with Levene’s test for equality of variance or chi-squared/ fisher’s exact tests as appropriate. Using variables that were significant in the univariate analysis, cox proportional hazard models were created to identify independent predictors for unplanned readmission.

Results
A total of 1931 cases of hip arthroscopy were identified. There were 18 cases of unplanned readmissions within 30 days of index procedure (0.9%). The median time to unplanned readmission was 14.5 days (interquartile range: 3.875-25.125 days). The most common reasons for readmission were surgical site infection (11.1%), wound complications (11.1%), and thromboembolic events (11.1%). Multivariate analysis identified increasing BMI, chronic corticosteroid use, and perioperative blood transfusion as factors independently associated with increased risk for unplanned readmission.

Conclusion
There exists a low incidence of 30-day unplanned readmission, predominantly secondary to surgical site infections, wound complications, and thromboembolic events. Independent risk factors for unplanned readmission include higher BMI, chronic corticosteroid use, and perioperative transfusions.

Clinical Relevance
These findings may help surgeons identify potential areas for intervention to decrease unplanned readmissions following hip arthroscopy while improving quality of care.
EP12.8 Sexual function after hip arthroscopy for femoroacetabular impingement syndrome with capsular management: Position matters

Dr Hannah Morehouse¹, Dr Kyle Sochacki¹, Dr Shane Nho², Dr Joshua Harris¹

¹Houston Methodist Hospital, Houston, United States, ²Rush University Medical Centre, Chicago, United States

EP12 - Communicating risk and managing complications

Biography
Dr Joshua Harris is an orthopaedic surgeon who specializes in sports medicine and arthroscopy. Dr Harris obtained his undergraduate degree from Wright State University in Dayton, Ohio, and he completed both his medical degree and orthopaedic residency at Ohio State University College of Medicine in Columbus. He then completed a fellowship in sports medicine at Rush Medical Centre in Chicago where he was assistant team physician for the Chicago Bulls, White Sox, and DePaul University. Dr Harris’ special interests include sports-related injuries including hip arthroscopy, patellofemoral disorders, multiligamentous knee injuries, knee joint preservation, and platelet-rich plasma (PRP).

Background
There is limited evidence on the safety of return to sexual activity following hip arthroscopy. Purpose: To determine the safety of sexual activity after hip arthroscopy relative to hip instability and/or impingement risk.

Methods
Twelve common sexual positions were identified. Gender-specific hip motion was then assessed for the possibility of post-arthroscopic hip instability (due to disruption of iliofemoral ligament [interportal capsulotomy] repair) and/or impingement (labral or capsular compressive stress with disrupted repair) for all 12 positions (both right and left hips; 15 unique male and 14 unique female positions). Instability risk was defined as greater than 0° hip extension, greater than 15° external rotation (ER), or greater than 20° abduction. Impingement risk was defined as greater than 90° hip flexion, greater than 0° internal rotation (IR), and greater than 0° adduction.

Results
Return to sexual activity following hip arthroscopy may cause instability in 10/15 of male positions and 10/14 female positions. All male positions were at risk for instability due to excessive ER. Two positions were unstable due to a combination of ER and abduction and one position due to a combination of ER and extension. In female instability positions, 12 were unstable because of excessive abduction and 6 due to excessive external rotation. Impingement may be observed in 5/15 male positions and 8/14 female positions. In male impingement positions, all were due to excessive adduction. Four female positions risked impingement due to excessive flexion and four positions due to IR.

Conclusions
Following hip arthroscopy, patients need to be made aware of the possibility of hip instability and impingement due to excessive hip motion that may compromise their outcome. This study demonstrates risks that should be considered when counselling patients pre and post-operatively regarding sexual activity.
EP12.9 Rapidly destructive arthrosis of the hip two months after hip arthroscopy: A case report
Mr Kourosh Kalachi, Dr Scott Koenig, Dr Farshad Adib
1University of Maryland School of Medicine (UMSOM), Baltimore, United States of America

Biography
Farshad Adib, MD, is an Assistant Professor of Orthopaedics at the University of Maryland School of Medicine. He specializes in sports medicine and total joint care. His focus is on the care of pediatric and adult patients with hip and knee disorders.

He is the author of several peer-reviewed scientific articles and book chapters on the topics of hip arthroscopy and other hip and knee surgeries. In addition, he has presented his research at national and international conferences.

Introduction
Hip arthroscopy is a safe procedure with a major complication rate <1%. Nerve injury, avascular necrosis and femoral neck fracture are some of these major orthopaedic complications that require conversion to total hip arthroplasty. This case serves as a profound example of rapidly destructive arthrosis, a rare complication after hip arthroscopy whose expeditious diagnosis remains difficult to evaluate.

Methods
A 40-year-old South Korean female with history of chronic hip pain and no gross osteoarthritis presents with worsening right hip pain and positive anterior impingement. She had failed all the non-operative treatments and initial radiographs showed minimal sclerotic changes, preserved joint space, and a spherical femoral head (Figure 1). She opted to proceed with right hip arthroscopy, labral repair, and capsular plication.

Results
Initially her symptoms improved but at 2-month follow-up, she presented with an atraumatic increase in right hip pain and an AP pelvis XR showing significant flattening/destruction of the femoral head, loss of joint space and superolateral displacement of the femoral head (Figure 2). Aspiration ruled out possibility of infection while MRI ruled out avascular necrosis. RDA without known cause prompted total hip arthroplasty to be performed.

Discussion
Rapidly destructive arthrosis remains an idiopathic event despite other theories for this etiology. A description of the cause remains elusive because of the rapid onset and lack of reports that catch patients in earlier stages of the problem. One such report found that radiographs prior to ultimate RDA showed progressive joint-space narrowing and T1-weighted MRI revealed a bone-marrow edema pattern on the femoral head and lateral acetabulum. This case report of the first known incident of RDA after hip arthroscopy in a younger female further demonstrates how much more is to be learned about rapidly destructive arthrosis of the hip and first such case in the literature.

Summary
This case report describes the first known rapidly destructive hip arthrosis status post hip arthroscopy in the literature.

Mr. Zain Khazi1, Ms. Qiang An1, Dr Kyle Duchman1, Dr Robert Westermann1

1University Of Iowa Hospitals and Clinics, Iowa City, United States

Purpose
To determine the incidence of postoperative venous thromboembolism (VTE) after hip arthroscopy (HA).

Methods
Patients ≥20 years old who underwent HA between 2007 and 2017 were identified within the Humana Inc. administrative claims database using relevant Current Procedural Terminology (CPT) and International Classification of Diseases Ninth and Tenth Revision (ICD-9 and 10) codes. Basic demographics, including age, gender, obesity (body mass index [BMI] ≥30 kg/m2), oral contraceptive (OC) use, and smoking history, were recorded. Postoperative incidence of deep vein thrombosis (DVT), pulmonary embolism (PE), and VTE was identified at 30 and 90 days postoperatively.

Results
Overall, 9477 HA procedures were performed over the study period of which 5085 (53.7%) were female. The overall incidence of VTE in all patients was 0.77% (n=73) and 1.14% (n=108) at 30 and 90 days, respectively. Multivariate analysis identified age ≥45 (Odds Ratio [OR]: 1.82, 95% Confidence Interval [CI]: 1.36 - 2.49, P = .0001), obesity (OR: 1.54, 95% CI: 1.27 - 1.86, P <.0001), smoking (OR: 1.26; 95% CI: 1.04 - 1.53, P = 0.0177), diabetes (OR: 1.59, 95% CI: 1.32- 1.92, P <.0001), and chronic lung disease (OR: 2.10, 95% CI: 1.63- 2.68, P < .0001) as independent risk factors for higher incidence of VTE after HA. However, neither gender nor OC use were risk factors for VTE after HA.

Conclusions
For patients undergoing HA, the incidence of postoperative VTE is low. Prophylaxis should be considered on a case by case basis. This study identified older age, obesity, tobacco use, diabetes and chronic lung disease as independent risk factors for VTE after HA.
EP12.11 Pain management and activity tolerance in the early postoperative period following post-less low-pressure hip arthroscopy

Dr Matthew Kraeutler¹, Ms. Laylaa Ramos², Dr K Welton³, Dr Tigran Garabekyan⁴, Dr Omer Mei-Dan²
¹St. Joseph’s University Medical Centre, Paterson, United States, ²University of Colorado School of Medicine, Aurora, United States, ³MultiCare Orthopaedics & Sports Medicine, Auburn, United States, ⁴Southern California Hip Institute, North Hollywood, United States

Biography
Dr Kraeutler is a resident physician at St. Joseph’s University Medical Centre in Paterson, New Jersey. His main research and clinical interests include femoroacetabular dysplasia and adult hip dysplasia.

Background
Despite the rapid growth in the use of hip arthroscopy, conclusive and standardized data on optimal postoperative pain management and rehabilitation is lacking.

Purpose
The purpose of this study is to quantify narcotic consumption and use of the stationary bicycle in the early postoperative period following hip arthroscopy performed without a perineal post and utilizing low fluid pressure.

Methods
Patients undergoing a primary post less low-pressure hip arthroscopy procedure by the senior author were asked to fill out a daily survey for nine days postoperatively. Patients were asked to report their pain level each day on a visual analogue scale (VAS) from 1-10 along with the total milligram amount of narcotic (Percocet) pain pills they used during these post-operative days (POD). Patients were also instructed to bike daily starting on the night of surgery for a minimum of 3 minutes twice per day and were asked to rate their pain as a percentage of their preoperative pain level and the number of minutes spent cycling on a stationary bicycle per day.

Results
A total of 182 patients were included in this study. Pain levels (POD1: 5.6, POD4: 3.9, POD9: 3.6) and the percentage of preoperative pain (POD1: 53.7%, POD4: 33.7%, POD9: 30.3%) significantly decreased over the study period (both p < 0.01). The amount of narcotics used per day also significantly decreased (POD1: 3.8 mg, POD4: 2.0 mg, POD9: 0.9 mg, p < 0.0001). Fifty percent of patients discontinued all narcotics by POD4 and, by POD9, 74% of patients were completely off narcotic medication. Patients were able to significantly increase the number of minutes spent cycling each day (POD1: 7.6 minutes, POD4: 14.1 minutes, POD: 19.3 minutes, p < 0.0001). Finally, female patients reported spending significantly more time cycling on POD1 compared to male patients (p = 0.041).

Conclusion
In the days following post less low-pressure hip arthroscopy, patients exhibit a significant and rapid reduction in narcotic consumption as well as a significant increase in activity tolerance. Patients used an average of 3.8 mg of narcotics on POD1, with 50% of patients discontinuing all narcotics by POD4.
EP12.12 Hip arthroscopy in the lateral position using a post-less distraction system

MD Michael Muldoon1,2, Research Coordinator Robert Healey1,2
1Hip Preservation Centre of Excellence, San Diego, United States, 2Sharp Healthcare, San Diego, United States

EP12 - Communicating risk and managing complications

Biography
Dr Muldoon is a graduate of the United States Naval Academy and the Uniformed Services, University of the Health Sciences. Dr Muldoon completed his residency in Orthopaedic Surgery at the Naval Medical Centre, San Diego. He went on to complete a fellowship in Adult Reconstructive Surgery at the Mayo Clinic in Rochester, Minnesota.

At the Naval Medical Centre, San Diego, Dr Muldoon was the Director of the Hip and Knee Service for 7 years and served as the Assistant Chairman of the Department of Orthopaedics.

Dr Muldoon has extensive experience in hip, knee and shoulder replacement surgery as well as complex hip and knee revisions. His particular area of expertise is arthroscopic hip surgery for traumatic and degenerative conditions. Dr Muldoon has a special interest in hip and knee problems in young active patients. Dr Muldoon has published numerous papers on reconstructive surgery and continues to be active in research and teaching at Orthopaedic Medical Group.

Introduction
Central compartment hip arthroscopy requires distraction. Initially traction was applied using fracture tables. As the procedure evolved, specialized devices have been developed using a perineal post to provide counter-traction but allowing the use of standard operating room tables. Traction associated complications have long been associated with the amount of force required as well as traction time. More recently, the use of post-less distraction in the supine has been advocated employing a new traction device, using body weight and Trendelenburg positioning as counter traction. This technique has not been performed in the lateral position to our knowledge and we report our initial experience.

Methods
30 consecutive patients underwent hip arthroscopy in the lateral at one centre using a Guardian hip distractor. (Stryker). We monitored adequacy of traction, amount of traction required, duration, post-operative complaints of neuropraxia, pain in perineal region, and contralateral leg symptoms.

Results
Study included 30 patients over a 5-month period. Seventeen women and 13 men were included with ages ranging from 19 to 61. Weight ranged from 115lbs to 265. Maximum traction force ranged from 40-125lbs. (Average 77lbs) Traction times were between averaged 59 Min (32-91).
Postoperatively, one patient had dorsal foot numbness resolved at 6 weeks. There were no pudendal nerve issues, contralateral limb complaints or midline hip pain reported.
One patient reported transient sciatica 3 weeks post operatively that was not present at 2-week follow-up.
All patients had adequate distraction for safe hip arthroscopy.

Conclusions
Our initial experience suggests that post-less hip arthroscopy can safely be performed in the lateral position. Absence of significant complications is encouraging. Prospective studies will be necessary to validate effectiveness and safety in comparison with standard traction techniques.
EP12.13 Outcomes of revision hip arthroscopy: A systematic review and meta-analysis
Michaela O'Connor¹, Gabrielle K. Steinl¹, Dr Ajay Padaki¹, Dr Kyle Duchman², Dr Robert Westermann², Dr T. Sean Lynch¹
¹Columbia University, New York, United States, ²University of Iowa Health Care, Iowa City, United States

Introduction
While the indications for primary hip arthroscopy in treating femoroacetabular pathology continue to be defined, the indications and outcomes for revision hip arthroscopy remain ambiguous. However, revision hip arthroscopy is performed in 5-14% of patients following their index procedure. While patient-reported outcome (PRO) scores generally improve following revision procedures, the extent of their improvement is not well defined. The purpose of this study was to determine the outcomes and efficacy of revision hip arthroscopy in patients who remain symptomatic after their index procedure.

Methods
The terms “hip arthroscopy,” “revisions,” “outcomes,” and “femoroacetabular impingement,” were searched in PubMed, Web of Science, Scopus, Cochrane Library and Google Scholar. After screening, fifteen studies were included for review. In addition to hip-specific metrics, functional outcome measures were included. Pooled estimates and 95% confidence intervals were calculated using inverse variance methods.

Results
A total of 4,765 hips in 4,316 patients were identified. The most common indication for revision surgery was inadequate bony resection during the index procedure. Meta-analysis showed that all patient-reported outcomes (PROs) improved significantly from baseline to final follow-up after revision hip arthroscopy. Notably, the modified Harris Hip Score increased an average of 17.2 points following revision hip arthroscopy, the Hip Outcomes Score (HOS) improved by 13.98 and the Visual Analog Score for Pain (VAS) decreased by 3.16. However, when compared to primary hip arthroscopy, the mean PRO scores after revision hip arthroscopy were lower. After revision hip arthroscopy, rates of conversion to total hip arthroplasty ranged from 0—14% and rates of further arthroscopic revisions ranged from 2—14%.

Conclusion
Inadequate bony resection represents the most common indication for revision hip arthroscopy. Patient-reported outcomes improve significantly after revision hip arthroscopy but remain lower than those of patients undergoing primary hip arthroscopy.
Background
Femoroacetabular impingement (FAI) is an increasingly recognized source of hip and groin pain. As our understanding of FAI has grown, the number of patients being diagnosed with this pathology has risen. With this increase, it is imperative that patients have the tools to access accurate and reliable information about FAI and hip arthroscopy. The purpose of this study was to determine patients’ initial impressions of their diagnosis and if these results parallel with common misconceptions that surround FAI and hip arthroscopy.

Methods
Patients diagnosed with FAI completed questionnaires to assess health literacy, hip arthroscopy knowledge, and patient-reported outcomes such as the modified Harris Hip Score (mHHS) and the PROMIS Physical Function Computer Adaptive Test (PF CAT).

Results
Four patients (25% female) with an average age of 26.25 ± 2.06 years of age had complete questionnaire data. All included patients were college-educated, with two having an undergraduate degree and the remainder with graduate degrees. The mean mHHS was 63.75 ± 4.5 and the mean PROMIS PF CAT was 42.1 ± 1.9. Two patients reported having little knowledge of hip impingement, one reported moderate knowledge and one reported having considerable knowledge. One patient believed that one could not have asymptomatic FAI, while all patients thought it was possible to have an asymptomatic labral tear. One patient (25%) felt physical therapy (PT) wasn’t an effective general treatment for hip impingement. For labral tears, two patients thought PT was the most appropriate first-line treatment whereas two felt hip arthroscopy was the most appropriate intervention. There was also a discrepancy between patients’ understanding of a timeline for returning to sports, with half believing a 3-6-month course and the remainder estimating a 6-9-month recovery.

Conclusion
Our results show that there is an inconsistency in what patients understand about femoroacetabular impingement. Half of the patients felt the appropriate treatment for labral tears was hip arthroscopy, rather than physical therapy as a first-line treatment. This study highlights the lack of easily accessible, accurate information on hip impingement currently available for patient education.
EP12.16 Post-operative oral thromboprophylaxis in at risk patients undergoing hip arthroscopy mitigates the risk with a low side-effect profile: A single surgeon series in a developing country.

Dr Wesley Verhoogt¹, Dr Jurek Pietrzak², Sr Kathleen Nortje², Dr Josip Cakic²

¹Gauteng Department of Health, Johannesburg, South Africa, ²University of the Witwatersrand, Johannesburg, South Africa

EP12 - Communicating risk and managing complications

Biography

Doctor in Community Service at Edenvale Hospital Johannesburg with passion for academic endeavour, medical innovation and accessibility to healthcare.

Globally, the demand for Hip Arthroscopy (HA) has increased 25-fold. Complication rates, however, may be under-estimated in the literature. The risk of venous thrombo-embolic events (VTE) is lower than knee arthroscopy and is approximately 2%. The aim of this paper was to determine the incidence of complications in a South African context.

Methods

We conducted a retrospective chart review of 647 consecutive patients who underwent HA by a single high-volume surgeon from 2012 to 2018. All patients underwent general anaesthesia complemented by fascia iliaca block by one of two anaesthetists. Oral thromboprophylaxis for 2 weeks post-operatively was prescribed for all patients with ≥1 risk factor for VTE. The incidence of VTE and subsequent correlation with these risk factors was recorded.

Results

There were 880 HA in 258 males and 388 females at an average age of 35.4±9.7 years. Follow up was 16.8±7.2 months. The overall complication rate was 2.39%(n=21) with 28%(n=6) of these being major complications and 72%(n=15) being minor complications. There were 4 patients with sciatic neuropraxia which resolved and 2 with surgical site infections treated with oral antibiotics. Complications were not related to any specific risk factor.

The most common risk factors for VTE was 2.4%(n=21) with a positive family history of VTE, 2.5%(n=22) with previous DVT, 6.7%(n=59) with obesity and 17.7%(n=156) on the combined oral contraceptive (COC). There was ≥ 1 risk factor in 2.95% (n=26). The incidence of VTE was 0.45% (3 DVT, 1 PE). The patient with Pulmonary Embolism had no risk factors and was not placed on oral thromboprophylaxis. There was a positive family history of VTE in 2 patients(66.7%) and 1 patient(33.3%) was on COC. Oral thromboprophylaxis was not associated with any post-operative bleeds, 30-or 60-day readmissions.

Conclusion

A lower rate of VTE in this series(0.45%) than in the reported literature may highlight the value of identifying patients with risk factors for VTE and initiating post-operative oral thromboprophylaxis. Oral thromboprophylaxis for 2 weeks is safe and efficacious with a low side-effect profile. Early mobilization and regional anaesthesia may help to further mitigate the risk of VTE events.
Purpose
To evaluate patient-reported sadness as an indicator of perceived pain, symptoms, and clinical disease severity in patients with hip pain.

Methods
A review of prospectively collected PROMs in patients presenting with hip pain was performed. Those who reported feeling ‘downhearted and blue’ sometimes, often or always on the SF-12 (SAD) were compared to those who did not (NOT SAD). HOOS scores were compared between groups. Radiographic measures and surgical data were reviewed in patients diagnosed with FAI.

Results
Of 125 participants, mean age was 14.8 (range 7-26) and 65.6% were female. Twenty-nine were in the SAD group, 72.4% of which were female. Ninety-six, were in the NOT SAD group, 63.5% of which were female. SAD patients reported significantly worse symptoms (56.6 vs. 67.4, p=0.03), quality of life (34.1 vs. 46.2, p=0.03), and physical function in daily life (62.1 vs. 73.6, p=0.03) and physical function in sports/recreation (39.0 vs. 51.4, p=0.04) on the HOOS, resulting in a lower overall HOOS score (56.1 vs. 66.2, p=0.04).

In a cohort of 43 patients diagnosed with FAI (mean age 16.2; 76.7% female), SAD subjects reported a significantly worse quality of life (26.6 vs. 42.3, p=0.03). Additionally, SAD subjects had higher alpha angles (67.02° vs. 57.35°, p=0.008) but no difference in acetabular coverage. Of patients who underwent surgery, early results suggest that those who reported feeling sad at baseline may not demonstrate short-term improvement in their function, but more follow-up is needed.

Conclusion
Feeling ‘downhearted or blue’ appears to be associated with symptom and disease severity in patients with hip impingement and may be a risk factor for poor early surgical outcomes.
EP12.18 Surgeon accuracy of predicting patient-reported outcome and satisfaction scores in patients undergoing hip arthroscopy

Douglas Zaruta¹, Raymond Kenney¹, Joseph Schaffer¹, Dan Kleehammer¹, Molly McCann¹, David Lawton¹, Kelly Adler¹, Brian Giordano¹

¹University of Rochester Medical Centre, Rochester, United States

EP12 - Communicating risk and managing complications

Biography
Resident Physician at University of Rochester Medical Centre in Rochester, NY.

Objectives
Excellence in surgical judgment is a highly sought skill developed over one’s career which guides decision-making and thought to be an integral part of becoming a competent surgeon. Comparing a surgeon’s preoperative prediction of patient-reported outcomes (PRO) data would provide valuable insight into the accuracy of a surgeon’s judgment and may lead to improved patient care. Identifying differences in accuracy by surgeon level of training (novice vs expert) would also be helpful to elucidate the effect of clinical experience on surgeon judgement. The purpose of this study was to 1) determine if surgeons can accurately predict patient-reported outcomes after hip arthroscopy and 2) to assess if accuracy of surgeon prediction differs with level of training.

Methods
An ongoing, longitudinal cohort of patients undergoing elective arthroscopic hip surgery at a single academic medical centre from November 2017 to April 2019 were enrolled into the study. Eligible patients completed a series of validated outcome questionnaires (mHHS, NAHS, and PROMIS) at preoperative and postoperative intervals (2 weeks, 6 weeks, 6 months, 12 months). A pre-operative questionnaire designed to predict PRO scores for each patient undergoing arthroscopy was constructed and completed by surgeons, varying by level of training (expert vs. novice). Descriptive statistics were conducted to characterize study sample, and Pearson’s correlations were used to compare surgeon and patient outcomes. Regression analyses were also conducted to assess the relationship between surgeon predictions and PRO scores across study time points and by level of training.

Results
A total of 185 patients were enrolled during the study time frame, the majority being female (67%). Mean age was 35 (+/- 12.6) years. PROs significantly improved from preoperative scores at 6 and 12 months (p-values <0.0001). Surgical predictions indicated moderate correlation (r= 0.4-0.5) with all PROs at the varying time points. There were no meaningful differences between expert and novice predictions.

Conclusions
Patients undergoing hip arthroscopy for FAI had significant improvements in patient-reported outcomes by 6 months postoperatively. Surgeons demonstrated moderate correlation with predicting PROs. These results may provide meaningful information to assist with clinical decision-making in the context of surgical discussion and planning with patients.
The “salvage” periacetabular osteotomy: Early outcomes in patients treated for iatrogenic hip instability

Christopher Brusalis¹, Jeffrey Peck¹, Geoffrey Wilkin², Robert Buly¹, Danyal Nawabi¹, Anil Ranawat¹, Bryan Kelly¹, Ernest Sink¹

¹Hospital For Special Surgery, New York, United States, ²The Ottawa Hospital, Ottawa, Canada

Background

The periacetabular osteotomy (PAO) has proven to reduce pain and improve the quality of life in patients with hip dysplasia. While its utility for patients without traditional radiographic parameters for hip dysplasia has not been previously established, the PAO may provide a salvage treatment option for patients with hip instability following single or multiple hip arthroscopic procedures.

Methods

A hip preservation registry at a single institution was queried to identify patients with an LCEA > 23° degrees where a “Salvage PAO” was performed for hip pain and/or instability with failed hip arthroscopy. Descriptive summary statistics were reported on patient demographics, change in LCEA, and patient-reported outcome measures including the modified Harris Hip Score [mHHS] and International Hip Outcome Tool [iHOT-33].

Results

Of 27 patients (mean age 27.1 ± 6.7 years, 100% female) the mean LCEA increased from 26.3° ± 3.3° preoperatively to 38.8° ± 5.0° postoperatively. Overall, mean improvement in mHHS was 11.9 (preoperative = 60.0 ± 11.9; postoperative 71.9 ± 20.1) and mean iHOT-33 improvement was 24.7 ± 22.2 (preoperative =32.4 ± 17.1; postoperative 57.1 ± 29.0). Nineteen patients (70.4%) met MCID for mHHS (mean improvement 17.9 ± 12.9) and iHOT-33 scores (mean improvement 34.3 ± 19.1). No significant differences in preoperative Tonnis grade, age, BMI, alpha angle, femoral version, or LCEA were identified between the 19 patients who showed improvement and the 8 patients who did not show improvement.

Conclusions

This study evaluates outcomes of PAO in a challenging population of patients with persistent hip pain after failed arthroscopic surgery that do not meet traditional criteria for acetabular dysplasia. In select patients with persistent or iatrogenic hip instability after at least one hip arthroscopic procedure, the PAO is an effective salvage option.

Dr Mohamed Abd El-Radi1, Prof. Hatem Galal Said1, Dr Jesús Más Martínez2, Prof. Mohamed Abdel Hamid1, Dr Javier Sanz-Reig2, Dr Oliver Marin-Peña3, Prof. Hesham El-Kady1
1Assiut University Hospitals, Assiut, Egypt, 2Clinica Vistahermosa, Alicante, Spain, 3Hospital Universitario Infanta Leonor, Madrid, Spain

Purpose
To evaluate clinical outcomes following intra-articular platelet rich plasma (PRP) injection in femoroacetabular impingement (FAI) patients undergoing hip arthroscopy for labral repair and femoral osteochondroplasty.

Methods
A prospective controlled study was conducted in the period from February 2015 to February 2017 with minimal follow up of 24 months. 67 patients underwent hip arthroscopy for treatment of femoroacetabular impingement associated with labral tears (Tönnis 0-1 hips) were considered for this study from two centres. Both groups underwent arthroscopic femoroacetabular osteochondroplasty and labral repair. The study group (39 patients) received an intra-articular PRP injection after capsular closure where the control group (28 patients) was not received injection of PRP or local anaesthetic. Selection of patients for the study group was based on week on which the patient underwent surgery. The protocol included administration of visual analogue scale and three hip patient-reported outcome scales. Scores were recorded at the preoperative visit and at 6 months, 1 year and 2 years postoperatively.

Results
Both groups had insignificant difference in visual analogue scale, at 6 months, 1 year and 2 years postoperatively. No significant difference was observed for the Hip Outcome Score (Activities of Daily Living subdivision), modified Harris Hip Score and international Hip Outcome Tool 12 at any time point. There was significant difference in patient-reported satisfaction about sport practicing regarding the differences between preoperative Hip Outcome Score (Sport subdivision) and at 12th and 24th month post-operatively with P value of 0.01 and 0.04 respectively. There were no cases of conversion to total hip arthroplasty or revision surgery at the writing moment.

Conclusions
Based on the results of this study, intra-articular PRP injection improves the clinical outcomes of patients undergoing arthroscopic hip labral repair and femoroacetabular osteochondroplasty as regarding sport practicing.

Level of Evidence
Level II, prospective controlled study.
EP13.2 Health-related quality of life after hip arthroscopy for femoroacetabular impingement: A systematic review and meta-analysis
Chetan Gohal, Saif Shamshoon, Muzammil Memon, Jeffrey Kay, Nicole Simunovic, Filippo Randelli, Associate Professor Olufemi Ayeni

1Mcmaster University, Hamilton, Canada, 2Istituto di Ricovero e Cura a CarattereScientifico (IRCCS), Milan, Italy

Objective
Hip pain from femoroacetabular impingement (FAI) can impair health-related quality of life (HRQL) but can be treated via hip arthroscopy techniques. The objectives of this study were to systematically assess the health-related quality of life outcomes following arthroscopic management of FAI.

Data Sources
Three online databases (EMBASE, PubMed, and Ovid [MEDLINE]) were searched for relevant literature from database inception until June 2018 and screened by two reviewers independently and in duplicate. Level I to IV English studies that investigated HRQL outcomes after hip arthroscopy were included. Data for generic and hip specific HRQL outcomes was collected. Mean differences were combined in a meta-analysis using a random effects model when possible.

Results
A total of 29 studies were included for assessment. Of the 6476 patients (6959 hips), the mean age was 32 years (range 9 to 79) and 50.7% were female. Significant improvements were reported in all studies assessing generic HRQL outcomes, including the Short Form-12 (SF-12) (range of mean postoperative scores, 82.0 to 89.8), and EuroQOL-5D (EQ-5D) scores (range of mean postoperative scores, 0.74 to 0.87). Significant improvements were similarly identified in the hip specific HRQL outcomes scores, with the majority of studies reporting improvement at 12 to 24 months post-operatively. Mean improvement in International Hip Outcome Tool-33 (iHOT-33) scores from preoperative values to 12 to 24 months postoperative values was 34.1 (95% CI= 31.0, 37.2; p<0.0001, I2=44%).

Conclusions
Hip arthroscopy leads to significant improvement in generic and hip specific health-related quality of life outcomes at 12 to 24 months post-operatively in patients with FAI who do not have advanced hip osteoarthritis. Confirmatory, high quality, prospective studies are warranted to compare this observed improvement with other treatment modalities for FAI and to determine long-term outcomes.

Biography
Dr Ayeni is an Associate Professor of Orthopaedic Surgery, Adjunct Professor in the Health Research Methodology, Evidence and Impact program, and Director of Orthopaedic Sports Medicine Research at McMaster University. He is also the Medical Director for the Hamilton Tiger Cats Organization. Dr Ayeni is an orthopaedic surgeon that specializes in the treatment of femoroacetabular impingement (FAI, or hip impingement), which is common in the active/athletic adult population. To date, most articles published concerning FAI have been initiated and written by Dr Ayeni and his research team at McMaster University.
Predictors of outcomes following hip arthroscopy for femoroacetabular impingement: A systematic review

Olawale Sogbein², Ajay Shah¹, Jeffrey Kay¹, Muzammil Memon¹, Nicole Simunovic¹, Etienne Belzile³, Associate Professor Olufemi Ayeni¹
¹Mcmaster University, Hamilton, Canada, ²Laurentian University, Sudbury, Canada, ³Laval University, Quebec, Canada

EP13 - FAI surgery

Biography
Dr Ayeni is an Associate Professor of Orthopaedic Surgery, Adjunct Professor in the Health Research Methodology, Evidence and Impact program, and Director of Orthopaedic Sports Medicine Research at McMaster University. He is also the Medical Director for the Hamilton Tiger Cats Organization. Dr Ayeni is an orthopaedic surgeon that specializes in the treatment of femoroacetabular impingement (FAI, or hip impingement), which is common in the active/athletic adult population. To date, most articles published concerning FAI have been initiated and written by Dr Ayeni and his research team at McMaster University.

Background
The benefits of hip arthroscopy in the setting of femoroacetabular impingement (FAI) have been well-established, however, some patients may experience a greater degree of improvement than others.

Hypothesis/Purpose
The objective of this systematic review was to identify demographic, radiographic, and operative predictors of positive and negative outcomes following hip arthroscopy for patients with FAI. It is hypothesized that factors including FAI morphology, age, body mass index (BMI), gender, dysplasia, articular cartilage damage, radiographic joint space, and labral treatment will predict outcomes following hip arthroscopy.

Methods
This systematic review was performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Three databases (EMBASE, PubMed, and MEDLINE) were searched on May 19, 2018 using terms including “hip”, “arthroscopy” and “FAI”. Studies were screened and data extracted in duplicate.

Results
Thirty-nine studies were included in this systematic review, comprising 9,298 hips with a mean age of 36.5 years and 47.2% females. Younger age, male sex, lower BMI (<24.5 kg/m²), Tönnis grade 0, and preoperative pain relief from diagnostic intraarticular hip injections predicted positive outcomes. Females, older patients (>45), patients with longer duration of preoperative symptoms (>8 months), elevated BMI, increased Tönnis grade (≥1), chondral defects, decreased joint space (< 2 mm), increased KL grade (>2), increased lateral centre-edge angle (LCEA), and performing labral debridement alone were predictors of negative outcomes.

Conclusion
Among patients with FAI, those with younger age (< 45), male gender, lower BMI (<24.5), Tönnis grade 0 and pain relief from preoperative intra-articular hip injections were significantly more likely to achieve a positive outcome following hip arthroscopy. On the other hand, older age, female gender, elevated BMI, patients with osteoarthritic changes including decreased joint space (≤2mm), chondral defects, increased LCEA, and undergoing labral debridement versus labral repair were associated with negative outcomes.
EP13.4 FAI treatment with mechanical hip arthroscopy augmented with biological therapy: a prospective controlled study

Dr Ali Bajwa1,2, Mr Richard Villar1,2
1Princess Grace Hospital, London, United Kingdom, 2Villar Bajwa Practice, Cambridge and London, United Kingdom

Introduction
Hip arthroscopy for FAI is a mechanical treatment, which is effective. Recently bone marrow harvested mesenchymal stem cells (MSC) have been used in conjunction with hip arthroscopy.

Aims
To compare FAI treatment with mechanical hip arthroscopy augmented with biologics using bone marrow harvested MSCs (biologically augmented group) with mechanical hip arthroscopy alone (control) in non-arthritic patient model.

Methods
Study design was that of a prospective case-control study of 102 patients undergoing hip arthroscopy for FAI in non-arthritic patient-model (biologically augmented group (n=51), control group (n=51)). Mechanical arthroscopic treatment and rehab programme were standardised. Patients with radiographic signs of arthritis (Tonnis >1) and/or arthroscopic ICRS grade >1, were excluded. Data were collected pre/per/post-operatively at 6,12,26 weeks and then annually. Demographics, functional scores including modified Harris Hip Score(mHHS), VAS for satisfaction(0-10), Non-Arthritic Hip Score(NAHS), return to sport and adverse events were recorded. Mean follow-up was 28 months (range 24,36). Descriptive statistics, t-test for parametric and chi-squared test for non-parametric variables were employed with alpha set at 5% and beta at 80%.

Results
Biologically augmented group and controls were matched in mean age (32 (18,45) vs 31(19,41) and gender (males 56% vs 60%) respectively. Pre-operative mean scores improved in the biologically-augmented group (mHHS from 66 to 88 (p<0.01), VAS from 5 (median 6) to 9 (median 9), NAHS from 64 to 85 (p<0.01) and in control-group (mHHS from 66 to 84(p<0.01), VAS from median 5.5(median 6) to 8.8(median 9), NAHS from 62 to 81(p<0.01). Magnitude of improvement was greater in biologically augmented group(mmHS 22 vs 18, NAHS 21 vs 19) and return to sport higher (92% vs 84%).

Conclusions
Treatment of FAI with mechanical arthroscopy alone or augmented with biologics both offer significant functional improvement in non-arthritic individuals. Biological augmentation shows a trend towards greater improvement and a higher return-to-sport rate.
EP13.5 Lateral cams: How important are the vessels?

Ms. Lindsay Barter¹, Dr. Nickolas Boutris¹, Dr. Luis Pulido¹, Dr. Thomas Ellis², Dr. Shane Nho³, Dr. Joshua Harris¹
¹Department of Orthopaedics and Sports Medicine, Houston, United States, ²Orthopedic One, Upper Arlington, United States, ³Midwest Orthopaedics at Rush, Chicago, United States

Biography
Lindsay Barter is a research coordinator for Dr Joshua Harris in the Department of Orthopaedics and Sports Medicine. Lindsay obtained her undergraduate degree from Spring Hill College in Mobile, AL, and completed her master’s degree in Health Psychology at the University of the Sciences in Philadelphia, PA.

Background
Arthroscopic correction for cam-type femoroacetabular impingement (FAI) is a highly complex surgical technique. Statistically significant and clinically relevant short- and mid-term outcomes are related to the correction of cam pathomorphology. The most common location of the apex of the cam is at 1:15 (right hip) on the femur (11:45 to 2:45); in some situations, the cam extends posterolaterally. Surgeons performing posterolateral femoral osteoplasty to completely correct cam FAI must respect the vascular supply to the femoral head to avoid iatrogenic avascular necrosis (AVN).

Purpose
The purpose of this study is to prompt a re-analysis of the possible reasons the authors Rupp and Rupp (2016) did not observe AVN in any of the 14 patients following femoroplasty contouring of the posterolateral regions of the femoral head and neck, with necessitated removal of the penetrating vascularity of this region.

Methods
An electronic search of biomedical and social science databases was conducted. Relevant investigations evaluating proximal femoral vascular supply were identified and relevant data extracted.

Results
The exact reason was unable to be definitively determined. Six possibilities were identified. Based on the literature, avoidance of excessive traction, avoidance of distal posterolateral capsulotomy / capsulectomy, and avoidance of intentional disruption of the superior retinacular vessels should keep this AVN rate low.

Conclusion
Hip extension, internal rotation, and distraction are useful in arthroscopically better visualizing posterolateral (or posterosuperior) cams and can facilitate a more complex cam correction and avoidance of vascular disruption. Thus, if a modifiable safe reason is further identified, this could possibly significantly alter our cam treatment algorithm.
EP13.6 Functional and clinical outcomes of patients undergoing revision hip arthroscopy with borderline hip dysplasia at two-year follow-up

Dr Jourdan Cancienne1, Dr Edward Beck1, Mr. Kyle Kunze1, Dr Jorge Chahla1, Dr Sunikom Suppauksorn1, Kaitlynn Paul3, Mr. Jonathan Rasio1, Dr Shane Nho1

1Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

Purpose
To compare outcomes of patients undergoing revision hip arthroscopy with borderline hip dysplasia (BHD) with 1) patients with BHD undergoing primary hip arthroscopy for FAIS and 2) patients undergoing revision hip arthroscopy for FAIS without dysplasia.

Methods
A retrospective cohort study was performed to identify patients undergoing arthroscopy between January 2012 and January 2016 by a single surgeon with a 2-year follow up. Patient demographics, comorbid medical conditions, and preoperative outcome scores were compared between patients with BHD (LCEA 18°-25°) who had revision hip arthroscopy to patients with BHD undergoing primary arthroscopy and patients without BHD (LCEA > 25°) undergoing revision arthroscopy. Cohorts were matched 2:1 by age and BMI. Multivariate regressions were used to compare Hip Outcome Score Activities of Daily Living (HOS-ADL), Hip Outcome Score Sports Subscale (HOS-SS), and modified Harris Hip Score (mHHS) between the cohorts at 2-year follow-up. Binomial regression analysis was used to determine predictors of achieving minimal clinically important differences (MCID) and patient acceptable symptom state (PASS).

Results
There was no statistical difference in age and BMI between the BHD revision (29.1±8.8years; 25.5±3.58kg/m2), BHD non-revision (28.9±8.5years; 24.6±3.1kg/m2), and non-dysplastic revision (29.15±8.6years; 25.01±3.2kg/m2), cohorts. There were no statistically significant differences in 2-year clinical outcomes between BHD revision patients when compared to both BHD primary and non-dysplastic revision patient groups. Non-BHD revision patients and BHD primary patients were more likely to achieve the PASS for the HOS-SS (OR:8.0, p=0.031 and OR 6.3; p=0.047).

Conclusion
Patients with borderline hip dysplasia undergoing revision hip arthroscopy experience similar clinical outcomes to patients without borderline hip dysplasia undergoing revision arthroscopic surgery and patients with borderline hip dysplasia undergoing primary hip arthroscopic intervention. Revision surgery of borderline dysplastic patients are less likely to achieve PASS HOS-SS.
EP13.7 Preoperative hip strength is an independent predictor of achieving short-term clinically significant outcome after hip arthroscopy for femoroacetabular impingement syndrome

Dr Edward Beck1, Ms. Laura Krivicich2, Dr Benedict Nwachukwu2, Ms. Kyleen Jan2, Dr Sunikom Suppauksorn2, Dr Philip Malloy2, Mr. Jonathan Rasio2, Dr Shane Nho2

1Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, United States, 2Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

Purpose
To determine whether isometric hip strength is associated with hip function outcome scores at 6-months, minimal clinically important difference (MCID), and patient acceptable symptomatic state (PASS) in patients undergoing hip arthroscopy for FAIS.

Methods
Data on consecutive patients undergoing primary hip arthroscopy for the treatment of FAIS between March and August 2018 by a single, fellowship-trained surgeon were analysed. All patients included in the analysis had preoperative measures of isometric hip strength on both affected and non-affected limbs, as well as preoperative and 6-month patient reported outcome (PRO) scores. For the analysis, isometric hip strength was normalized by body weight. Paired samples t-tests were used to compare strength differences between the affected and non-affected limbs. Pearson’s correlation coefficients were evaluated to determine correlation between normalized isometric hip strength measurements and PROs. Logistic regression models were used to determine whether strength measurements were predictive of achieving MCID or PASS.

Results
74 (80.1%) patients had 6-month PROs and were included in the final analysis, with an average age of 31.9±12.4 years and BMI of 26.2±5.9. There was a statistically significant difference between strength measurement averages between affected and unaffected hips in all except internal rotation (p<0.05 for all). Hip extension strength on both sides was correlated with all postoperative PROs, MCID, and PASS (all p-value>0.05). Abduction strength on both sides was correlated with postoperative HOS-ADL, MCID, and PASS (all p-value>0.05). Regression analysis showed that extension strength of the affected side was the only strength measurement predictor of achieving PASS (1.043; p-value=0.049).

Conclusion
Preoperative isometric hip extension and abduction strength are correlated with 6-month postoperative PRO scores. Furthermore, hip extension strength is a predictor of achieving clinically meaningful outcomes. The current study findings may have implications for maximizing preoperative rehabilitation and hip muscle strengthening as means to optimize short term postoperative outcomes.
Successful arthroscopy for pincer-morphology: 2-year outcomes in patients with acetabular over coverage compared with matched controls

Mr Matthew J Brick¹, Claudia R Brick², Dr Catherine J Bacon³

¹Orthosports North Harbour, Auckland, New Zealand, ²Monash University, Melbourne, Australia, ³Faculty of Medicine and Health Sciences, University of Auckland, Auckland, New Zealand

Background
Patients with pincer-type FAI are commonly treated with hip arthroscopy. A recent publication demonstrated inferior outcomes in patients with acetabular over coverage compared with controls with normal acetabular coverage. Casual observation of our prospective database suggested equivalent improvements. This prompted a similar analysis, hypothesising that larger rim resection may increase contact pressures through the hip and lead to lesser improvements, even when postoperative acetabular coverage remains within normal range.

Methods
Data collected prospectively from patients with minimum 2-year follow-up receiving hip arthroscopy by a single surgeon were reviewed to identify those with pincer-type morphology (LCEA >40°) and matched according to sex, age, chondral damage and surgery date in a 1:1 ratio with controls with a LCEA 25°-40°. Exclusion criteria included any previous hip surgery or hip conditions. Radiographic measurements of coverage, intra-operative findings, procedures, and minimum 2-year outcomes were recorded, including the 12-item IHOT, NAH score, HOOS, VAS for pain, rates of revision arthroscopy and conversion to THA.

Results
A total of 159 hips (129 patients) met the inclusion criteria for the pincer group and 942 hips (787 patients) for the control group. The pincer group (aged 33.5±11.8 years) did not differ in age, BMI or follow-up from controls. LCEA was reduced in both groups: the pincer group from 44.5°±3.5 pre-operatively to 34.3°±2.9 post-operatively, and the controls from 32.9°±4.1° to 31.0°±3.0. No differences in improvement were observed: IHOT12 improved by 35 points in both groups (P =.9 for ANOVA interaction) and NAH by 22 points in the pincer group and 21 points in the controls (P =.6). Rates of revision surgery (6.9%) and conversion to THA (1.3%) did not differ between pincer hips and eligible or matched controls.

Conclusion
There were no differences in any outcomes for pincer-type morphology compared to normal coverage, and both are associated with significant improvements.
EP13.10 Factors associated with failure following hip arthroscopy for FAI in patients over 40

Dr Ioanna Bolia\textsuperscript{1}, Ms Karen Briggs\textsuperscript{1}, Dr Marc Philippon\textsuperscript{1}
\textsuperscript{1}Steadman Philippon Research Institute, Vail, United States

Biography:
Dr Bolia completed medical school in Greece, followed by a research fellowship at the Steadman Philippon Research Institute. She has completed a one-year surgical residency at Wake Forest.

Previous studies have shown age may be a predictor of failure following hip arthroscopy; however, it is unclear what factors lead to failure. The purpose of this study was to determine factors associated with conversion to total hip arthroplasty in patients over 40 undergoing hip arthroscopy.

Methods
268 patients who were over 40, had primary hip arthroscopy for FAI with labral repair were included. All had minimum joint space of >2mm. There were 144 females and 124 males, with an average age of 49±6. Hips were evaluated using the modified Harris hip score (mHHS), Hip Outcome Score (HOS), WOMAC and patient satisfaction (1 to 10; 10=very satisfied). Conversion to THA was confirmed by patients.

Results
87 patients underwent THA. Patients who converted to THA were significantly older (50 vs 48; \( p=0.001 \)), higher Tonnis angle (10.7 vs 6.8; \( p=0.016 \)), lower lateral centre edge (34 vs 37; \( p=0.044 \)), larger alpha angle (77 vs 70; \( p=0.028 \)). The following preoperative subjective complaints were associated with THA: stiffness interfering with activity were 3.7 [95%CI, 2-7] times more likely to convert to THA (\( p<0.001 \)); weakness were 2.7[95%CI,1.5-5] times more likely to convert to THA (\( p=0.001 \)) and loss of motion were 1.9[95%CI,1.1 to 3.2] times more likely to convert to THA. At arthroscopy, the presence of femoral cyst was not associated with THR, but patients with an acetabular cyst were 3.0 [95%CI,1.6-5.4] times more likely to convert to THA. Patients with microfracture were 10 [95%CI, 6-18] times more likely to convert to THR. Using regression analysis, preoperative weakness, microfracture, and acetabular cyst were independent predictors of THA (\( p<0.001 \), \( R^2=0.408 \)).

Of the patients who did not have THA, at an average 7-year follow-up (5 to 11 years), the mean SF-12 PCS was 51.7±9, and mHHS was 85±17, HOS ADL was 89±15. The median WOMAC was 5 [95%CI 8.7-12.9] and median patient satisfaction with outcome was 10 [95%CI 8-9]. HOS-ADL PASS was achieved in 75% of patients.

Conclusions
Factors associated with THR following arthroscopy in patients over 40 include age, symptoms of weakness, stiffness, and loss of motion, and microfracture and acetabular cysts at arthroscopy. Those patients who do not require THR, have excellent outcomes and high patient satisfaction.
The evolution of symptomatic versus asymptomatic femoroacetabular impingement: Case report of a professional hockey player with ten-year follow-up

Dr Patrick Buckley, Ioanna Bolia, Karen Briggs, MPH, MBA, Marc J. Philippon

University Orthopaedic Associates and Robert Wood Johnson University Hospital, Wall Township, United States.
Steadman Philippon Research Institute, Vail, United States

Biography
Orthopaedic and sports medicine surgeon practicing in central New Jersey, USA.

Background
The natural history of femoroacetabular impingement and its potential impact on the risk of future degenerative arthritis of the hip is not clearly defined.

Methods
We describe the diagnosis, treatment, rehabilitation and ten-year outcomes of a National Hockey League (NHL) player who was treated successfully with full return to professional competition with hip arthroscopy for symptomatic femoroacetabular impingement (FAI) of his right hip. At the time of initial evaluation, asymptomatic radiographic FAI was present on the contralateral (left) hip and was untreated.

Results
At ten-year follow-up, the patient presented with maintained symptom resolution of the surgically treated hip, but with new symptoms on his contralateral hip consistent with FAI. Furthermore, his non-operatively treated hip showed radiographic progression of degenerative changes that were not present on initial imaging ten years prior.

Conclusion
In this case report, we present ten-year follow-up in an elite athlete of both treated and un-treated radiographic femoroacetabular impingement. We discuss indications for treatment as well as screening for asymptomatic but radiographically present FAI in athletes. In this athlete, untreated radiographic FAI, combined with continued participation in a sport that places the hip at risk, resulted in progression of degenerative changes of the hip at ten-year follow-up.
EP13.12 Arthroscopic FAI treatment with initial access to the peripheral compartment. Outcomes with a minimum two years follow up.

Dr Pedro Dantas¹,², Dr Sergio Gonçalves¹,², Dr Antonio Camporese³, Dr Vasco Mascarenhas⁴, Dr Oliver Marín-Peña⁵

¹Hospital Cuf Descobertas, Lisboa, Portugal, ²Hospital Curry Cabral, Lisboa, Portugal, ³Policlinico Abano Terme, Padova, Italy, ⁴Hospital da Luz, Lisboa, Portugal, ⁵Hospital Infanta Leonor, Madrid, Spain

EP13 - FAI surgery

Biography

ORCID ID:  https://orcid.org/0000-0002-4010-0327

Hospital Activity

. Orthopaedic Residency: Orthopaedic Department - Hospital de Curry Cabral (Lisbon – Portugal) (from 1st of January 1996 to 26th of February 2002)
. The Robert Jones and Agnes Hunt Orthopaedic and District Hospital: 3 months fellowship on general orthopaedics with Professor James B. Richardson (1999)
. The Robert Jones and Agnes Hunt Orthopaedic and District Hospital: 3 months fellowship on hip and knee arthroplasty (2001)
. Staff Surgeon of the Orthopaedic Department of Hospital de Curry Cabral since 2003
. Staff Surgeon of the Orthopaedic Department of the Hospital CUF Descobertas since 2014
. Coordinator of the Hip Pathology clinic at Hospital Curry Cabral since 2010

Appointments

. Secretary of the Directive Board of the Orthopaedic College of the Portuguese Medical Association (2006-2009)
. Portuguese National representative in the European Hip Society
. Member of the editorial board of The Portuguese Journal of Orthopaedics and Traumatology
. Member of the board of The Portuguese Society of Arthroscopy and Sports Trauma
. Editor of Cadernos de Ortopedia do Hospital CUF Descobertas

Hip arthroscopy with primary access to the peripheral compartment (PC) without traction allows for CAM deformity correction with limited capsulotomies thus preserving iliofemoral ligament function and arthroscopically guided central compartment portal creation with decreased risk of chondral and labral iatrogenic injury.

We report on a single surgeon series, with a minimum of 2 years follow-up, of arthroscopic FAI treatment with PC access first.

Exclusion criteria were previous hip surgery, Tonnis grade ≥2 osteoarthritis, Wiberg LCE <25° and workers compensation cases. 160 hips met the inclusion criteria (84 females and 70 males, 6 bilateral cases), with an average age of 36.2 years. The minimum follow-up was 24 months (average 44.9 months). Femoral osteoplasty was performed in all but one hip, acetabular rim trimming in 45.0% of the hips and the labrum was repaired in 76.8% of the cases.

There was a significant improvement in the NAHS from 56.1 to 83.2 postoperatively (p<0.01) and the mean average improvement was 27.7 points, which largely exceeded the reported minimal detectable change.
Subgroup analyses did not reveal any association between NAHS improvement and the type of impingement, the presence of acetabular retroversion and an age cut off of 35 years. An association was found between better NAHS improvement and the female gender ($p<0.027$).

The alpha angle was corrected on average $23.1^\circ$ ($p<0.01$), the mean Wiberg LCE angle correction when acetabuloplasty was undertaken was $6.5^\circ$ ($p<0.01$).

There were 7 reoperations (5 revisions arthroscopies and 2 THR) and we report no iatrogenic labral perforation and no full thickness chondral damage.

Favourable clinical and radiographic outcomes for the arthroscopic management of FAI with PC first access technique are reported, which appear to be comparable to a more classical approach (central compartment initial access with interportal and T capsulotomies) and somewhat protective against iatrogenic chondral and labral damage.

Dr Yoshi Pratama Djaja1,2, Prof. Yong Chan Ha2, Prof. Sujin Kim3, Prof. Guen Young Lee3

1Department of Orthopaedics and Traumatology, Fatmawati General Hospital, Jakarta, Indonesia, 2Department of Orthopaedic Surgery, Chung-Ang University College of Medicine, Seoul, Korea, 3Department of Radiology, Chung-Ang University College of Medicine, Seoul, Korea

Background
Although os acetabuli (OSA) has been recognized since a long time ago, there are still some controversies regarding its cause (unfused ossification centre, acetabular rim fracture, labral ossification) and how to differentiate them. There is also no previous study that evaluated the prevalence of OSA in asymptomatic population.

Purpose
The aim of this study was to investigate; 1) the prevalence, size and location of os acetabuli (OSA) in general population; 2) differentiation between the characteristic types of OSA: unfused ossification centres, rim fractures and labral ossifications; 3) correlation between OSA, and femoroacetabular impingement (FAI) with symptoms.

Study design
Case Control Study

Methods
We retrospectively reviewed images from 5684 patients who underwent abdominal and pelvic Computed-Tomography (CT) images in 2016 with non-orthopaedic indications in 2016 (asymptomatic group) and images from 264 patients who underwent hip arthroscopy surgery from 2010 to 2016 in our institution (symptomatic group). Two investigators evaluated these images to find the prevalence of OSA, distribution of its size and location, its relationship with hip pain and FAI. We also correlated them with the types of OSA based on previous literatures (unfused ossification centre, rim fracture, labral ossification and loose bodies).

Results
The prevalence of OSA in symptomatic and asymptomatic groups were 8.65% (25/289) and 3.3% (378/11356), respectively. The distribution of OSA types were labral ossifications (55.1%), rim fractures (33.5%), unfused ossification centre (1.2%) and others (7.9%). Male predominance was found in all type of OSA. Labral ossification had the smallest size and mostly was asymptomatic. Rim fracture was correlated with FAI in general (90.3%; p<0.005), but not with any specific types of FAI. Size of OSA had a significant relationship with symptom (895.28 vs. 103.64 mm³; p<0.001).
Conclusions
The prevalence of OSA in general population are 3.46%, with significantly higher prevalence of OSA were found in symptomatic group (8.65% vs. 3.3%). Labral ossification was the most common OSA type. Significant relationship was found between rim fracture and general FAI but not with any specific types of FAI. Size of the OSA was significantly associated with hip pain.
EP13.14 Tracing outcomes and survivorship against age and gender in hip arthroscopy surgery

Dr David Maldonado¹, Cammille Go¹, Dr Ajay Lall¹, Dr Benjamin Domb¹
¹American Hip Institute, Chicago, United States

Biography
Dr David Maldonado is a senior fellow at the American Hip Institute.

Purpose
To compare patient-reported outcomes (PROs) of patients undergoing hip arthroscopy for FAI according to sex and age.

Methods
Prospectively collected data from February 2008 to September 2016 were retrospectively reviewed. Patients were included if they had a primary hip arthroscopy for FAI treatment and had minimum 2-year follow-up for the following PROs: modified Harris Hip Score (mHHS), Nonarthritic Hip Score (NAHS), Hip Outcome Score-Sports Specific Subscale (HOS-SSS), and Visual Analog Scale (VAS). Exclusion criteria were Tönnis grade > 1, LCEA ≤ 18°, previous ipsilateral hip surgery, and previous hip conditions.

Results
1,269 hip arthroscopies met the inclusion and exclusion criteria. Of these, 1,056(83.2%) hips had minimum 2-year follow-up. 687(65.1%) patients were females and 369(34.9%) patients were males, with an average follow-up of 51.1±22.3 months. 674 patients were eligible for minimum 5-year follow-up, and 545(80.9%) had follow-up at minimum 5-year. BMI and alpha angle were the only statistically significant differences between males and females. All groups, except for females and males ages 61 years and over, showed significant improvement in all PROs and VAS at minimum 2-year follow-up. This improvement was sustained at minimum 5-year follow-up. A comparison of age groups within the same sex demonstrated significant differences in PROs for females depending on age at latest follow-up. Females between 31-40 years old experienced significantly worse outcomes than females <21 years old. Likewise, females 41-50 years old also reported significantly worse outcomes than females <21 years old. Similarly, male patients <21 years old had significantly better outcomes than males ages 31-40, 41-50, 51-60, and >60 years old.

Conclusion
Although all patients had significant improvements in all PROs following hip arthroscopy, younger patients reported better postoperative PROs and lower rates of conversion to THA. Female patients reported similar levels of improvement in PROs compared to their male counterparts.
Anterior intra and extra articular sub spine impingement in patients with pincer FAI due to protrusio acetabuli and acetabular retroversion

Dr Med. Till Lerch¹, Florian Schmaranzer¹, Inga Todorski¹, Simon Steppacher¹, Guoyan Zheng¹, Moritz Tannast¹, Klaus Siebenrock¹
¹Dept. of orthopaedic surgery, Inselspital Bern, University of Bern, Bern, Switzerland

Introduction
The exact location of hip impingement in pincer hips is unknown. Therefore, we evaluated symptomatic hips with protrusio acetabuli and acetabular retroversion and questioned:
(1) What is the 3D femoral head coverage and 3D acetabular orientation?
(2) What is the osseous impingement-free range of motion?
(3) Where are the osseous femoral and acetabular impingement zones located?
Furthermore, we compared these patients to a normal group

Methods
This is a retrospective, comparative controlled study involving 68 hips with symptomatic anterior FAI. Surface models based on 3D CT scans were reconstructed for hips with acetabular retroversion (28 hips), with protrusio acetabuli (14 hips) and normal hips (26 hips). Validated 3D collision detection software was used to simulate impingement-free range of motion and location of impingement.
To answer question (1) specific software was used to calculate Anteversion, Inclination and femoral head coverage.
To answer questions (2 and 3) Flexion, extension, internal and external rotation in 90° of flexion were calculated with a previously validated method.

Results
(1) Mean total and anterior femoral head coverage was significantly (p<0.001) increased in hips with protrusio and in hips with acetabular retroversion compared to normal hips.
(2) Mean flexion was significantly (p<0.001) decreased in hips with protrusio and in hips with acetabular retroversion compared to normal hips. Mean internal and external rotation in 90° of flexion were significantly (p<0.001) decreased in hips with protrusio compared to normal hips.
(3) Extraarticular Sub spine FAI was detected in 87% of the hips with acetabular retroversion and in 8% of the hips with protrusion acetabuli. Femoral location of impingement differed significantly (p<0.001) between hips with protrusio and in hips with acetabular retroversion compared to normal hips. Anterior Acetabular location of impingement differed significantly (p<0.001) between hips with protrusion and normal hips.

Conclusion
Acetabular retroversion and protrusio hips are pincer- morphologies associated with extraarticular sub spine FAI. Sub spine FAI was detected mainly in hips with acetabular retroversion. Location of impingement and range of motion differs between hips with protrusio and normal hips and between hips with acetabular retroversion and normal hips. Detailed analysis of location of impingement could help to optimize surgical treatment.
Labral repair (LR) for femoroacetabular impingement (FAI) is increasing. We aim to compare two different knotless suture anchors. We hypothesize that the type of knotless anchor does not affect post-operative PROMS.

Methods
In 2015, 70 patients underwent primary hip arthroscopy for FAI performed by a single senior surgeon at a single hospital. LR was carried out in 37 patients using the Bio raptor knotless anchor (Smith and Nephew, London, United Kingdom). From December 2016, LR was carried out in 26 patients until April 2017 by the same surgeon in the same hospital, using the Speed lock Hip knotless anchor (Smith and Nephew). 15 patients from each cohort were matched for age ($p=0.37$) and sex ($p=0.62$). Hip Disability and Osteoarthritis Score (HOOS), International Hip Outcome Score Short Form 12 (iHOT-12), and Non-Arthritic Hip Score (NAHS) were recorded pre-operatively and at a minimum of three months follow-up (average 2 years, range 3 months - 3 years). Radiological and operative findings were recorded. Other than the use of a different anchor, a standard surgical technique was utilised to treat femoroacetabular impingement in both cohorts, and all patients underwent post-operative physiotherapy and were followed up according to the same protocol.

Results
The Bio raptor cohort contained 13 females and 2 males, average age 37 years (range 19-57); Speed lock 12 females 3 males, average age 41 (16-59). Both had similar Kellgren and Lawrence grade (average 0, $p=0.58$), but Speed lock had a higher Konan and Haddad chondrolabral junction grading (average 2.8, 1.7 in Bio raptor, $p=0.011$). An average of two anchors were used per case in each cohort ($p=0.575$). Radiological measurement of acetabular index, lateral centre edge angle, and alpha angle were comparable ($p=0.72$, $p=0.54$, $p=0.67$).

Both cohorts showed a significant improvement in PROMS, but no difference between the two cohorts except HOOS sports ($p=0.37$, stiffness $p=0.75$, activities of daily living $p=0.35$, sports $p=0.02$, quality of life $p=0.13$, iHOT-12 $p=0.68$, NAHS $p=0.15$).

Conclusion
The knotless suture anchor used for LR during primary hip arthroscopy for FAI does not affect the post-operative PROMS. We recommend that surgeons use the system that they are most confident with.
Compressive cryotherapy is better than cryotherapy alone in reducing pain after hip arthroscopy for femoroacetabular impingement

**Biography**

Ianiv Klaber, MD. is a fellow-trained hip surgeon from Chile. He’s orthopaedic surgery and hip surgery training was carried in the Pontifical Catholic University of Chile, where he now works as consultant and orthopaedic surgery instructor for the University. Dr Klaber recently completed AOA accredited training in hip arthroscopy under the direction of Mr. John O’Donnell in Melbourne, Australia. With special academic interest in newer surgical techniques and devices to enhance hip arthroscopy surgery rehabilitation and return to sport activities, he is currently running grant-awarded qualitative studies on hip impingement effects on female patients’ quality of life.

**Introduction**

The early post-operative period after hip arthroscopy for femoroacetabular impingement is characterized by pain and swelling. Minimization of pain is of critical importance to the patient, but pain might also reduce patients’ compliance to early physiotherapy, delay rehabilitation and hospital discharge. Avoiding early mobilization represents a risk factor for developing capsulolabral adhesions.

Compressive cryotherapy has been shown to reduce postoperative pain after knee and hip replacement surgery. The aim of this study was to assess the effect of the inclusion of compressive cryotherapy in the postoperative pain management and early discharge after hip arthroscopy for femoroacetabular impingement.

**Material and Methods**

A prospective cohort of 20 patients who received compressive cryotherapy (Group 1) and 20 retrospectively matched controls who received ice therapy alone (Group 2) were compared. In Group 1 compressive cryotherapy was added to the standard postoperative analgesia and rehabilitation protocol. Using non-parametric tests, the percentage of patients discharged in postoperative day one, pain VAS scores and analgesia requirement were compared.

**Results**

The Group 1 reported significantly lower pain scores compared to controls; VAS 1(0-3) and 2(0-5) (p=0.0028), respectively. A non-significant reduction in analgesic requirement 1.75 vs 2.8 doses per patient was found. In the Group 1 20/20 patients were discharged on Postoperative Day 1 (POD1) vs 17/20 in the Group 2 (p=0.23). No complications related to the compressive cryotherapy device were documented.

**Conclusion**

Patients treated with compressive cryotherapy after hip arthroscopy reported lower levels of pain during the early postoperative phase and were able to be discharged home sooner when compared with a matched control group receiving ice therapy alone. A trend towards lower opioid analgesia requirement was observed.
EP13.18 Impairment of sexual life in female patients with femoroacetabular impingement. A qualitative-quantitative study

Ms. Maria Jesus Lira, Ms Pamela Mery, MD Daniel Schweitzer, MD Claudio Rojas

1Pontificia Universidad Catolica De Chile, Santiago, Chile, 2Hospital del Tabajador de Santiago, Santiago, Chile, 3Clínica Dávila, Santiago, Chile

Introduction

Femoroacetabular impingement (FAI) is the leading cause of hip pain in young patients. Several studies have analysed hip osteoarthritis effects on sexual life, especially for female patients, however the knowledge of FAI effects on the matter are scarce. The aim of this study was to analyse the impact of FAI in the sexual life of female patients with a combined qualitative-quantitative methodology.

Methods

Qualitative-Quantitative mixed study. Sexually active female patients who were scheduled for arthroscopic treatment for FAI were included. Patients with prior surgeries to the hip, dysplasia and history of sexual dysfunction were excluded. Patients underwent in-deep interviews carried by a trained qualitative study interviewer (qualitative arm), reporting the most relevant emergent codes and categories. Demographics, IHOT scores and a sexual activity survey were recorded (quantitative arm) and reported using descriptive statistics. Sample size was determined by data saturation from the interviews.

Results

Data saturation was reached at the 10th interview, 2 more interviews were included (12 patients in total) to assure quality. Patients had a median of 35 years (range 26-51) and a median score of 25.3 (9.4-37.4) in the IHOT33 scale. Nine out of 12 and 7/12 patients reported sexual difficulties due to FAI and reduced intercourse frequency, respectively. Pain VAS score during and after intercourse were 4(2-8) and 5(3-9), respectively.

Five main categories emerged from the interviews. The consequences of FAI in sexual intercourse itself (reduced satisfaction, loss of spontaneity, frustration and difficulty reaching orgasm). The pain during and after intercourse plus the fear of having pain generating avoidance and interruptions. The effects over the relation with the partner and the importance of communication and understanding for coping with FAI. Regarding motivations to pursue surgical treatment, sexual life impairment was considered relevant, although not as important as the pain, fear of progression to osteoarthritis and disability. Recovering a normal sexual life was commonly included in their goals when undergoing surgery.

Conclusion

Sexual life in female patients is severely affected by FAI, representing a major concern. It sets fears and expectations regarding surgical treatment and prognosis.
Acetabular morphology predicts early conversion to arthroplasty following isolated hip arthroscopy for femoroacetabular impingement

**Dr Brian Giordano**, Dr Benjamin Kuhns1, Dr Itay Perets2, Leslie Yuen2, Dr Benjamin Domb2
1University Of Rochester Medical Centre Department of Orthopaedics & Rehabilitation, Rochester, United States,
2American Hip Institute, Hinsdale, United States

EP13 - FAI surgery

**Biography**
Orthopaedic Surgery resident at the University of Rochester Medical Centre with a career interest in open and arthroscopic hip preservation surgery.

**Background**
Hip arthroscopy in the setting of dysplasia and borderline dysplasia is controversial. Dysplasia severity is most often defined by the Lateral Centre Edge Angle (LCEA), but it can also be evaluated radiographically by the Acetabular Inclination (AI). The purpose of this study was to determine the impact of AI on outcomes following isolated hip arthroscopy for femoroacetabular impingement (FAI). We hypothesized that dysplastic patients would have higher arthroplasty rates as well as inferior clinical and functional outcomes compared to non-dysplastic patients.

**Methods**
A hip arthroscopy registry was reviewed for subjects undergoing arthroscopic correction of FAI from 2/28/2008-6/10/2013. Subjects required a clinical diagnosis and isolated arthroscopic correction of FAI with preoperative imaging and intra-operative cartilage status recorded. AI dysplasia was defined as an AI >10⁰, LCEA dysplasia was an LCEA <18⁰, and borderline LCEA dysplasia was 18⁰-25⁰. Patients without an acetabular deformity (LCEA 25⁰-40⁰; AI<10⁰) served as a control population. Postoperative variables included patient reported outcome surveys with conversion to arthroplasty as the primary endpoint. Minimum 5-year outcome scores were obtained on 337/419 (80.4%) of patients.

**Results**
419 patients were included in this study with 9 (2%) with LCEA dysplasia, 42 (10%) with AI dysplasia, and 52 (12.4%) with borderline dysplasia. The AI, but not LCEA was significantly correlated with lower outcome scores on the Harris Hip Score (HHS; p=0.01), Non-Arthritic Hip Score (NAHS; p=0.04), Hip Outcome Score-Sports Subscale (HOS-SS; p=0.04). LCEA dysplastic patients had an arthroplasty rate of 56% (OR 8.4) while AI Dysplastic (AI>10) had an arthroplasty rate of 31% (OR 3.3) and were significantly greater than the non-dysplastic cohort (13.5%; p<0.0001). Borderline dysplastic patients did not have increased rates of arthroplasty. A multivariate analysis found increasing age, increasing AI, Tönnis grade >1, and femoral Outer bridge >3 to be most predictive of conversion to arthroplasty.

**Conclusions**
An elevated acetabular inclination, along with age, Tönnis grade >0, and femoral Outer bridge grade >2 significantly predict early conversion to arthroplasty following isolated hip arthroscopy. We recommend using the AI, in addition to the LCEA, when evaluating hip dysplasia prior to hip arthroscopy.
Proximal over-resection during femoral osteochondroplasty negatively affects the distractive stability of the hip joint

Orthopaedic Surgeon Lionel E. Lazaro, Orthopaedic Surgeon Daniel P. Lim, Trevor J. Nelson, Sam A. Eberlein, Orthopaedic Surgeon Michael B. Banffy, PhD Melodie F. Metzger

1 Miami Orthopaedic and Sports Medicine Institute, Baptist Health South Florida, Miami, United States, 2 Kerlan-Jobe Orthopaedic Clinic, Los Angeles, United States, 3 Cedar Sinai, Los Angeles, United States

Introduction

Hip micro instability is an increasingly recognized source of hip pain and disability. Femoral osteochondroplasty is usually performed with direct visualization through an arthroscope, assisted with repeated fluoroscopic imaging. However, a two-dimensional representation of a three-dimensional structure is misleading and may compromise the precision of the planned osteochondroplasty. The resection can occasionally extend proximally into the Femoral Head diminishing the articular surface area available for suction seal. The purpose of this study was to determine whether proximal over-resection decreases the rotational and distractive stability of the hip joint.

Methods

Six hemi-pelvises were repeatedly tested in the following conditions: (a) intact, (b) T-capsulotomy, (c) Osteochondroplasty to the physical scar, followed by (d) 5mm and (e) 10mm proximal extension. The pelvis was secured to a metal plate and the femur was potted and attached to a multi-axial hip jig. Specimens were axially distracted with a load from 0-150N followed by 5Nm of internal and external torque at 0°, 15°, 30°, 60°, 90° of flexion. Displacement/rotation was recorded using a 3D motion tracking system. Repeated measures ANOVA was used with significance set at p<0.05.

Results

Proximal extension of the resection by 5mm and 10mm increased axial instability at every angle of flexion tested, with the greatest increase observed at higher angles of flexion, p<0.05. T-capsulotomy alone increased both internal and external rotation at all angles of flexion, p<0.05. Subsequent resection and extension of the resection did not significantly increase rotational instability compared to the capsulotomy state.

Conclusion

Extending the osteochondroplasty proximally into the femoral head compromises the distractive stability of the hip joint but doesn’t not affect hip rotational stability. Clinically, this highlights the importance of accuracy when performing femoral osteochondroplasty to minimize proximal extension that may increase iatrogenic instability of the hip joint, leading to reduced post-operative outcomes.
EP13.21 Arthroscopic outcomes as a function of acetabular coverage from a large hip arthroscopy study group

Dr Dean Matsuda1, Dr Benjamin Kivlan2, Dr Shane Nho3, Dr Andrew Wolff4, Dr Jonathan Salvo5, Dr John Christoforetti6,7, Dr Thomas Ellis8, Dr Dominic Carreira9

1DISC Sports and Spine, Marina del Rey, United States, 2Duesquene University, Pittsburgh, United States, 3Rush Medical Centre, Chicago, United States, 4Washington Orthopaedics and Sports Medicine, Washington, United States, 5Rothman Institute, Philadelphia, United States, 6Texas Health Presbyterian Hospital Allen, Allen, United States, 7Allegheny Health Network, Pittsburgh, United States, 8Orthopedic ONE, Dublin, United States, 9Peachtree Orthopaedics, Atlanta, United States

EP13 - FAI surgery

Biography
Dean Matsuda is recognized as one of the foremost leaders in hip arthroscopy. He has developed numerous procedures including arthroscopic treatment of the most extreme forms of femoroacetabular impingement (FAI), labral reconstruction, arthroscopic treatment of femoral head and acetabular fractures, and endoscopic treatment of athletic pubalgia and has authored the AAOS teaching video on arthroscopic surgery for FAI. Dr Matsuda is past chairman of the AAOS Sports Medicine program committee, long-time editorial board member of Orthopaedics Today, member of the ISHA educational committee, and director of the travelling fellowship for Orthopaedics Overseas. He is the director of Hip Arthroscopy at DISC Sports and Spine in Marina del Rey where he has one of the very few practices with an exclusive focus on non-arthritic hip and groin conditions.

Problem
Outcomes from hip arthroscopy for dysplasia and global pincer FAI have fallen short of those for patients with normal acetabular coverage, but no study has investigated arthroscopic outcomes across the spectrum of acetabular coverage.

Purpose
To report comparative hip arthroscopic outcomes of patients with low (borderline dysplasia), normal, and high (global pincer FAI) lateral acetabular coverage.

Methods
A retrospective analysis of prospectively collected data from a large multi-centre registry (seven United States centre’s) was performed. Primary hip arthroscopy patients were assigned to one of three groups based on preoperative lateral centre-edge angle (LCEA): borderline dysplasia (≤25°), normal (26-38°), and pincer FAI (≥39°). Repeated measures ANOVA compared pre-operative to 2-year minimum post-operative iHOT-12 scores. Subsequent ANOVA determined the effect of acetabular coverage on magnitude of change in scores.

Results
Of 437 patients, the only statistical difference between groups was lower prevalence of acetabuloplasty in the borderline dysplasia group (p=0.001). A significant improvement in the pre-operative to post-operative iHOT-12 scores for patients with normal acetabular coverage, acetabular under coverage, and acetabular over coverage was observed; F(1, 339)=311.06; p<0.001, with no statistical differences in pre-operative (p=0.505) and post-operative (p<0.488) iHOT-12 scores when comparing the groups based on acetabular coverage. Mean iHOT-12 scores increased from 37.3 pre-operatively to 68.7 postoperatively, p<0.001, in the borderline dysplasia group, from 34.4 to 72, p<0.001, in the normal coverage group, and from 35.3 to 69.4, p<0.001, in the pincer group. These pre-operative scores increased by 31.4, 37.8, and 34.1, respectively, with no effect for acetabular coverage on the magnitude of change from pre-operative to post-operative iHOT-12 scores, F(2,339) =1.18; p=0.310.
10 subjects (2.3%) underwent conversion arthroplasty and 19 patients (4.4%) underwent revision arthroscopy with no significant effect of acetabular coverage on the incidence of revision or conversion surgery, $X^2 (6,433)=11.535, P = 0.073$.

Conclusion
Lateral acetabular coverage did not influence outcomes from primary hip arthroscopy performed in patients with low (borderline dysplasia), normal, and high (global pincer FAI) LCEA. Borderline dysplasia and moderate global pincer FAI with no or minimal osteoarthritis do not compromise successful 2-year minimum outcomes or survivorship following primary hip arthroscopy when performed by experienced surgeons.
EP13.22 Hip arthroscopy for femoroacetabular impingement and labral tears: Minimum 2-year outcomes

Dr Jun-ki Moon¹, Dr Chul-Ho Kim¹, Dr Jae-Youn Yoon¹, CNS Mi Yeon Jeong¹, Dr Sun Hyung Lee², Prof. Hee Joong Kim², Prof. Pil Whan Yoon¹

¹Asan Medical Centre, Seoul, South Korea, ²Seoul National University Hospital, Seoul, South Korea

Biography
Pil Whan Yoon, M.D., Ph.D. is associate professor of orthopaedic surgery in Asan medical centre in South Korea. He is specialized in surgery for hip and pelvis, including arthroplasty, arthroscopy and hip preservation surgery. Professor Yoon has been making considerable contributions for research of hip and pelvis surgery as an academic editor of Plos One journal, as a member of International Society for Hip Arthroscopy, as a member of American Academy of Orthopaedic Surgeons and as a member of editorial board of Hip and Pelvis journal.

Aims
The present study investigated the minimum 2-year outcomes of hip arthroscopy for femoroacetabular impingement (FAI) and labral tears in Korean.

Methods
Between January 2012 and December 2017, the patients who underwent hip arthroscopy for FAI and labral tears were included. The patients with Tönnis grade-2 or grade-3 hip osteoarthritis, previous hip surgery on the same side, or non-completion of minimum 2-year follow-up were excluded. Plain radiographs were performed pre- and post-operatively. The arthroscopic characteristics of labral tears and the status of chondral lesions were recorded intraoperatively. Clinical assessments were performed using modified Harris hip score(mHHS) and the Western Ontario and McMaster Universities Osteoarthritis Index(WOMAC) at the latest follow-up.

Results
A total of 73 patients (90 hips) who underwent hip arthroscopy for FAI and labral tears were enrolled. There were 58 males and 15 females with a mean age of 34.4 (range, 15 to 63) years. 43 hips (47.8%) had cam-type, 7 hips (7.8%) had pincer-type, and 40 hips (44.4%) had mixed-type FAI. In cam and mixed type FAI hips, the mean alpha angle was significantly decreased from preoperative 66.7° to postoperative 44.9°. Twenty-five hips had Seldes type I labral tear, 8 hips had type II labral tear, and 57 hips had mixed type I and type II labral tear. There were 74 hips with Outer bridge grade I and 16 hips with grade II chondral lesions of the acetabulum. Arthroscopic treatments for labral tears were performed in 26 hips with partial resection, in 23 hips with labral repair, and in 41 hips with acetabuloplasty and labral refixation. The mean mHHS and WOMAC significantly increased from preoperative 74.8 and 75 to postoperative 93 and 89.4, respectively. There was no significant difference in the clinical outcomes according to the classification of labral tears, the status of chondral lesions, and treatment methods. There were three cases of complications (two transient pudendal nerve palsy and one transient sciatic nerve palsy). There was no additional surgery required.

Conclusions
At minimum 2 years of follow-up, hip arthroscopy may be an effective treatment for FAI and labral tears in Korean.
EP13.23 Five-year outcomes after arthroscopic treatment for femoroacetabular impingement syndrome

Dr Axel Öhlin¹, Dr Mattias Ahldén¹, Dr Ida Lindman¹, Dr Páll Jónasson¹, Dr Neel Desai¹, Dr Adad Baranto¹, Dr Olufemi R. Ayeni², Dr Mikael Sansone¹

¹University Of Gothenburg, Department of Orthopaedics, Göteborg, Sweden, ²McMaster University, Division of Orthopaedic Surgery, Department of Surgery, Hamilton, Canada

Purpose
Femoroacetabular impingement (FAI) syndrome is an important cause of hip pain and dysfunction in the young and active population. The aim of the present study was to evaluate the five-year outcome of arthroscopic treatment for FAI syndrome.

Methods
Patients were prospectively enrolled in the study and hip function was evaluated pre-operatively and at a five-year follow-up using the International Hip Outcome Tool (iHOT-12), the Copenhagen Hip and Groin Outcome Score (HAGOS), the Hip Sports Activity Scale (HSAS), the EuroQol-5 Dimension Questionnaire (EQ-5D), the EQ-Visual Analogue Scale (VAS), the VAS for overall hip function and overall satisfaction of treatment. Survivorship, defined as not converting to total hip arthroplasty, was calculated. A total of 184 patients (males = 110 (59.8%), mean age 38.0, were included in the analysis. The Wilcoxon signed rank test was used to compare preoperative PROM values with those obtained at the five-year follow-up.

Results
At significant (p<0.05) improvement at the five-year follow-up was obtained for all outcome scores, except for the HSAS; iHOT-12 (42.9 vs 67.2), HAGOS different subscales (50.2 vs 69.6, 55.7 vs 76.1, 59.2 vs 72.3, 41.1 vs 66.4, 30.8 vs 60.2, 31.6 vs 60.4), EQ-5D (0.570 vs 0.742), EQ-VAS (66.6 vs 74.4), HSAS (3.13 vs 3.17) and VAS for overall hip function (47.9 vs 69.2). Satisfaction with treatment was 84.6%. Survivorship at the five-year follow-up was 86.4%.

Conclusion
There is a significant improvement in hip function following arthroscopic treatment for FAI syndrome 5-year post-surgery.
Simultaneous acetabular labrum reconstruction and remplissage of the femoral head-neck junction. Technical note.

Biography
Dr Luis Perez-Carro is an orthopaedic surgeon specializing in Sports Medicine and Arthroscopy of all joints at the Department of Orthopaedic and Trauma Surgery at the Hospital Clinica Mompia in Santander (Spain). He also performs surgery for primary and revision THR and TKR. He is the chairman of the Santander hip meeting (Santander-Spain). He has published over 65 international and 50 national journal articles and now research in the hip arthroscopy field. Active member of AAOS, ISAKOS, ESKA and ISHA. Co-Chairman of the 2019 ISHA meeting.

Introduction
The purpose of this paper is to present the surgical technique and early outcomes of a simultaneous acetabular labrum reconstruction in combination with a remplissage of the Femoral Head-Neck Junction (RFHN) in a patient with recurrent hip pain after hip scope.

Material and methods
A 36-year-old male patient with a history of previous surgery 3 years earlier for right femoroacetabular impingement syndrome consulted in our clinic for residual inguinal pain. The score on the modified Harris Hip scale was 68 points. Radiographs revealed a loss of contour in the head neck union in the projection of Dunn. Magnetic resonance revealed an area of excessive resection with loss of the normal femoral head-neck contour and areas of degeneration / re-rupture in the anterosuperior acetabular labrum. Revision arthroscopy revealed a degenerated labrum and adhesions which led to the removal of the affected segment and labral reconstruction with a semitendinosus autograft of 3 cm. A dermal allograft (Arthrex ®) appropriate to the dimensions of the head defect was cut and prepared, delivered into the joint, positioned in the defect and fixed with arthroscopic knots and 3, 2.4-mm Iconix (Stryker ®) suture anchors preloaded with a No. 2 Fiberwire. The hip was evaluated dynamically in all planes of motion to assess the fixation, position of the graft, and recreation of the suction seal on the femoral head and neck.

Results
The patient followed the usual post-operative rehabilitation of labral repair and osteocondroplasty and did not register any postoperative complications and significantly improved his inguinal symptoms with a score on the modified Harris Hip scale of 86 at 6 months. He continues with periodic reviews to see the long-term evolution.

Discussion and Conclusion
Performing both a labrum reconstruction in combination with a remplissage of the Femoral Head-Neck Junction (RFHN) in a patient with recurrent hip pain after hip scope is an option to retain physiological integrity in the hip joint. This is the first report of such a combination and the first to use dermal graft for the RFHN. Long-term studies must be done to evaluate the efficacy and durability of this surgical technique.
EP13.25 Hip arthroscopy for femoroacetabular impingement (FAI) patients with self-reported allergies: Do multiple allergies have an effect on outcome?

MD Nicholas Ramos1, MD Michael Gerhardt1, MD Michael Banffy1

Kerlan Jobe Institute, Los Angeles, United States

Biography
Dr Nicholas Ramos is a sports medicine fellow at the Kerlan Jobe Institute and previously completed residency training at the NYU Langone Hospital for Joint Diseases.

Purpose
Multiple self-reported allergies have been suggested as a crude yet meaningful indicator of comorbid psychopathology, which may impact patient outcomes following orthopaedic procedures. The purpose of this study is to identify associations between allergies and postoperative outcome scores in patients undergoing hip arthroscopy for femoroacetabular impingement.

Methods
A retrospective review of surgically treated FAI patients at our institution was performed. Patient reported allergies and 6-month and 1-year modified Harris Hip Scores (mHHS) were recorded. Bivariate analysis was performed evaluating association between allergies and postoperative mHHS. Multivariate regression was used to identify independent factors associated with postoperative mHHS while controlling for age, sex, BMI, symptom duration, labral repair vs debridement, capsular management, chondral lesions, and use of adjunct PRP.

Results
Seventy patients were analysed. Average age was 30.7 years old (SD 8.96). 52.9% were females. 26 patients (37.1 percent) had reported allergies. At 6 months, bivariate analysis demonstrated no significant association between allergies and postop mHHS. This was true comparing patients with 0 vs 1 vs 2 vs 3 vs 5 allergies as separate groups (medians from 83.1 to 91.0, p=0.60) as well as when combining patients with >2 allergies into one group (0 vs 1 vs 2-5 allergies) (medians 84.7, 83.1, 86.0 respectively, p=0.328). At 1 year, this lack of association was more pronounced (separate groups: p=0.9265 and combined groups: p=0.6450). Linear regression demonstrated preop mHHS and age were significantly associated with 1-year mHHS. (logit mHHS rate=0.026±0.008 per unit, p=0.0014 for preop mHHS and logit mHHS rate=-0.061±0.018 per year, p=0.0010 for age) After controlling for age and preop mHHS, allergies were not associated with postop mHHS.

Conclusions
Allergies demonstrated no association with postoperative outcome following surgical treatment of FAI. Acceptable outcomes can be achieved in this patient population following arthroscopic management of FAI.
EP13.26 Treatment of impingement cysts using a bioabsorbable suture anchor

Dr. Brian Samuelsen1, Mr. James Spratt1, Dr. Ashley Payne1, Dr. Marc Philippon1
1Steadman Philippon Research Institute, Vail, United States

Biography
Originally from Northeast Pennsylvania, Dr. Samuelsen graduated from Union College in Schenectady, NY with a B.S. in Biology and a minor in Economics. In college, he was a four-year member of the men's varsity crew team. After college, he earned a Master of Business Administration with a focus on healthcare management at Union University, and subsequently worked for two years as a Health Systems Specialist at the Albany VA Medical Centre. He attended Temple University School of Medicine in Philadelphia, Pennsylvania, where he graduated with honours while discovering his interest in orthopaedics.

Dr. Samuelsen completed his residency at the Mayo Clinic in Rochester, Minnesota where he was also chosen as an American Orthopaedic Association (AOA) resident leader and emerging leader. While at the Mayo Clinic, he provided physician coverage for the John Marshall high school football team, the Rochester Ice Hawks junior league hockey team, and assisted with both Minnesota Timberwolves and Minnesota Twins coverage. His research interests at the Mayo Clinic included anterior cruciate ligament injuries, meniscus repair, and shoulder arthroplasty. This research has been presented both nationally and internationally.

Subchondral cysts of the femoral head-neck junction, often referred to as impingement cysts, are common findings in patients undergoing hip arthroscopy for femoroacetabular impingement (FAI). While smaller cysts may be inconsequential, larger defects can exacerbate symptoms or compromise the mechanical integrity of the femoral neck through generation of a stress riser.

The most commonly reported treatment for larger cysts is allogenic bone grafting. Although bone graft fills the defect and is osteoconductive, it takes weeks to months for the graft to provide structural support. Moreover, there is no described method for securing the bone graft into the defect and preventing escape into the joint.

This technical note describes a novel technique of treating large impingement cysts with bioabsorbable suture anchors. The senior author addresses any cyst greater than 4.5-mm in diameter, particularly in the posterosuperior aspect of the femoral neck. Following osteochondroplasty of the femoral head neck junction, the cyst is evacuated and curetted down to healthy bone. The defect is sized to determine if a 4.5-mm, 5.5-mm, 6.5-mm, or a combination of suture anchors will be required to fill the defect. The defect is carefully and slowly tapped, ensuring that the tap remains perpendicular to the bone. After the suture anchor is secured into the defect, the sutures are removed, and the anchor is conformed to the head-neck junction using a burr.

There are several benefits to this technique. Although costs vary between institutions, suture anchors can frequently be obtained at a lesser cost than bone graft. Additionally, the technique is simple, avoids the risk of debris in the joint, and provides immediate structural support allowing the patient to participate in the standard postoperative protocol without alterations.
EP13.27 Sub spine type 2 is predictable by anteroposterior and false profile radiographic views: A cohort study

Dr Osamu Miyamoto¹, Dr Yoichi Murata¹, Dr Hajime Utsunomiya¹, Dr Akihisa Hatakeyama¹, Dr Marc Philippon², Dr Soshi Uchida¹
¹Wakamatsu hospital of University of Occupational and Environmental Health, Kitakyushu, Japan, ²Steadman Philippon Research Institute, Vail, United States

Biography
In my first period of professional career, I had been working as an orthopaedic surgeon including my PhD school years. After basic training of orthopaedics including trauma, joint replacement, and spine surgery, I have specialized in sports medicine from 2009. In 2013, I earned PhD degree in Medical Science. As an MD PhD researcher, I have worked on dozens of sports medicine-related clinical studies and researches for translational medicine. As an international research fellow at Steadman Philippon Research Institute between 2016 and 2019, I had been working on hip arthroscopy-related biomechanical studies and clinical outcome studies. From April 2019, I started to practice at Wakamatsu hospital of University of Occupational and Environmental Health, Kitakyushu, Japan.

Background
Anterior inferior iliac spine (AIIS) morphology can be quite variable and frequently result in impingement against the distal femoral neck. However, recent literature lacks a clear understanding of whether plain radiographs can predict AIIS impingement.

Purpose
To clarify whether plain radiographs can predict AIIS impingement.

Methods
299 patients undergoing hip arthroscopy between 2015 and 2017 were enrolled. AIIS morphology was diagnosed by 3DCT preoperatively in all subjects (100%). Patients with osteoarthritis (Tönnis grade >1), osteochondromatosis, diffuse idiopathic skeletal hyperostosis, rim fracture, and with previous ipsilateral hip surgery, were excluded. Radiographic evaluations included anteroposterior, false profile, and Dunn views. Lateral centre edge angle (LCEA), Sharp angle, Tönnis angle, vertical centre anterior angle (VCAA), and alpha angle were measured. As for new measurements, sub spine angle and AIIS angle were measured in the false profile view. Data was presented by mean[SD] or median[IQR]. Student t, Kruskal-Wallis, chi-square, and Fisher’s exact tests were used. The cut-off value was detected by ROC curve analysis. Logistic regression analysis was performed to identify the risk factors of the AIIS type 2.

Results
245 hips (132 males and 113 females, 35.1[15.8] year-old) were investigated. Twenty-one hips were diagnosed as AIIS type 1, 212 hips as type 2, and 12 hips as type 3 by 3DCT. LCEA of AIIS type 3 was significantly lower compared to type 1 and type 2 (type 1 v 2 v 3, 35.0[30.0-39.0] v 27.0[21.5-32.0] v 22.0[13.5-27.0], p<0.001). There were significant differences between type 1 and 2 regarding Tönnis angle (4.5[5.8] v 7.8[6.3], p=0.02), and sub spine angle (49.5[17.5] v 34.8[15.6], p=0.03). There were 97 hips with LCEA<30°, Tönnis angle>5.5°, and sub spine angle <50°, and it was found that 98% of them had AIIS type 2 (odds ratio, 7.7 [95%CI, 1.8-34.5], p=0.007).

Conclusion
Plain radiographic evaluation can be invaluable in the screening of AIIS impingement.
Patients with borderline hip dysplasia achieve clinically significant outcome after arthroscopic femoroacetabular impingement surgery: A case-control study with minimum 2-year follow-up

Dr Edward Beck¹, Dr Benedict Nwachukwu², Dr Jorge Chahla², Ms Kyleen Jan², Dr Timothy Keating², Dr Shane Nho², Mr Jonathan Rasio²

¹Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, United States, ²Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

Purpose
To determine whether patients with borderline hip dysplasia (BHD) achieved 2-year similar patient reported outcomes (PROMs), Minimally Clinical Important Difference (MCID), and Patient Acceptable Symptomatic State (PASS) compared to non-BHD patients, and to identify predictors for achieving MCID and PASS in BHD patients undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS).

Methods
Data from consecutive patients undergoing primary hip arthroscopy for the treatment of FAIS between January 2012 and January 2017 were analysed. BHD patients (LCEA 20-25⁰) were matched 2:1 by age, gender, and BMI to control non-BHD patients (LCEA 25-40⁰). PROMs, MCID, and PASS were compared among the two groups. Multivariate logistic regression analysis was used to identify significant predictors of achieving MCID and PASS in the BHD patient group.

Results
A total of 112 patients with BHD were identified. MCID in BHD patients was defined as 9.2, 13.7, 8.5, and 15.2 for HOS-ADL, HOS-SS, mHHS, and iHOT-12, respectively. Threshold scores for achieving PASS in BHD and non-BHD groups was 87.9, 76.4, 78.1, and 60.0, respectively. Both groups saw statistically significant increases in score averages over the 2-year period, however, the difference among them was not significant (p>0.05 for all). There was no significant difference in the frequency of achieving MCID (86.6% vs 85.6%) and PASS (78.6% vs 79.8%) (p<0.05). Final logistic models demonstrated that lower BMI (OR: 0.872), lower alpha angle (OR: 0.965) and female gender (OR: 3.647) are independent preoperative predictors of achieving MCID, while lower alpha angle (OR: 0.943), and self-reported limp (OR: 18.53) are independent preoperative predictors of achieving PASS (p<0.05).

Conclusion
Outcome improvements in patients with BHD undergoing arthroscopic treatment of FAIS are not significantly different from patients with normal acetabular coverage. Lower BMI, lower alpha angle, absence of limp, and female gender are preoperative predictors of achieving meaningful clinically significant outcome improvement in BHD patients.
Clinical observation of the effect of hip arthroscopic surgery on femoral acetabular impingement syndrome (FAI) in elderly patients

Dr Chunbao Li, Dr Feng Gao, Dr Zhigang Wang, Dr Yujie Liu, and Dr Zhongli Li

The Sport Medicine Centre of Orthopaedics Department of the Chinese PLA General Hospital (301 Hospital), Beijing, China

Objective
To investigate the clinical efficacy of hip arthroscopic surgery for the treatment of femoral acetabular impingement syndrome (FAI) in the elderly in China.

Methods
Retrospective analysis was performed on the clinical effects of hip arthroscopic surgery on 20 elderly patients with FAI who were admitted to the department of orthopaedics of PLA general hospital from January 2015 to December 2017. Patients were evaluated for clinical efficacy by Visual Analogue Score (VAS), modified Harris hip score (mHHS), and patient satisfaction. The mean follow-up time of the 20 patients was 26.3±1.9 months. Patients were followed up on preoperatively, 1 year and 2 years postoperatively, respectively.

Results
The mHHS scores were 64.2±3.8, 86.5±2.7 and 88.4±2.0, respectively; VAS scores were 6.2± 0.8, 2.0± 0.7 and 1.6± 0.6, respectively; The mHHS and VAS score were significantly improved on 1 year and 2 years after surgery compared with those before surgery (P<0.05).

Conclusion
Hip arthroscopic surgery for FAI in elderly patients can effectively eliminate or reduce pain, improve hip joint mobility, improve patient quality of life and delay the development of osteoarthritis. Elderly patients in China can achieve the same results after hip arthroscopy compare with those in western countries.
Recurrence of low back pain associated with posterior hip pain has been continuously studied in the recent years showing hip pathology is involved in the development of lumbar complaint by the disruption of normal lumbopelvic kinematics. There are several hip pathologies that contribute to lumbar pathology in all hip layers. The objective of this study is to review a case series of twenty patients with Hip Spine Extension Syndrome, the different aetologies that cause this pathology, its anatomical changes and how to diagnose with a detailed physical exam with its corresponding radiological correlation.
EP14.2 A finite element analysis of ischiofemoral impingement, femoroacetabular impingement, and femoral version to investigate the effects on the lumbar spine

Anthony Khoury1,2, Tejas Mhetre2, Hal Martin1
1 Hip Preservation Centre. Baylor University Medical Centre at Dallas, Dallas, United States, 2 Bioengineering Department. University of Texas at Arlington, Arlington, United States

Biography
Anthony N. Khoury, PhD is a biomedical engineer with the Hip Preservation Centre in Dallas, TX. The primary focus of the research team is to develop a comprehensive understanding of the anatomy, biomechanics, and clinical aspects associated with abnormal hip pathology.

Finite element (FE) analysis is an effective tool to validate cadaveric biomechanics experiments and provide a comprehensive explanation of hip pathologies. The objective of this study is to develop a FE model of ischiofemoral impingement (IFI), femoroacetabular impingement (FAI), and increased and decreased femoral version (FV) to investigate the biomechanical effect on the lumbar spine facet joints (FJ) and intervertebral disk (IVD) during hip extension and flexion. The FE methods are based on published and pilot cadaveric experiments. FE osseous geometry includes femur, pelvis, and L3, L4, L5. Meshing and FE analysis was performed in ANSYS v19. Springs to simulate soft tissue include gluteus maximus, psoas major, rectus femoris, adductor longus, biceps femoris. 10 degrees and 20 degrees hip extension is used for the IFI and FV model and compared to the non-impingement (NI) femur. Hip flexion to 90 degrees is used for the FAI case and compared with the NI femur. IFI increased the sum of forces in the lumbar FJ segments compared to NI during 10- and 20-degrees hip extension. Cam-type FAI increased the sum of forces measured in the lumbar IVD compared to NI femur during 90 degrees hip flexion. The presence of decreased FV (-10 degrees FV) decreased the sum of forces in the FJ, whereas increased FV (+30 degrees FV) increased sum of forces in lumbar FJ compared to a NI case during 10- and 20-degrees hip extension. The resultant data for all hip pathologies and hip extension and flexion accurately validated the findings from benchtop cadaveric experiments. A FE analysis model to validate cadaveric benchtop experiments of IFI, FV, and FAI was successfully developed. The resultant data provide a strong foundation for the integration of advanced computational models to describe the intricate biomechanics associated with hip pathology and the lumbopelvic complex.
EP14.3 Diagnostic imaging prevalence of sacroiliac joint abnormalities and clinical outcomes in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome

Dr Vignesh Krishnamoorthy¹, Dr Edward Beck¹, Dr Jourdan Cancienne¹, Ms. Laura Krivicich¹, Dr Sunikom Suppausorn¹, Dr Olufemi Ayeni², Mr. Jonathan Rasio¹, Dr Shane Nho¹

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, ²Department of Orthopaedic Surgery, McMaster University, Hamilton, Canada

Biography
Dr Shane Nho is an orthopaedic surgeon specializing in sports medicine at Rush University Medical Centre in Chicago, IL, USA. His surgical interests include hip arthroscopy and treatment of femoroacetabular impingement. During residency at the Hospital for Special Surgery, Dr Nho was introduced to arthroscopic correction of FAI and PAO by Dr Buly, at a time when few surgeons were treating the disease. Dr Nho completed his sports medicine fellowship at Rush, working with Charles Bush-Joseph who was performing most hip arthroscopy procedures in Chicago. During this time, Dr Nho was selected as a Herodicus Traveling Fellow, working with Marc Philippon, Thomas Byrd, and Bryan Kelly to develop his arthroscopic surgical technique.

Currently, 80% of his clinical practice is devoted to arthroscopy and hip preservation. He is currently the Director of Young Adult Hip Surgery at Rush University Medical Centre.

In his time off, Dr Nho enjoys spending time with his wife, Sloan York, an OB-GYN physician at Rush, and their 2-year-old boy Connor. He also passionate about hockey, and cheers for his alma mater, North western, where he was captain of the men’s hockey team. He is also the team orthopaedic surgeon for the Chicago Fire Soccer Club.

Purpose
To quantify the prevalence of sacroiliac joint (SIJ) abnormalities in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS) using various imaging modalities and to compare outcomes based on SIJ abnormalities.

Methods
Plain radiographs, CT and MRI scans of patients who underwent primary hip arthroscopy for FAIS from January 2012 to January 2016 were identified. Exclusion criteria included patients undergoing bilateral or revision surgery, history of dysplasia, and less than two-year follow-up. On radiographs, SIJ joints were graded using the modified New York criteria for spondyloarthropathy. CT scans and MRIs were reviewed for joint surface erosions, subchondral sclerosis, joint space narrowing, pseudo-widening, bone marrow oedema, and ankylosis. Outcomes included the hip outcome score—activities of daily living (HOS-ADL), sports-subscale (HOS-SS), modified Harris hip score (mHHS), and visual analogue scales (VAS) for pain and satisfaction.

Results
Of 1,009 consecutive patients, 743 (73.6%) patients were included; 187 (25.2%) demonstrated SIJ changes. SI changes on any imaging modality were weakly correlated with pain of SI joint palpation (r=0.11; p=0.004) on physical exam. SIJ on physical exam (Odds ratio [OR] = 1.12, p=0.031) and history of SIJ pain (OR = 1.93, p=0.018) increased the odds of having an SIJ abnormality on any imaging modality. After matching, patients without SIJ abnormalities had significantly greater HOS-ADL (95.4 vs. 90.6;p=0.001), HOS-SS (91.1 vs. 77.5;p<0.001), and mHHS (91.3 vs. 84.5;p<0.001) scores and significantly less VAS pain (10.9 vs. 25.7;p<0.001) than those with abnormalities. Patients without SIJ abnormalities had greater odds of
achieving the MCID for the HOS-ADL (OR=2.91; p=0.001) and for the HOS-SS (OR=2.83; p<0.001), but not for the mHHS (OR=1.73; p=0.081).

Conclusion
There is a high prevalence (25.2%) of sacroiliac joint abnormalities seen on imaging in FAIS patients. These patients may demonstrate significantly inferior clinical outcomes and persistent postoperative pain after FAIS treatment.
Factors predicting acetabular chondral damage in femoroacetabular impingement

Md, MSc Diren Arsoy1, Md Kenneth Milligan1, Md Sujith Konan2, Md Johan D. Witt2
1Yale University, School of Medicine, Department of Orthopaedic Surgery, New Haven, United States, 2University College London Hospital, Department of Trauma and Orthopaedic Surgery, London, United Kingdom

Introduction
Femoroacetabular impingement is associated with chondral damage and predisposes to secondary osteoarthritis. Plain radiographs and, increasingly, CT scans with 3 dimensional reconstructions are used for preoperative planning. We investigated the association between radiographic and CT based femoral and acetabular parameters and acetabular chondro-labral damage witnessed during hip arthroscopy.

Methods
We reviewed 68 consecutive hips (70 patients) with symptomatic cam and/or pincer type FAI who underwent hip arthroscopy with concomitant osteochondroplasty and/or labral repair. Plain radiographs and CT measurements were reviewed. Chondral damage at arthroscopy was rated using the UCLH classification system. It was assumed that increasing grade and number of zones reflects worse damage. A regression analysis was undertaken using the chondral damage (recorded using the classification at arthroscopy) as the dependent variable and all other (x-ray, CT) parameters as explanatory variables.

Results
Increasing alpha angles from 11.00h to 15.00h were associated with worse damage appreciated at the time of hip arthroscopy. After regression analysis only increasing alpha angles at 14.00h were most implicated in damage to the joint.

Conclusion
This study highlights the association between femoral and acetabular morphology and chondral damage noted at hip arthroscopy.
EP15.2 Prevalence and clinical implications of chondral injuries after hip arthroscopy for femoroacetabular impingement syndrome

Dr Jorge Chahla\textsuperscript{2}, Dr Edward Beck\textsuperscript{1}, Dr Kelechi Okoroha\textsuperscript{2}, Dr Jourdan Cancienne\textsuperscript{2}, Mr. Kyle Kunze\textsuperscript{2}, Mr. Jonathan Rasio\textsuperscript{2}, Dr Shane Nho\textsuperscript{2}

\textsuperscript{1}Department of Orthopaedic Surgery, Wake Forest School of Medicine, Chicago, United States, \textsuperscript{2}Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

Purpose

To determine the effect of full and partial thickness chondral injuries on 2-year outcomes in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS) compared to patients without chondral damage. Additionally, to identify significant predictors of achieving patient acceptable symptomatic state (PASS) and minimal clinical important difference (MCID).

Methods

Data was reviewed from consecutive patients with evidence of chondromalacia at the time of primary hip arthroscopy with routine capsular closure for treatment of FAIS between January 2012 and September 2016. Patients were divided into partial (grade I-III) and full-thickness grade (IV) chondral defects and matched by age and BMI to patients without chondral injuries. Pre and postoperative outcomes were compared among the 3 groups, and a binary logistic regression analysis was utilized to identify significant predictors of achieving MCID and PASS.

Results

634 patients were included in the analysis, with an average age of 34.5±10.9 years and BMI of 25.2±4.7. There were statistically significant differences in the Hip Outcome score–Activities of Daily Living (HOS-ADL), Sports Subscale (HOS-SS), modified Harris Hip score, and pain satisfaction (p<0.01) among the 3 groups. Patients with grade IV chondromalacia experienced the poorest outcomes and lowest percentage of achieving PASS. Predictors for achieving any PASS threshold included preoperative alpha angle (OR:0.96; p=0.016), absence of preoperative limp (OR:7.25; p=0.002), absence of preoperative chronic pain (OR:5.83; p=0.019), primary hip arthroscopy (OR:0.17; p=0.05), patients who self-identified as runners (OR:2.27; p=0.037), and Tönnis grade=0 (OR:2.86, p=0.032). Male gender (OR:2.49, p=0.015) was the only predictor of achieving any MCID threshold.

Conclusions

Patients with grade IV chondral defects experience worse functional outcomes, lower satisfaction, and increased pain when compared to patients without chondromalacia or grade I-III chondromalacia at two-year follow-up. Several predictors were associated with achieving clinically significant function in patients undergoing hip arthroscopy for FAIS.
EP15.3 Do larger acetabular chondral defects portend inferior outcomes in patients undergoing arthroscopic acetabular microfracture? A matched-controlled study

Edwin Chaharbakhshi1, Dr David Hartigan2, John Spencer3, Dr Itay Perets3, Dr Ajay Lall4, Dr Benjamin Domb4

1Loyola Stritch College of Medicine, Maywood, United States, 2Mayo Clinic, Phoenix, United States, 3Hadassah Hebrew University Hospital, Jerusalem, Israel, 4American Hip Institute, Chicago, United States

Purpose
To elucidate the effect, if any, of acetabular chondral defect size on surgical outcomes after arthroscopic microfracture was performed with concomitant treatment for labral tears and femoroacetabular impingement (FAI) syndrome.

Methods
The study period was between February 2008 and November 2014. Data were collected on patients who underwent hip arthroscopy. The inclusion criteria were acetabular microfracture; concomitant treatment for labral tears and FAI syndrome; and preoperative modified Harris Hip Score, Nonarthritic Hip Score, Hip Outcome Score-Sports Specific Subscale, and visual analogue scale. Exclusion criteria were Workers’ Compensation, preoperative Tönnis grade >1, or previous ipsilateral hip surgeries or conditions. Patients were grouped based on smaller chondral defects (SCDs) or larger chondral defects (LCDs), then matched 1:1 by age at surgery 10 years, sex, body mass index ±5, labral treatment, capsular treatment, acetabuloplasty, and femoroplasty. Outcomes, secondary arthroscopies, and conversions to total hip arthroplasty (THA) were documented.

Results
Of 131 eligible cases, 107 (81.7%) had minimum 2-year follow-up. Before matching, the conversion rate to THA was higher for LCDs (24.6%) than for SCDs (12.0%). Thirty-five patients were matched for each group. Mean follow-up time was 47.9 months for the matched LCD group and 46.1 months for the matched SCD group. Ligamentum teres debridement was performed more frequently in the LCD group. No other differences were found regarding demographics, intraoperative findings, procedures, traction time, preoperative scores, or follow-up scores. Both groups demonstrated significant improvements in all scores. Rates of revision or conversion to THA were similar between groups. The relative risk for conversion to THA was 2.33 for patients with defects 300 mm² compared with patients with defects 250 mm². Deep vein thrombosis occurred in 3 (5.3%) patients with LCDs.

Conclusions
Matched patients with either SCDs or LCDs undergoing arthroscopic acetabular microfracture with concomitant treatment for labral tears and FAI syndrome demonstrated similar improvements at minimum 2-year follow-up. Patients with chondral defects approaching 300 mm² or greater may have a higher propensity toward conversion to THA.
Purpose
The German Cartilage Registry (GCR) has been extended by the hip module in 2014. It represents a German-speaking cohort study (Germany, Switzerland and Austria) which has been introduced by the working group “tissue regeneration” of the DGOU. In times of evidence-based medicine the GCR should provide a basis for long-term observational studies to represent the clinical reality of care and assess the effectiveness and efficiency of the therapies used.

Methods and Materials
A total of 1019 patients with cartilage defects at the hip (inclusion period 10/2014 to 08/2018) were included. Data collection was performed using a web-based remote data entry (RDE) system. All data were provided by the attending physician at the time of surgery of the affected hip.

Results
A total number of 23 centres were involved in this multicentre study. Mean patient age was 37,0± 12,1y. In 55.9% (514/919) of the cases, cartilage damage ICRS grade 3 or higher was documented. In more than 91% of cases cartilage damage was associated with a corresponding labrum damage greater than 1/3. Previous hip surgery was rare with 4.6% (46/995). Femoroacetabular impingement represents in 79.1% the main pathology. The mean defect size was 1.7 +/- 1.0 cm². The most commonly used treatment was debridement (44.2%), in which 57.4% (218/405) of the cartilage defects were ICRS less than or equal to 2. In cartilage defect grade 3 and higher, debridement continued to be the most common surgical technique (34.6%, 176/508), but also BM techniques and ACI (30.1%, 163/508) as well as combination interventions (25.8%, 131/508) were used.
Conclusion
Over the last four years, the GCR has established itself as the benchmark for documenting and tracking patients with cartilage damage in the lower extremity. The present epidemiological analysis of the available data represents the current, mostly arthroscopic supply situation of cartilage damage in the hip area.
EP15.5 Magnetic resonance arthrography of the hip with hyaluronic acid as contrast medium. interobserver reliability in the diagnosis of articular cartilage lesions and labral tears

Drs Elisabetta Nocerino¹, Dr Daniele Priano¹, Dr Federico Zaottini¹, Dr Alberto Fioruzzi¹, Dr Giacomo Folli¹, Drs Daniela Maglione¹, Drs Sara Favilla¹, Dr Filippo Randelli¹

¹Irccs Policlinico San Donato, San Donato Milanese, Italy

Biography
Dr Alberto Fioruzzi studied Medicine and Surgery at University of Pavia and complete with study with a final votation of 110 cum laude in 2012. He has done his residency in Orthopaedics and traumatology at University of Pavia and completed it with a thesis on gluteus maximus transfer with a votation of 50 cum laude in July 2018. He is now working in IRCCS Policlinico San Donato in Milan in the Department directed by Dr Filippo Randelli.

Purpose
Compare the diagnostic efficacy of magnetic resonance imaging with intra-articular hyaluronic acid as a contrast medium and of classical magnetic resonance arthrography, compared to the gold standard represented by hip arthroscopy.

Material and Methods
Twenty-Six patients who underwent hip arthroscopy due to femoro-acetabular impingement syndrome were studied retrospective. Two groups were formed: the first was made up of patients who performed classical magnetic resonance arthrography while the second consisted of those who performed the MRA with intra-articular hyaluronic acid. The groups are homogeneous for age, sex, and time elapsed between the execution of magnetic resonance imaging and surgery. The results of the examinations and the intraoperative reports in the diagnosis of chondral lesions and lesions of the acetabular labrum were then compared. The ICRS classification was used for articular cartilage, and the Lage classification was used for labral tears. The diagnostic reliability of the two methods to arthroscopic vision was statistically evaluated with Cohen's Kappa.

Results
Cohen's Kappa for classical MRA was 50.4% in the evaluation of labral lesions and 53% for chondral lesions. The MRA with intra-articular hyaluronic acid has shown excellent reliability for both assessments with a Cohen Kappa of 79.2% for labral lesions and 67.5% for cartilage lesions.

Discussion
The results obtained demonstrate an excellent contrastographic efficacy of the intra-articular hyaluronic acid. These positive features are also added to the antalgic efficacy demonstrated in the treatment of femoroacetabular impingement syndrome.

Conclusion
Hyaluronic acid is an excellent alternative to the intra-articular contrast medium in magnetic resonance allowing the correct visualization by the radiologist of lesions of the acetabular labrum and articular cartilage.
Demographic and radiographic factors associated with intra-articular hip cartilage injury: a cross-sectional study of 1511 hip arthroscopy procedures

Mr. Lasse Ishøi, Ass. Professor Kristian Thorborg, Mr. Otto Kraemer, Mr. Bent Lund, Mr. Bjarne Mygind-Klavsen, Prof. Per Holmich

Sports Orthopaedic Research Centre – Copenhagen (SORC-C), Department of Orthopaedic Surgery, Copenhagen University Hospital, Amager-Hvidovre, Denmark; Hvidovre, Denmark, Department of Orthopaedics, Horsens Regional Hospital, Denmark, Horsens, Denmark, Division of Sports Traumatology, Department of Orthopaedics, Aarhus University Hospital, Denmark, Aarhus, Denmark

Introduction

Per is a world-renowned orthopaedic surgeon within the field of groin injuries in sports, and arthroscopic knee- and hip surgery. He is the founder of SORC-C, head of the Arthroscopic department at Hvidovre Hospital and a professor at the Institute of Clinical Medicine at University of Copenhagen.

Background

Moderate-to-severe (grade 3-4) hip joint cartilage injury seems to impair function in subjects with femoroacetabular impingement syndrome.

Purpose

This cross-sectional study investigated if demographic and radiographic factors were associated with moderate-to-severe hip joint cartilage injury.

Methods

Subjects were identified in the Danish Hip Arthroscopy Registry. The outcome variables were acetabular cartilage injury (modified Beck grade 0-2 vs. 3-4) and femoral head cartilage injury (ICRS grade 0-2 vs. 3-4). Logistic regressions assessed the association with: Age (<30 years vs. 30-50 years); gender; sport activity level (Hip Sports Activity Scale; HSAS); alpha angle (AA) assessed as normal (AA<55°), cam (55°≤AA<78°), or severe cam (AA≥78°); lateral centre edge angle (LCEA) assessed as normal (25°≤LCEA≤39°), pincer (LCEA>39°), or borderline dysplasia (LCEA<25°); joint space width (JSW) assessed as normal (JSW>4.0 mm), mild reduction (3.1 mm≤JSW≤4.0 mm), or severe reduction (2.1 mm≤JSW≤3.0 mm).

Results

1511 subjects (mean age: 34.9±9.8 y) were included. Male gender (odds ratio; OR 4.42), higher age (OR 1.70), increased AA (cam: OR 2.23; severe cam: OR 4.82), and reduced JSW (mild: OR 2.04; severe: OR 3.19) was associated (p<0.05) with Beck grade 3-4. Higher age (OR 1.92), increasing HSAS (OR 1.13), borderline dysplasia (OR 3.08), and reduced JSW (mild: OR 2.63; severe: OR 3.04) was associated (p<0.05) with ICRS grade 3-4.

Conclusion

Several demographic and radiographic factors were associated with moderate-to-severe hip joint cartilage injury. Most notably increasing cam severity and borderline dysplasia substantially increased the risk of grade 3-4 acetabular and femoral head cartilage injury, respectively, indicating that specific morphology may drive specific cartilage injury patterns in the hip joint.
EP15.7 Minimum 12 month follow up of a randomized controlled trial comparing platelet-rich plasma versus hyaluronic acid in the treatment of symptomatic early osteoarthritis of the hip joint

Dr Matthew Kraeutler\textsuperscript{1}, Ms. Shannon Miller\textsuperscript{2}, Ms. Darby Houck\textsuperscript{2}, Dr Omer Mei-Dan\textsuperscript{2}

\textsuperscript{1}St. Joseph’s University Medical Centre, Paterson, United States, \textsuperscript{2}University of Colorado School of Medicine, Aurora, United States

EP15 - Cartilage injury and repair

Background
Hyaluronic acid (HA) and platelet-rich plasma (PRP) are two non-operative treatment options for patients with early hip osteoarthritis (OA). The purpose of this study was to compare the efficacy of intra-articular injections of HA and PRP in patients with early hip OA.

Methods
Patients presenting to a hip preservation surgeon with signs of early hip OA were randomized to treatment with HA or PRP. Each patient received 3 injections at 1-week intervals of either HA or PRP and were followed for a minimum of 12 months. The primary outcome, survivorship, was analysed by investigating the frequency of patient withdrawal to undergo surgery (total hip arthroplasty (THA) or hip resurfacing). The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score and hip range of motion were secondary outcomes.

Results
Twenty-eight patients (57\% male, mean age 54 years) with 30 hips (13 HA, 17 PRP) were included. Significantly more patients withdrew to undergo THA or hip resurfacing surgery from the HA group (6/13, 46.2\%) than the PRP group (1/17, 5.9\%) (p=0.043). There were no significant improvements or declines in any outcome among the HA group from pre-injection to 6 weeks, 3, 6, or 12 months. When comparing the difference in WOMAC scores from pre-injection to 12 months between groups, the PRP group demonstrated a significant improvement in WOMAC joint and function sub scores (both p<0.01), while the HA group actually demonstrated a decline in scores. When comparing the difference in WOMAC pain scores from 6 to 12 months, both groups' scores declined, but the HA group demonstrated a significantly greater decline compared to the PRP group (p=0.019).

Conclusion
Intra-articular injections of PRP in patients with early hip OA result in symptomatic improvement and delay the need for a THA or hip resurfacing procedure compared to treatment with HA. Further study is needed to determine the efficacy of HA injections within this population.
Differences in gene expression between femoroacetabular impingement (FAI) and end-stage hip osteoarthritis.
Dr Benjamin Kuhns\(^1\), Dr Gillian Soles\(^1\), Dr Cheryl Ackert-Bicknell\(^1\), Dr Brian Giordano\(^1\)
\(^1\)University Of Rochester Medical Centre Department of Orthopaedics & Rehabilitation, Rochester, United States

**Biography**
Orthopaedic Surgery resident at the University of Rochester Medical Centre with a career interest in open and arthroscopic hip preservation surgery.

**Background**
The morphological deformities in Femoroacetabular Impingement (FAI) have been associated with hip osteoarthritis (OA), however the molecular mechanisms for OA progression are poorly understood. The purpose of this study was to use whole genome RNA sequencing to characterize differences in gene expression of articular cartilage in patients with FAI and idiopathic OA. We hypothesized that there would be significant differences in genes expression in pathways related to inflammation as well as cartilage and bone turnover.

**Methods**
20 patients undergoing either hip arthroscopy for FAI (5 males, 5 female) or total hip arthroplasty (5 males, 5 female) for end-stage were included in the study. FAI patients required a Cam deformity with an Alpha Angle greater than 55 while patients with dysplasia (LCEA<25) or prior hip surgery were excluded. Exclusion criteria for the THA cohort included dysplasia, post-traumatic OA, or inflammatory OA. Cartilage samples were obtained over the Cam deformity prior to femoroplasty in the FAI group or over anterosuperior femoral head-neck junction in the OA group following extraction of the femoral head. Following RNA isolation, Next Generation RNA sequencing was performed to evaluate gene expression. A log-fold change of greater than 2 was used as a cut-off to determine dramatic expression differences.

**Results**
There were 3531 genes that were significantly differentially expressed between the FAI and OA cohorts. Of these, there were 27 genes that were upregulated by a greater than 2 log-fold change in the OA cohort and 524 genes that were upregulated by a greater than 2 log-fold change in the FAI cohort. There was significant differential expression in genes related to cartilage metabolism (Upregulated FAI: COL4A6, COL4A3, COL4A4; Upregulated OA: COL10A1, COL9A1); inflammatory pathways (Upregulated FAI: IL17B, NFkB1; Upregulated OA: MMP-1, MMP-13, IL1R1, IL2RA, TLR7), TGF-beta signalling (Upregulated FAI: LTBP, SMAD4; Upregulated OA: TGFB1, TGFB1, Runx2), and BMP signalling (Upregulated FAI: BMPR1, GREM1, Upregulated OA: CHRD12, BMP8A)

**Conclusions**
There are significant differences in gene expression between FAI and OA samples in pathways that are implicated in osteoarthritis. Further study of cartilage samples from FAI patients may provide insight into the molecular mechanisms of osteoarthritis progression.
EP15.10 Sport activity and clinical outcomes after hip arthroscopy with microfracture at a minimum 2 year follow up

MD, PhD Mattia Loppini\textsuperscript{1}, MD Francesco La Camera\textsuperscript{1}, MD Vincenzo Paolo Di Francia\textsuperscript{1}, MD Riccardo Ruggeri\textsuperscript{1}, Professor Guido Grappiolo, MD Federico Della Rocca
\textsuperscript{1}Humanitas Clinical and Research Centre, Rozzano, Italy, \textsuperscript{2}Humanitas University, Pieve Emanuele,

**Biography**
Clinical research to improve the current techniques and to develop innovative techniques in replacement and arthroscopic surgery of the hip and knee joints; to improve the outcome of patients undergoing hip and knee replacement surgery; to develop innovative techniques to improve the position of prosthetic components in hip and knee replacement; to develop protocols for rapid post-operative recovery (“fast track” in replacement surgery); to improve the diagnostic-therapeutic approach for periprosthetic infections.

Clinical research to improve the current surgical techniques and to develop innovative surgical techniques and to improve the outcome of patients undergoing surgery for the management of tendinopathies, tendon rupture, ligament and muscular injuries; to develop score systems for sport injury prevention and rehabilitation protocols.

**Objectives**
We aimed to assess the sport activity and clinical outcomes of patients with hip chondral defects managed with microfracture during hip arthroscopy.

**Methods**
Patients undergoing microfracture in hip arthroscopy in the period 2011-2016 were included. Clinical assessment was performed with modified Harris Hip Score (mHHS), Hip Disability and Osteoarthritis Outcome Score (HOOS) and visual analogue scale (VAS). Type and level of sport were evaluated preoperatively and in the last follow-up.

**Results**
We included 62 patients (M:F=58:4) with an average age of 35.1±8.1 years. The average follow-up was 53.7±18.3 months. Number of patients playing at the amateur and elite level was 38 (66.6%) and 19 (33.4%) preoperatively, and 49 (74.5%) and 9 (15.5%) at the last follow-up. Average mHHS changed from 71.3±6.5 to 89.3±5.1 at the last follow-up (<0.001), whereas average HOOS changed from 78.2±6.4 to 87.9±6.7 (<0.001). Age, body mass index, defect's size, Tönnis' grade and articular rim height did not affect the last follow-up mHHS and HOOS. There was no significant difference in terms of mHHS and HOOS according to postoperative sport activity. One (1.6%) patient underwent revision arthroscopy, and two (3.2%) patients underwent total hip replacement.

**Conclusions**
Microfracture for the management of full-thickness chondral defect provides good clinical results at a minimum follow-up of two years.
EP15.11 Quantitative hip cartilage MRI of patients with hip dysplasia: Evaluation of DdGEMRIC, T1p and T2* mapping

University Of Ottawa, Ottawa, Canada

Introduction
Delayed gadolinium-enhanced magnetic resonance imaging of cartilage (dGEMRIC) is a validated MRI technique for detecting early loss of proteoglycan (PG) requiring an injection of contrast agent and exercise prior to scanning. Newer MRI techniques (T1ρ and T2*) mapping are performed without any contrast injection. This study evaluates three quantitative MR techniques (dGEMRIC, T1p and T2* mapping) in patients with DDH. We hypothesize that both T1p and T2* correlate with dGEMRIC thereby providing effective non-contrast-based techniques for biochemical cartilage mapping in DDH hips.

Methods
Ten patients with DDH were recruited for this MRI study before surgery. DDH was defined as a lateral centre-edge angle under 25° and acetabular index >13° on the plain x-ray. MRI was performed at 3T using T1p, T2* and dGEMRIC mapping sequences. First T1p and T2* mapping was performed. After leaving the scanner the patients were injected with 0.4ml/kg Dotarem, walked for 15min and rested for 25min before returning back into the MRI for dGEMRIC mapping. For cartilage analysis the joint was subdivided into six regions of interest. (ROIs). The correlations between the different MRI techniques were evaluated using Spearman’s Rho and tested for significance.

Results
The analysis of all six ROIs for all subjects resulted in a significant (p<0.001) negative correlation (Rho = -0.58) between the dGEMRIC index and T1p. The correlation between dGEMRIC and T2* was positive (Rho = 0.56) and significant (p<0.001)

Discussion
Our results show a negative correlation between the dGEMRIC and T1p in patients with DDH. Both methods are known to probe the PG content of cartilage, where a decreased PG content leads to lower dGEMRIC index and an increased T1p value. The correlation coefficient was moderate, but significant, which shows that T1p mapping is an effective tool to probe the cartilage PG content similar to dGEMRIC. A comparable, but positive correlation was found between dGEMRIC and T2*. In symptomatic DDH, where an onset of OA is assumed, both PG depletion and collagen decay are in progress and can be evaluated with these mapping techniques.
Femoroacetabular impingement syndrome (FAI) is well known to cause acetabular chondral damage if left untreated. Acetabular microfractures are the gold standard to these chondral lesions, they are simple and inexpensive, unfortunately, most of the time they do not provide a full cartilage restoration. Gel scaffolds (GS) and membranes (MS) have shown to improve these acetabular chondral lesions in hip arthroscopy for FAI.

Method
Since 2015 we have used GS and MS. Patients in group A had gel scaffolds for treatment and it was either with Chondrofiller (collagen type 1) 26 patients with mean age of 43 were included and 30 patients, average age was 35 where treated with Cargel (chitosan with full autologous blood) the group of. Patients in group B had membrane scaffolds for treatment: 5 patients, with a mean age of 36 where treated with Hyalofast (semi-synthetic derivative of hyaluronic acid), and 15 patients, average age 37 where treated with Chondrogide (collagen matrix).

Results
Patients were evaluated with mHHS scale and the patient’s satisfaction scale (0 - 10) average mHHS score before surgery 58 - 67 (mean 61) and after surgery : 65 - 100 (mean 96) On patient satisfaction scale before surgery it was between 5 – 7 (mean 5.9) and after the surgery it was 6 - 10 (mean 9.7). In MRI after surgery only 3 cases (Tonnis 2) did not heal.

Conclusions
Membranes and gels have excellent results in patients with Tonnis 0-1. Gels are better than membranes in extensive and deep lesions. Surgery time is shorter when using gels. Chondrofiller is applied without microfractures, other three techniques require them. Gels can be used in so called “kissing lesions”. Membranes should be stabilized with tissue glue, which increases the procedure costs. Membranes and gels did not work on the Tonnis 2 changes.
EP15.13 Amniotic suspension allograft injection for hip osteoarthritis:
Prospective pilot study with 1 year follow up
MD Molly Meadows1, Katia Elisman1, MD Shane Nho2, **MD Marc Safran**1
1Stanford University, Redwood City, United States, 2Rush University, Chicago, United States

Background
There is increasing interest in non-arthroplasty strategies for management of patients with moderate osteoarthritis of the hip. Treatment of these patients can be challenging, as they are less likely to benefit from arthroscopy but may not yet be indicated for arthroplasty. Different biologic solutions are being tried. Based on early success in series involving knee arthritis, we wanted to study the efficacy of a commercially available amniotic suspension allograft (ASA) composed of particularized amniotic membrane and cells from amniotic fluid.

Hypothesis/Purpose
The purpose of our study was to evaluate the efficacy of an ASA (ReNu™, Organogenesis, Canton, Massachusetts, USA) injections in a pilot patient population with moderate osteoarthritis of the hip. We hypothesize that clinical results, as measured by patient-reported outcome tools, will demonstrate significant sustained improvement at 12 months post-injection.

Methods
Ten patients with symptomatic hip osteoarthritis, defined as Tonnis grade 1 or 2 on radiographic examination, were prospectively enrolled. Each patient received a single image-guided injection of ReNu™ into the hip joint. Patient-reported outcomes measures, including the iHOT12, mHHS, and SANE scores were recorded at several intervals, including baseline, 6 months, and 12 months post-injection. A linear regression model was performed to detect differences in outcome scores from baseline.

Results
Nine patients had complete 12-month data available for analysis, while 1 underwent a total hip arthroplasty 2 months after injection. The cohort includes 5 males and 4 females, ages 47-67. iHOT scores demonstrated a significant improvement between baseline and 12 months (p = 0.02). SANE scores demonstrated a significant difference between baseline and 6 months (p < 0.001), and between baseline and 12 months (p < 0.001). There was no significant difference between baseline, 6 months, or 12-month mHHS scores. There were no major adverse events in the course of the study period.

Conclusion
The ASA used demonstrated improvements in iHOT and SANE scores by 6 weeks, which were maintained for a year following injection. Further randomized controlled trials are needed to compare the results of ReNu™ hip injections to other traditional treatment modalities.
The role of Microfracture in the treatment of full-thickness chondral defects in hip arthroscopy: A mean 8 year follow up study

Md José Oñativia1, Md Pablo Slullitel1, Md Gerardo Zanotti1, Md Martin Buttaro1, Md Francisco Piccaluga1, Md Fernando Comba1

1Hospital Italiano De Buenos Aires, Ciudad Autonoma De Buenos Aires, Argentina

Aim
Our aim was to determine the hip joint preservation rate and functional outcomes in patients treated with microfractures for full thickness acetabular chondral damage during hip femoroacetabular impingement (FAI) arthroscopy.

Methods
Between 2009 – 2011 a cohort of 19 patients were treated with hip arthroscopy for FAI, microfractures were done to address full thickness chondral acetabular damage found intraoperatively. Previous hip surgery, avascular necrosis, or less than 1-year follow-up were exclusion criteria. The series consisted of 17 male and 2 females with mean age of 36 years old (SD6,5 years). Patients were stratified based on Tonnis class as being 1 or less, or 2 or more. Clinical outcomes were measured using mHHS and WOMAC scores, excluding patients reoperated with total hip arthroplasty (THA) during follow-up, that were considered failures. Mean follow-up was 8 years (SD 8 months).

Results
At final follow-up, joint preservation rate was 85% (95CI 60.42 – 96.62), with 3 patients requiring THA at 3 postoperative years in average (Range 6 to 48 months). THA as savage procedure was more frequent in Tonnis 2 or more group, p=0.02; and between lesions bigger than 150mm2, p=0.004. Clinical outcomes were, among preserved joints, 97.02 points in mHHS (SD 4.44) and overall 2,26 points in WOMAC (SD 2.85), being significantly lower in tonnis 2 or more group (33 points lower for mHHS, and 2,7 points higher for WOMAC), p=0,001).

Conclusions
Microfractures for the treatment of intraoperative full thickness acetabular chondral defects presented an 85% joint preservation rate in these series. Lesions bigger than 150mm2; and preoperative tonnis 2 patients were at high risk for THA at less than 48 months and should be cautiously counselled.
EP15.15 Optimization of human articular chondrocytes isolation with a single enzymatic digestion procedure

Dr Lourenço Peixoto¹
¹Into, Rio De Janeiro, Brazil

Biography
Orthopaedic Surgeon of National Institute of Orthopaedics and Traumatology in Rio de Janeiro Brazil
President of Brazilian Society of Hip Surgery Rio de Janeiro 2016-2017
Fellowship Steadman Philippon Research Institute 2012

There are several protocols for isolating articular chondrocytes, varying enzymes, enzymatic concentration, time after the first medium changing, among other parameters. Our objective was to develop a simplified and optimized protocol for isolating human articular chondrocytes. Articular cartilage samples were extracted from the surface of the femoral head from volunteer donors who had undergone total hip arthroplasty surgery (n = 9). Samples were washed with phosphate-buffered saline (PBS) (Sigma-Aldrich), mechanically dissociated into fragments of 1mm³, and weighed. Then, fragments were incubated in a digestion solution under static condition at 37°C in humidified atmosphere of 5% CO2 for 18 hours in 6-well plates. Digestion solution comprised of 2 mg/mL collagenase type II (Gibco) dissolved in Dulbecco’s modified Eagle’s medium (Sigma-Aldrich). Digested suspension was collected and centrifuged at 2000 RPM for 5 minutes at 21 °C (Thermo Megafuge). Pellet was resuspended in 2 mL of Iscove’s Modified Dulbecco’s Medium (IMDM, Sigma-Aldrich) supplemented with 10% foetal bovine serum (FBS, Vitrocell) and seeded in 24-well plates. After ten days of culture, cells reached 80-90% confluency, and were detached using 0.78 mM EDTA (Gibco) and 0.125% trypsin (Gibco) solution and re-seeded at a density of 104 cells/cm². Before first trypsinization step, cells were considered in primary culture, and after first trypsinization step, cells were considered in passage 1. By using only 2mg/mL collagenase type II solution we varied the ratio of tissue (gram) to the enzymatic solution (volume); the seeding density, expressed as digested tissue (gram) to cell culture well area (cm²); and time for medium changing discarding non-adherent cells. The use of 100 mg of tissue per mL of enzymatic solution and seeding at 20 mg/cm² with medium changed after 5 days results optimized cell yield (8.24 ± 2.83 x 10⁵ cells per gram of digested cartilage, after the first trypsinization step occurred 10 days after seeding). Future work is still necessary to verify if cells phenotype obtained by this protocol may differ from other protocols in the literature.
EP15.16 Arthroscopic treatment of acetabular cartilage lesions in cam-type hip impingement with membrane induced chondrogenesis versus micro fracturing

Dr Jan Somers¹, Dr Cyriëlle Stevens¹,², Dr Cedric Depuydt¹,³
¹Jan Yperman Hospital, Ypres, Belgium, ²University of Ghent, Ghent, Belgium, ³University of Louvain, Louvain, Belgium

EP15 - Cartilage injury and repair

Biography
Dr Jan FA Somers graduated as Orthopaedic Surgeon in 1996 (Louvain, Belgium) after training in Belgium and South Africa. He is a former Ling Fellow (PEOH and University of Exeter, UK). He focused on surgery of the Hip, Pelvis and Shoulder, and had extensive arthroscopic training in both joints. He is working in the Jan Yperman Hospital, Ypres, Belgium, where he is Chairman of the Surgical Department since 2007. He is performing Hip Arthroscopy for more than 20 years.

Dr Somers is a member of BVOT (Belgian Orthopaedic Society), BHS (Belgian Hip Society – board member), BELSS (Belgian Elbow & Shoulder Surgeons Society), ISHA (International Society of Hip Arthroscopy), ISAKOS (International Society of Arthroscopy, Knee Surgery and Sports Medicine), SECEC (European Society of Shoulder and Elbow Surgery), SICOT and ICRS (International Cartilage Repair Society). He is reviewer for several orthopaedic journals.

Dr Somers is lecturing both nationally and internationally regularly, and he has a visiting training programme for mini-invasive THR (PATH and Super PATH) and for Hip Arthroscopy. He is performing more than 200 hip arthroscopy procedures annually – most for FAI and advanced cartilage treatment. He is performing arthroscopic AMIC in the hip since 2012.

We reported earlier on a consecutive series of patients with cam type FAI (Femoro-Aacetabular Impingement) with acetabular cartilage rim lesions larger than 150 mm² that were treated with an arthroscopic AMIC (Autologous Matrix Induced Chondrogenesis) procedure. The AMIC group consisted 16 patients with a mean age of 34. This group was compared to an age, sex and cartilage size defect matched cohort of patients who underwent an arthroscopic micro fracturing. At 3 years the HHS (Harris Hip Score) was 96.5 in the AMIC group and 93.5 in the micro fracturing group. Patients had significantly less symptomatic synovitis postoperatively in the AMIC group and more athletes could resume their activities to the pre-injury level in this group. We now present a FU (follow-up) report at a mean of 81 months (range 77-87) for the AMIC group and 102 months (range 84-113) for the comparison group. With longer FU, one additional patient failed in each group (both had worse clinical outcomes at the 3-year FU). In the AMIC group conversion to THR (Total Hip Replacement) was observed at 8, 36 and 48 months, respectively. In the micro fracturing group, 4 patients had conversions to THR after 12, 14, 24 and 68 months. HHS and HOOS improved further to 97 (range 86-100) and 98 (range 94-100) in the AMIC group and decreased slightly to 92.3 (range 40-100) and 92 (range 50-100) respectively in the control group. In conclusion, clinical results of AMIC in the treatment of cartilage lesions in patients with cam-type FAI remain excellent with longer follow-up. Most failures are observed in the early phase.
Early results of autologous matrix induced chondrogenesis and bone marrow aspirate concentrate for acetabular cartilage lesions

Dr Jan Somers
Jan Yperman Hospital, Ypres, Belgium

Biography
Dr Jan FA Somers graduated as Orthopaedic Surgeon in 1996 (Louvain, Belgium) after training in Belgium and South Africa. He is a former Ling Fellow (PEOH and University of Exeter, UK). He focused on surgery of the Hip, Pelvis and Shoulder, and had extensive arthroscopic training in both joints. He is working in the Jan Yperman Hospital, Ypres, Belgium, where he is Chairman of the Surgical Department since 2007. He is performing Hip Arthroscopy for more than 20 years.

Dr Somers is a member of BVOT (Belgian Orthopaedic Society), BHS (Belgian Hip Society – board member), BELSS (Belgian Elbow & Shoulder Surgeons Society), ISHA (International Society of Hip Arthroscopy), ISAKOS (International Society of Arthroscopy, Knee Surgery and Sports Medicine), SECEC (European Society of Shoulder and Elbow Surgery), SICOT and ICRS (International Cartilage Repair Society). He is reviewer for several orthopaedic journals.

Dr Somers is lecturing both nationally and internationally regularly, and he has a visiting training programme for mini-invasive THR (PATH and Super PATH) and for Hip Arthroscopy. He is performing more than 200 hip arthroscopy procedures annually – most for FAI and advanced cartilage treatment. He is performing arthroscopic AMIC in the hip since 2012.

We report on the early results of a consecutive series of 37 hips treated with arthroscopic Autologous Matrix Induced Chondrogenesis (AMIC) supplemented with Bone Marrow Aspirate Concentrate (BMAC) for Acetabular Cartilage Lesions. A Chondrogide collagen matrix was applied arthroscopically and the membrane was saturated with BMAC at the end of the procedure. Twenty-nine men (4 bilateral hips) and 4 women with average age of 29 years (range 17-42) were treated between 2015 and 2018 for full thickness acetabular cartilage lesions greater than 125 mm² with this novel arthroscopic technique. Mean cartilage defect was 275 mm² (range 125-550). Twenty hips were graded Tönnis stage 0, 14 stage I and 3 stage II. Five hips were revision procedures; 34 had cam resection for cam-type FAI. Twenty-three had labral repair. Mean preop CE-angle was 27 (range 17-33); 8 hips were graded as having borderline dysplasia. Mean follow-up was 27 months (range 12-50). Mean alfa-angle improved from 82 to 55. No hip showed bone oedema on MRI at FU. No hip showed radiographic deterioration. No failures or conversions to THR were reported. Twenty patients had an excellent result and returned to their pre-injury sports (15 soccer, 2 kickboxing, 1 martial-arts, 1 Frisbee, 1 triathlon) within one year. Eleven patients were rated as very good but had not returned to their pre-injury level by the time of review. Two patients had a fair result. Mean preop UCLA was 5; mean UCLA at FU was 9. At a mean of 2-year FU, these results seem promising in the treatment of large full thickness acetabular cartilage lesions. The results favour well compared to a group of patients with similar type of cartilage defects and treated with AMIC only. No adverse reactions to the use of BMAC were described.
The alpha angle in femoroacetabular impingement can predict the severity of acetabular cartilage damage

**Mr. Hao-Che Tang**, 1 Prof. Michael Dienst 2
1Chang Gung Memorial Hospital, Keelung City, Taiwan, 2Orthopädische Chirurgie München, Munich, Germany

Purpose
Acetabular cartilage damage and chondrolabral separation are commonly observed in patients with femoroacetabular impingement (FAI). The study was designed to determine if the alpha angle is a predictor for acetabular cartilage damage and chondrolabral separation.

Methods
We assessed patients who underwent hip arthroscopic cam resection between January 2018 and August 2018. Patients with lateral centre-edge angle (LCEA) < 25° or LCEA ≥ 40°, Tönnis grade > 1, previous surgery history on the same hip, or concomitant hip synovial disease were excluded. Patients’ demographic data, radiographic parameters, and intra-operative findings were collected prospectively. The acetabular cartilage condition was classified as normal, bubble, pocket, flap or subchondral bone exposure. The chondrolabral junction was classified into normal, stable separation and unstable separation.

Results
Seventy-one patients with a mean age of 33 years (range, 17-58 years) were included in this study. The mean alpha angle on AP view and Dunn lateral view was 59.9° (range, 35.1°-88.5°) and 68.3° (range, 39.6°-89°), respectively. The alpha angle on both AP and Dunn lateral view was significantly associated with the severity of acetabular chondral defect. An increase of alpha angle by 7.1° on AP view and 5.2° on Dunn lateral view can predict the progression of severity of acetabular chondral defect according to the classification. However, the alpha angle did not correlate with the stability of chondrolabral junction.

Conclusions
Increase of alpha angle in patients with symptomatic FAI is associated with more severe acetabular cartilage damage.
EP15.20 Sustained benefit of autologous matrix-induced chondrogenesis (AMIC) for hip cartilage repair in athletic patients

MD, PhD Fritz Thorey¹, MD Dimitrios P. Giotis
²ATOS Hospital Heidelberg, Heidelberg, Germany

Biography
Dr Fritz Thorey is a specialist for hip reconstruction and arthroplasty for many years in the ATOS Hospital for Special Surgery in Heidelberg, Germany. He performs hip arthroscopy for over 15 years in professional athletes and regular patients with femoro-acetabular impingement. Furthermore, he is specialist in cartilage reconstruction like AMIC procedure and ACI. He has published many papers in the field of hip surgery and received some grants for his work. Dr Fritz Thorey has done many fellowships, e.g. with Dr Marc Philippon in Vail, USA and Dr Michael Leunig in Zurich, Switzerland.

Purpose
Femoroacetabular impingement, trauma, labral tears, and existence of loose bodies are the most common causes of chondral lesions in the hip joint of athletes or young active patients. The size and location of these lesions might cause severe pain or even functional limitation. For small defects, micro fracturing alone has been reported to offer satisfactory results. However, for bigger cartilage defects, amongst others, autologous matrix-induced chondrogenesis (AMIC) procedure is considered to be quite effective. To investigate the clinical outcome of AMIC implementation for mid-sized chondral lesions of the acetabulum in young active patients and assess their potential to resume an active lifestyle including return to sports.

Methods
Sixty-two patients with full-thickness mid-sized acetabular chondral lesions were studied. All patients underwent an arthroscopic AMIC procedure for reconstruction of chondral defects, were assessed pre-operatively, and at least 5 years post-operatively using the Hip disability and Osteoarthritis Outcome Score (HOOS), modified Harris Hip Score (mHHS) and Visual Analog Scale (VAS) for pain.

Results
A significant improvement in all three scores at the time of follow-up was found. The mean HOOS improved from 58.8 ± 7.4 pre-operatively to 87.1 ± 8.4 at follow-up (p<0.001) while the mean mHHS improved from 53.4 ± 6.6 to 85.6 ± 8.4 (p<0.001). There was a significant decrease from 4.9 ± 1.1 pre-operatively to 1.3 ± 0.8 post-operatively (p<0.001) in the VAS pain evaluation, indicating that the patients were satisfied with their relief of pain.

Conclusions
The AMIC procedure is an effective single-stage technique for the reconstruction of mid-size chondral defects of acetabulum in young active patients. This intervention enhanced the potential for patients to resume daily sport-related activities and the 4-year clinical outcome as evaluated by the HOOS, mHHS and VAS showed sustained improvement over the pre-operative evaluations. Further research examining the long-term results of cartilage repair with AMIC in such patients would be beneficial.
EP15.21 RELIABILITY OF ARTHROSCOPIC CLASSIFICATION OF HIP CHONDRAL LESIONS

MD Antônio Augusto Guimarães Barros¹, Rafael Baroni Carvalho¹, MD Carlos Cesar Vassalo³, MD Lincoln Paiva Costa¹, Juan Gómez-Hoyos², Vinícius de Oliveira Paganini³, MD, PhD Marco Antônio Percope de Andrade³

¹Hospital Madre Teresa, Belo Horizonte, Brazil, ²Baylor Scott and White Research Institute, Hip Preservation Centre, Dallas, United States, ³Departamento do Aparelho Locomotor da Faculdade de Medicina da UFMG, Belo Horizonte, Brazil

EP15 - Cartilage injury and repair

Biography

Objective
To evaluate the inter and intra observer reliability of the Outer bridge, Beck and Haddad classifications for acetabular joint cartilage lesions through the arthroscopic procedure. Methods: 60 hip arthroscopy videos were evaluated twice by 4 surgeons at two different times to assess inter and intra observer reproducibility of the classifications and data analysed by means of the weighted Cohen Kappa index.

Results
The mean weighted Kappa value in the interobserver assessment of the Outer bridge, Beck and Haddad classifications were respectively 0.72, 0.78 and 0.68. The three classifications were considered to be of good inter observed agreement. Regarding the intra observer assessment of the Outer bridge, Beck and Haddad weights Kappa values were respectively 0.9, 0.9 and 0.93. All of them being considered excellent in intra observer comparison Conclusion: In our series, the Outer bridge, Beck and Haddad classifications showed good interobserver reproducibility and excellent intraobserver reproducibility when evaluating arthroscopic acetabular chondral lesions.

Keywords
Arthroscopy, Hip, Classifications, Reliability.
EP15.22 Short-term results of mosaicplasty for the treatment of femoral head osteochondral lesions: a report of 5 cases and surgical technique
M.D. Gerardo Zanotti1, M.D. Fernando Diaz Dierienia1, M.D. Jose Ignacio Oñativia1, M.D. Fernando Comba1, M.D. Martin Buttaro1, M.D. Francisco Piccaluga1
1Hospital Italiano De Buenos Aires, Buenos Aires, Argentina

Biography
Former chief resident of Hospital Italiano de Buenos Aires, Argentina. Nowadays, working as a fellow of the Sir John Charnley Hip Centre at Hospital Italiano de Buenos Aires.

Background
Treatment of hip joint osteochondral lesions (OCL) is challenging due to its deep location and complex biomechanics. We sought to analyse the initial results of 5 patients with symptomatic cartilage defects and cam type impingement of femoral head successfully treated with surgical hip dislocation and autologous osteochondral grafting.

Methods
We retrospectively studied 5 male patients with symptomatic femoral head OCL operated between 2015-2018. Median follow-up was 16 months (IQR, 11-21). Median age was 24 years (IQR, 23-34). Median modified Harris Hip Score (mHHS) and pain evaluation according to the Visual Analogue Scale (VAS) was 63 (IQR, 54-63) and 8 (IQR, 8-9) respectively. All patients had a grade IV lesion according the Outer bridge Grading System, and median defect size was 2 cm2 (IQR, 2-2). Using a posterolateral approach, all cases underwent autologous osteochondral mosaicplasty along with femoral osteochondroplasty following surgical hip dislocation. All defects compromised subchondral bone and were reconstructed with osteochondral plugs obtained from a non-weight-bearing zone of the lateral femoral condyle.

Results
At final follow-up, mHHS improved significantly with a median postoperative value of 94 points (IQR, 91-95), (p=0.04). Postoperative VAS evaluation decreased significantly to a median value of 1 (IQR, 0-2), (p=0.04). Magnetic resonance imaging showed adequate graft union and healthy chondral surface formation at final evaluation. No complications were registered during the postoperative period. No further surgeries were required in any case, and there were no signs of osteonecrosis at final review.

Conclusions
OCL of the parafoveal region of the femoral head are still challenging in orthopaedic practice. Although it is a demanding procedure, autologous osteochondral mosaicplasty and femoral neck osteochondroplasty combination is an effective treatment alternative for young patients.

Keywords
Femoral head osteochondral lesion, Mosaicplasty, Surgical hip dislocation, Osteochondral grafting
EP15.23 Are chondrocytes overlying cam morphology suitable for therapeutic use?

Dr Robert Westermann¹, Mr Michael Slattery¹, Dr Mitchell Coleman¹
¹University Of Iowa, Iowa City, United States

**Biography**

Dr Westermann (Robby) is an Orthopaedic Surgeon and team physician University of Iowa. He went to medical school at the University of Washington in Seattle, WA and completed his residency in Iowa City. He completed a sports medicine fellowship at the Cleveland Clinic and was subsequently awarded the William Harris Award in Hip Preservation and completed a Traveling Fellowship with the ANCHOR Hip Preservation group spending time in St Louis, Michigan and Twin Cities, MN. He practices sports Medicine at the University of Iowa and treats athletic injuries of the knee, hip and shoulder. He is involved in cellular and biomechanics basic science research and Multi-centre clinical outcomes research through the MOON and ANCHOR groups.

Michael Slattery BA, Robert Westermann MD, Mitchell Coleman PhD
University of Iowa Carver College of Medicine – Iowa City, IA

Cam-type femoroacetabular impingement (FAI) results in extra bone and cartilage on the anterolateral femoral head-neck junction, causing abnormal contact between the femur and the acetabulum. We investigated whether chondrocytes isolated from cam lesions in FAI patients are metabolically similar to normal chondrocytes and therefore a potential option for therapeutic use via autologous implantation.

Cam cartilage was obtained intraoperatively from 7 human patients with cam lesions (Alpha angle > 60 degrees) (4 arthroscopy, 2 arthroplasty, and 1 periacetabular osteotomy). Healthy femoral and acetabular articular cartilage was obtained from 8 Yucatan minipig hips for comparison. Chondrocytes were extracted from the cartilage then cultured at a high density for up to 1 week. Mitochondrial stress testing procedures (with 2 µM oligomycin, 2.5 µM carbonyl cyanide p-trifluoromethoxy-phenylhydrazone (FCCP), 2 µM rotenone, 5 µM antimycin A) for determination of the chondrocytes basal and maximal respiration were performed.

No significant differences in basal (p = 0.73) or maximum (p = 0.40) respiration were found when comparing chondrocytes from cam lesions to normal porcine articular chondrocytes. There was a significant difference in maximum respiration when comparing chondrocytes from cam lesions in patients who underwent a total hip arthroplasty to chondrocytes from other cam lesions (p = 0.007).

Basal and maximum respiration in chondrocytes from cartilage overlying cam lesions suggests a similar level of respiration to healthy articular chondrocytes. Given the importance of mitochondria to cartilage homeostasis, this study supports that chondrocytes overlying femoral cam lesions may be a novel source of healthy chondrocytes.
V15.18 Technique of arthroscopic BMAC (Bone Marrow Aspirate Concentrate) supplementation in AMIC (Autologeous Matrix Induced Chondrogenesis) for hip cartilage lesions

Dr Jan Somers
1

1Jan Yperman Hospital, Ypres, Belgium

EP15 - Cartilage injury and repair

Biography
Dr Jan FA Somers graduated as Orthopaedic Surgeon in 1996 (Louvain, Belgium) after training in Belgium and South Africa. He is a former Ling Fellow (PEOH and University of Exeter, UK). He focused on surgery of the Hip, Pelvis and Shoulder, and had extensive arthroscopic training in both joints. He is working in the Jan Yperman Hospital, Ypres, Belgium, where he is Chairman of the Surgical Department since 2007. He is performing Hip Arthroscopy for more than 20 years.

Dr Somers is a member of BVOT (Belgian Orthopaedic Society), BHS (Belgian Hip Society – board member), BELSS (Belgian Elbow & Shoulder Surgeons Society), ISHA (International Society of Hip Arthroscopy), ISAKOS (International Society of Arthroscopy, Knee Surgery and Sports Medicine), SECEC (European Society of Shoulder and Elbow Surgery), SICOT and ICRS (International Cartilage Repair Society). He is reviewer for several orthopaedic journals.

Dr Somers is lecturing both nationally and internationally regularly, and he has a visiting training programme for mini-invasive THR (PATH and Super PATH) and for Hip Arthroscopy. He is performing more than 200 hip arthroscopy procedures annually – most for FAI and advanced cartilage treatment. He is performing arthroscopic AMIC in the hip since 2012.

Bone Marrow Aspirate Concentrate (BMAC) with use of a collagen membrane has been described to add healing of cartilage defects in the ankle and knee joints. Early results were promising with this novel open surgical technique.

In 2016 we adapted the original open technique for use in hip arthroscopy. The surgical technique consists of an AMIC (Autologeous Matrix Induced Chondrogenesis) procedure with a thinner collagen membrane, followed by retrieval of autologeous bone marrow from the iliac crest for preparation. During this time other surgical pathology is addressed and formal femoroplasty performed in cases of cam deformity. At the end of this procedure traction is reapplied, the joint dried after verification that the collagen membrane has remained in situ (after withstanding repeated motion, manipulation and irrigation), and finally BMAC is gently infused over the collagen matrix, ensuring full saturation of the matrix. More than 39 patients have been treated since 2016 and no adverse reactions or donor site morbidity has been observed to date. No cases of heterotopic ossification or bone formation over the treatment area have been observed so far.

In conclusion, a novel and easy to use technique to deliver BMAC during AMIC for hip cartilage lesions is described.
EP16.1 Acetaminophen versus oxycodone-apap for pain management after hip arthroscopy: A randomized controlled trial

Samuel Baron\textsuperscript{1}, Matthew Kingery\textsuperscript{1}, \textbf{Dr Thomas Youm}\textsuperscript{1}
\textsuperscript{1}NYU Langone Health Department of Orthopaedic Surgery, New York, United States

\textbf{Biography}
Dr Thomas Youm is a fellowship trained sports medicine orthopaedic surgeon. He operates out of NYU’s Langone Orthopaedic Hospital, where he is the director of hip arthroscopy research. He is a perennial speaker at national and international orthopaedic conferences and his research efforts have been published in many peer reviewed journals.

Introduction
Opioid prescription for outpatient orthopaedic surgery has been a source of controversy in response to the opioid abuse crisis. Recently, the need for opioids after minimally invasive surgery, such as hip arthroscopy, has come into question. The purpose to this study is to determine if alternative pain management modalities can adequately control pain and reduce opioid use following hip arthroscopy.

Methods
This is a single centre, randomized controlled trial. Patients undergoing simple hip arthroscopy (cam resection, pincer resection, shaving chondroplasty, or debridement) were enrolled and randomized into one of two groups. The control group was prescribed #1-2 5mg/325mg oxycodone-acetaminophen every 6 hours as needed for pain (total of 28 tablets). The experimental group was prescribed #3 200mg acetaminophen (APAP) every 8 hours as needed for pain and given #10 5mg/325mg oxycodone-APAP for breakthrough pain. Patients in both groups were instructed to record daily opioid and APAP consumption and VAS pain for postoperative days 1, 4, and 7. Both cohorts Received aspirin for DVT prophylaxis and celecoxib for heterotopic ossification prophylaxis.

Results
Thirty-one patients completed the study (17 in the control group and 14 patients in the experimental group). There was no statistically significant difference in baseline pain or pain on postoperative days 1, 4, or 7 between groups. The control group used a greater number of opioid tablets on POD1 compared to the experimental group (1.74 +/- 1.77 tablets versus 0.61 +/- 0.84 tablets, \( p = 0.029, 95\% \text{ CI} [0.129, 2.127] \)). There was no statistically significant difference in the total number of opioid tablets used between the control and experimental groups (5.03 +/- 5.12 versus 2.68 +/- 3.98, \( p=0.161 \)). There was no statistically significant difference in satisfaction with pain control on a scale of 0-10 (\( p=0.776 \)).

Conclusion
Patients prescribed APAP for pain following hip arthroscopy take fewer opioid in the immediate postoperative period than those given only oxycodone-APAP and showed no statistical difference in postoperative pain and satisfaction levels. Patients in both groups took very few opioid overall and, ultimately, patients undergoing hip arthroscopy may need fewer opioids for postoperative pain than expected.
EP16.2 Does use of a virtual reality hip arthroscopy simulator influence medical students’ attitudes toward a career in orthopaedic surgery?

Dr Jonathan Bartlett1, Dr Fawz Kazzazi3, Dr Kendrick To2, Mr John Lawrence2, Mr Vikas Khanduja2

1Basildon & Thurrock University Hospital, London, United Kingdom, 2Addenbrookes Hospital, Cambridge, United Kingdom, 3Royal London Hospital, London, United Kingdom

Background

With declining interest in orthopaedic surgery, there has been increasing investigation into novel means of stimulating interest in this specialty. With the potential advent of virtual reality (VR) based surgical skills acquisition, it is unclear how exposure to these training methods will impact students’ attitudes towards orthopaedics. We therefore sought to answer the following: does VR arthroscopic simulator use influence medical students’ attitudes towards a career in orthopaedic surgery?

Methods

Twenty-five medical students completed seven unsupervised sessions on a VR hip-arthroscopic simulator. All participants completed a pre- and post-simulator pseudo-anonymized questionnaire consisting of ten questions - six 10-point Likert scale questions addressing their interest in orthopaedics, surgery and arthroscopy; and four 5-point Likert scale questions addressing their attitudes towards simulation. Pre- and post-paired datasets were analyzed using Wilcoxon signed rank test.

Results

Interest in both orthopaedics and surgery was found to increase after simulator use (Orthopaedics - 6.3 to 8.6 P<0.01; Surgery - 6.9 to 9.0, P<0.01). It was also found that simulator use increased participants’ interest in arthroscopy (5.4 to 8.3, P<0.01) and hip-arthroscopy (4.8 to 7.8, P<0.01). Participants reported they were more likely to attend endoscopic and arthroscopic surgical lists after simulator use (7.1 to 8.7, P<0.01; and 6.1 to 8.6, P<0.01). After using the simulator, participants felt more strongly that VR simulation is a valuable training modality (P<0.01), that simulation should be a mandatory part of orthopaedics and surgical training (P<0.01 and P<0.01), and that access to VR simulators improves the quality of surgical training (P<0.01).

Conclusions

These results demonstrate that exposure to VR arthroscopic simulation increased medical students’ interest in orthopaedics, surgery and arthroscopy, without the need for direct supervision. This demonstrates a novel means of stimulating interest in orthopaedic surgery and that there would be good engagement of future trainees with VR simulation training modalities.

Biography

Dr Jonathan Bartlett is an Academic Foundation Doctor working in the Essex, Bedfordshire, Hertfordshire Deanery. He graduated with a Distinction from the University of Cambridge in 2018
EP16.3 The influence of distance from orthopaedic treatment centre on achieving minimally clinically important difference in patients undergoing surgery for femoroacetabular impingement

Mr. Reagan Chapman¹, Dr Benedict Nwachukwu¹, Dr Edward Beck¹, Ms. Elaine Lee¹, Mr. Jonathan Rasio¹, Dr Shane Nho¹
¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

Purpose
To determine whether an increased distance from a patient’s primary orthopaedic clinic has an influence on their ability to reach a minimal clinically important difference (MCID) in their outcomes from surgery for femoroacetabular impingement (FAI).

Methods
A retrospective cohort analysis was performed with patients undergoing surgery for FAI from a single surgeon from 03/07/2012 to 01/20/2017. 692 patients were identified and split into two groups, ≤50 miles driving distance from our institution and >50 miles driving distance. Functional outcomes were assessed after patients in the study completed preoperative as well as postoperative 2-year follow up using Patient Reported Outcome Measures (PROMs) including Hip Outcome Score – Activity of Daily Living (HOS-ADL), Hip Outcome Score – Sport Specific, International Hip Outcome -12 (iHOT-12), and modified Harris Hip Score (mHHS). Patients with a prior history of hip surgery or future contralateral FAI repair were excluded. Patients achieving a MCID in any included PROM were analysed using a Chi-square analysis.

Results
In total, 670 (96.26%) patients completed 2-year follow-up were included for the analysis. 123 (18.35%) Patients were identified as ≤50 miles from MOR, and 547 (81.65%) were identified as >50 miles driving distance. 107 patients in the ≤50 miles cohort reached a MCID in ≥1 PROM, while 547 patients in the >50 miles cohort reached a MCID in ≥1 PROM. There was no statistically significant difference in reaching MCID in any of the included PROMs between the 2 cohorts (86.99% MCID for ≤50 miles and 89.58% for >50 miles p=0.502).

Conclusion
Distance does not have a demonstrable effect on reaching a MCID in patients undergoing repair of FAI. This supports the establishment of centres of excellence for Hip Arthroscopy, as distance is not a contraindication for physician selection.

**Miss Madison Morrish**, Mr David Georgy

1Australian Sports Physiotherapy, Melbourne, Australia

**Biography**

Dedicated and thorough Physiotherapist with experience in the Management of Musculoskeletal and Orthopaedic clientele. Supportive and always meticulous, David endeavours to provide a prompt diagnosis and effective treatment to aid recovery and get clients back on track.

Co-Director of ASP & Senior Physiotherapist

Bachelor of Physiotherapy (University of South Australia)

Sports trainer & sports physiotherapy experience

Working in conjunction with orthopaedic surgeons and medical professionals

Post-operative orthopaedic rehabilitation

Clinical Supervisor for Masters of Physiotherapy students from Bond University and Bachelor of Physiotherapy students from ACU University

Member of Australian Physiotherapy Association (APA)

Registered member of Australian Heath Practitioner Regulation Agency (AHPRA)

Certificate 1 in Dry Needling

A hip arthroscopy is a minimally invasive procedure that involves treating existing hip pathologies within the hip joint.

Unfortunately, hip and groin pain are a common side effect after these procedures and for some patients, this procedure does not solve all their existing problems.

Despite the current research in advancing surgical technique and rehabilitation; there is little discussion about the patient's physical and mental experience which plays a major role in recovery.

The aim of this single subject study is to determine and understand the outcomes and experiences of a patient following Hip Arthroscopy intervention performed in Australia.
EP16.5 How many opioid pain medications should we prescribe following hip arthroscopy? A randomized control-trial
MD Matthew Hartwell¹, MD Ryan Selley¹, Joshua Barrett¹, Elijah Ogunkoya¹, MD Vehniah Tjong¹, MD Michael Terry¹
¹Department of Orthopaedic Surgery, Feinberg School of Medicine, Northwestern University, Chicago, United States

Background
Opioid pain medications are frequently used to manage peri-operative pain following hip arthroscopy and there is considerable variability in the number of pills prescribed by orthopaedic surgeons. Leftover pills are at risk for diversion for nonmedical use. Thus, the aim of this study was to determine if a reduced number of pills prescribed at discharge reduces the number of leftover pills without increasing a patient’s postoperative pain.

Methods
Patients undergoing hip arthroscopy were randomly divided into two groups: one group received 30 tablets of hydrocodone/acetaminophen 10/325 postop and a second group received 60 tablets of hydrocodone/acetaminophen 10/325 postop. Following surgery, patients’ postoperative pain was assessed using a 10-point scale and the number of pills used/remaining were assessed at 2 hours, 24 hours, 48 hours, 7-14 days, and 21 days postop. The total number of pills used/remaining and pain at final follow-up were compared using student t-tests and linear correlations were made between postoperative pain 2 hours after surgery and the total number of tablets consumed.

Results
39 patients were enrolled and had an average age of 38.3 and 59% were female (n=23). Patients in the 60-tablet group had an average of 26.8 more tablets remaining than the 30-tablet group (45.7 vs 19.0, p<0.0001) with no significant change in subjective pain at last documented follow-up (2.2 vs 1.9, p=0.61). There was no significant difference in the number of tablets consumed between the 60 and 30-tablet groups (14.3 vs 10.0, p=0.39). There was a strong correlation between patients’ pain at 2 hours after surgery and total number of tablets consumed by 21 days postop (r²=0.66, p<0.0001 for the 30-tablet group, r²=0.69, p<0.0001 for the 60-tablet group).

Conclusions
Prescribing a reduced number of opioid pain medications following hip arthroscopy can reduce the number of leftover pills without increasing a patient’s postoperative pain. Increasing levels of pain immediately following surgery is correlated with the total number of opioid pain medications used in the postoperative period.

Level of Evidence
I, Randomized control-trial
EP16.6 Pre-emptive analgesia in hip arthroscopy: No added benefit of intra-articular bupivacaine injection following preoperative peri-acetabular block

Dr Efi Kazum¹, Dr Ehud Rath¹, Dr Amir Shlaifer¹, Dr Zachary Sharfman², DO Hal David Martin³, Dr Gilad Eizenberg¹, Dr Evgeny Reider¹, Dr Eyal Amar¹

¹Ichilov Sourasky Medical Centre, 6 Weizmann Street, Israel, ²Montefiore Medical Centre, The University Hospital for Albert Einstein College of Medicine, New York, U.S.A., ³U.S.A, ¹Hip Preservation Centre, Baylor University Medical Centre, U.S.A

Aim
This study aimed to assess the added benefits of intra-articular bupivacaine blockade performed at the end of hip arthroscopy in patients treated with preoperative peri-acetabular blockade.

Patients
A total of 52 patients were divided into 2 groups. Group 1 (20 patients) who received peri-acetabular Bupivacaine 0.5% blockade at the start of the procedure with an additional dose of intra-articular Bupivacaine at the end of the procedure. Group 2 (32 patients) who received peri-acetabular Bupivacaine 0.5% blockade at the beginning of the procedure without additional interventions. Postoperative pain was recorded via visual analogue scale (VAS), analgesic consumption, and in pain diaries completed for two weeks postoperatively.

Results
VAS scores did not differ postoperatively at any time point, except for the 30-minute recovery room assessment, were group 1 scored significantly lower VAS scores then group 2 (VAS scores Group 1: 1.1 ; Group 2: 3.00, p=.034). No significant differences were found with regard to narcotic and non-narcotic analgesic consumption between groups.

Conclusion
Pre-incisional peri-acetabular blockade was shown to be non-inferior to peri-acetabular blockade with the addition of intra-articular bupivacaine. We recommend the use of preoperative peri-acetabular bupivacaine blockade for pain control in the setting of hip arthroscopy surgery without postoperative intra-articular blockade.
EP16.7 Do patients receive physical therapy for hip pain prior to consulting a hip surgeon?
Amanda Paulson¹, Zain Khazi¹, Dr Micheal Willey¹, Dr Robert Westermann¹
¹University Of Iowa Hospitals and Clinics, Iowa City, United States

Biography
Dr Westermann is a staff physician at the University of Iowa Hospitals and Clinics, and the team physician for the Hawkeyes.

Background
The use of physical therapy (PT) for hip pain before consulting a hip surgeon is unknown.

Purpose
To investigate the incidence and type of PT administered to patients with hip pain prior to consulting a hip surgeon.

Methods
We conducted a single-centre, questionnaire driven study at a young adult hip preservation clinic that exclusively treats patients with hip pain. Thirty (88.2%) of thirty-four consecutive new patients answered the 15-item questionnaire. The questionnaire was designed to inquire about the reason for the visit, type of formal PT received (hip strengthening, leg strengthening etc.), and additional treatments received prior to the visit (electric stimulation, narcotics etc.). Descriptive statistics were utilized to quantify the reason for visit, PT prior to the visit, and type of exercises performed during physical therapy.

Results
The most common reasons for the visit was hip pain with prolonged sitting (86.7%), jogging or running (86.7%), and walking (73.3%). Patients also complained of hip pain with climbing stairs (66.7%), sleeping on the side (70%), and getting in and out of a car (53.3%). Overall, 21 (70%) patients received PT and 26 (86.7%) received additional treatments prior to the visit. Of those who received PT, 90.5% (n=16) did hip strengthening exercises, 76.2% (n=16) did focused hip stretching exercises, 61.9% (n=13) did leg strengthening exercises, 57.1% (n=12) did joint mobilization exercises, and 52.4% (n=11) did focused core strengthening exercises. However, only 47.6% (n=10) reported improvement in symptoms with PT. Of those who received additional treatments, 76.9% (n=20) took anti-inflammatory medications regularly, 50% (n=13) underwent electric stimulation, 30.8% (n=8) had chiropractic manipulation, 19.2% (n=5) underwent soft tissue mobilization, 15.4% (n=4) received steroid injections, and 11.5 (n=3) were prescribed narcotics for hip pain.

Limitations
This study relied on a questionnaire which is subject to recall bias. Additionally, patient compliance with PT was difficult to reliably assess.

Conclusions
Despite the limitations, the study offers insight into the incidence and type of formal PT patients with hip pain receive before consulting a hip surgeon. Rehabilitative efforts for conservative care for hip pain is highly variable making outcomes of PT difficult to assess in this population.
EP16.8 What are the costs for conservative care prior to arthroscopic treatment of femoroacetabular impingement syndrome?

Zain Khazi1, Dr Nicolas Bedard1, Dr Robert Westermann1

1University Of Iowa Hospitals and Clinics, Iowa City, United States

Biography
Dr Westermann is a staff physician at the University of Iowa Hospitals and Clinics, and the team physician for the Hawkeyes.

Purpose
To determine the cost of conservative care for femoroacetabular impingement syndrome (FAI) for 1 year prior to hip arthroscopy (HA).

Methods
The Humana database was used to identify and track patients with hip pain that underwent HA from 2010 to 2017q1. The cost of conservative care was categorized into non-operative provider care (office visits and physical therapy), diagnostic imaging (X-Rays, computed tomography (CT), magnetic resonance imaging (MRI)) and pharmacologic treatment (image-guided steroid injection and oral medications) for the year prior to hip arthroscopy. Total costs and per patient costs ($/patient) were calculated for each category and specific treatment modalities.

Results: In total, 1,383 patients with FAI that underwent HA were identified in the database. The total cost of conservative care during the year prior to hip arthroscopy was $2.4 million. The cost of non-operative provider care was $0.7 million (29.2%), diagnostic imaging was $1.2 million (50%), and pharmacologic treatment was $0.5 million (20.8%) during the study period. Specifically, MRI accounted for the highest cost for diagnostic imaging ($1 million; $904.80/patient) followed by CT scans ($0.11 million; $598.83/patient), and X-Rays ($0.05 million; $68.88/patient). For non-operative provider care, office visits ($0.5 million; $358.76/patient) comprised the highest cost followed by physical therapy ($0.2 million; $451.92/patient).

For pharmacologic treatment, image guided steroid injection constituted the highest cost ($0.46 million; $1,570.47/patient) followed by analgesics ($16,564; $67.61/patient), opioids ($11,264; $52.64/patient), NSAIDs ($9,754; $44.34/patient), muscle relaxants ($3,178; $31.16/patient), Tramadol ($1,065; $13.83/patient), anxiolytics ($1,057; $13.21/patient), and Gabapentin ($755; $21.57/patient).

Conclusion: With the increasing incidence of diagnosing patients with FAI, the economic burden of conservative care prior to HA is not known. This study found that during the year prior to HA for FAI, diagnostic imaging accounted for nearly half of the total cost. Additionally, the use of image-guided steroid injections had the highest per patient cost. These economic factors should be taken into consideration for patients with FAI to maximize efficiency and patient care in the setting of bundled payments.
EP16.9 Use of a single dose of IV Toradol to decrease post-operative opioid need and improve efficient discharge form the hospital following hip arthroscopy.

Dr Brian Lewis¹, Dr Robert Kollmorgen²

¹Duke University Medical Centre, Durham, United States, ²University of California San Francisco- Fresno, Fresno, United States

Biography:
Dr Lewis is fellowship trained in hip preservation surgery. One of his areas of research is patient pain control and factors that can improve post-operative pain while minimizing or eliminating the use of opioids

Post-operative pain following hip arthroscopy is a cause of increased time to discharge, increased opioid use, and in some cases necessitates admission for overnight monitoring for pain control. IV Toradol is ideal for this purpose as it has rapid onset within 10 minutes and peak analgesia at 150 minutes. Serious adverse events are extremely rare when used for short duration (less than 5 days). Toradol has been shown to be more effective than other NSAIDs and corticosteroids for post-operative pain control. While many studies have evaluated its use in multiple doses, a meta-analysis has shown efficacy with even single dose administration.

Given these facts, a protocol change was initiated to administer a one-time dose of 30mg IV Toradol immediately prior to extubation in the operating room. Hospital records were retrospectively reviewed. The patients were divided into two groups: Group 1 did not receive Toradol in the operating room (n=65), Group 2 received Toradol (n=57). Data examined included total opioids given in morphine equivalents, time spent in PACU, total time to discharge, and unplanned admissions. All values were compared using the Two tail Mann Whitney U test.

Group 1 mean opioid use was 24.8 MEDD (0-92.5) while Group 2 mean opioid use was 19.6 MEDD (0-47), p:0.0375. Time spent in the PACU was 98.5 (44-335) minutes for Group 1 and 84.4 (30-336) minutes for Group 2, p:0.246. Median total time to discharge was 170 (79-335) minutes in Group 1 and 151 (85-349) minutes in Group 2, p:0.289. There were 2 unplanned admissions in Group 1 and no unplanned admissions in Group 2. No complications were noted from the use of IV Toradol.

A single dose of IV Toradol given immediately prior to extubation showed a statistically significant decrease in the amount of opioid analgesia required post-operatively. There was also a trend towards decreased time spent in the PACU and total time until discharge. We conclude that a single dose of IV Toradol is an inexpensive and safe way to decrease the use of opioids and may improve time to discharge from the hospital after hip arthroscopy.
EP16.10 Effect of neuromuscular relaxation on perineal pressures and hip distraction during traction for hip arthroscopy

Dr Tao Shan Lim¹, Dr Yi Ying Heng¹, Mr Artur Kotov², Mr Shaun Hontomin³, Mr Francis Winfield⁴, Dr Hon Earn Sim¹, Prof Thomas Ledowski⁴,⁵

¹Joondalup Health Campus, Joondalup, Australia, ²University of Kiel, Kiel, Germany, ³University of Notre Dame, Fremantle, Australia, ⁴University of Western Australia, Perth, Australia, ⁵Royal Perth Hospital, Perth, Australia

Biography

Tao completed his orthopaedic training in Perth, Western Australia, and did subspecialty training in arthroscopic and sports surgery as a fellow at the University of British Columbia, Vancouver, Canada. His practice is focused on arthroscopic and sports surgery of the hip, knee and shoulder.

Background

Traction is an integral part of hip arthroscopy in order to distract the joint and enable arthroscopic access. Previous publications have raised concerns regarding the safety of traction against the perineal post which can lead to pudendal nerve damage and perineal soft tissue injury. One study found that intraoperative neuromuscular paralysis may result in reduced perineal pressures.

Methods

After study registration and ethics approval, 40 patients undergoing hip arthroscopy were enrolled. Pressures on the perineum were measured in 20 subjects with an ultra-thin sensor mat on the perineal post after induction of general anaesthesia, after tractioning of the leg and after administration of deep muscle relaxation (intravenous rocuronium 0.6 mg/kg). In a further 20 subjects, a modified technique of distraction was used with the post in contact with the medial thigh rather than the perineum; joint distraction was measured via x-ray and standardized ruler before and after traction application as well as after muscle relaxation.

Results

22 male and 18 female patients (42 (9.3) years) were included. Pressures on the perineum were very high after traction (median maximum pressure 2540 g/cm²; median mean pressure 277 g/cm²). Neuromuscular paralysis significantly reduced the mean pressure but only by a small amount (-5 g/cm²; P = 0.007). Traction increased the measured hip joint space significantly (mean 4.7 mm prior to distraction vs. 14.5 mm after distraction; P < 0.001) and muscle relaxation further increased joint space by a mean of 4.1 (0-16)%; P = 0.001. Neuromuscular relaxation provided greater distraction in males than females (6.8 vs 2.8 %; P = 0.04) and was also advantageous in patients in whom traction did not achieve at least a 60% increase in measured hip joint space (increase after paralysis 11.5 vs 3.3%; P = 0.008).

Conclusion

Although neuromuscular relaxation may reduce perineal pressures during traction for hip arthroscopy, the effect is generally small and is unlikely to be of clinical relevance. Neuromuscular paralysis may be of benefit in male patients and/or patients in whom traction alone produces a relatively small increase in hip joint space.
EP16.11 Prospective Evaluation of Opioid Utilization After Hip and Knee Arthroscopy

Dr Elise Bixby¹, Gabrielle K Steinl¹, Michaela O’Connor¹, Connor Crutchfield¹, Dr Jamie Confino¹, John Cosgrove¹, Karen Yancopoulos¹, Dr T. Sean Lynch¹

¹Columbia University, New York, United States

Biography:
T. Sean Lynch specializes in the nonoperative and operative treatment of hip and knee disorders in athletes of all levels at Columbia Doctors Orthopaedics. He is an expert in hip surgery and knee ligament reconstruction with minimally invasive and arthroscopic techniques. His particular clinical interests include injuries of the ACL, knee articular cartilage and the meniscus. He also specializes in labral injuries of the hip and uses advanced arthroscopic techniques to treat this ever-increasing problem.

Background
Orthopaedic surgery is notoriously painful, and orthopaedic surgeons commonly provide post-operative opioids. However, there is little data about the amount of opioids patients require. A survey during the 2014 American Academy of Orthopaedic Surgeons symposium showed that most surgeons don’t know how many pills their patients actually take. Early studies suggest that orthopaedic surgeons often prescribe many more opioids than needed, and more judicious prescriptions could help reduce excess opioids available for abuse. The goal of this study was to determine the optimal amount of opioids to prescribe following hip arthroscopy (HA), as well as to identify patient factors that affect opioid requirements.

Methods
Patients undergoing HA were given a questionnaire on which they provided demographic information and chronicled their postoperative pain regimen and their average pain score each day for 20 days following surgery. Patients brought their questionnaire, and remaining opioids and benzodiazepines to their first 2 postoperative appointments.

Results
Seven hips in 6 patients (66.7% male) with an average age of 31.5 ± 10.1 years (range 19-49) were included. Four (66.7%) patients reported that their pain was very well-controlled with only one (16.4%) patient reporting that their pain was not well-controlled. The majority of patients (66.7%) felt that they were prescribed too much pain medication. All patients were prescribed 30 hydrocodone (5/325mg) pills and had an average of 20.2 ± 12.3 pills (0-30) remaining. Five patients were prescribed 15 Valium and had an average of 10.8 ± 6.4 pills (0-15) remaining.

Conclusion
Despite a small sample size at present for this ongoing study, our findings show that oftentimes patients have excess opioids and benzodiazepines following hip arthroscopy. Of interest, the only person to finish both prescriptions underwent bilateral hip arthroscopy. Further research could help elucidate other surgery and patient factors associated with low or high opioid and benzodiazepine use post-operatively.
Background
Hip arthroscopy is a rapidly growing field, and as a result, pain management in these patients has become an important area of research. While prior literature has evaluated the use of nerve blocks to help control post-operative pain, they come with potential procedural risks, need for specialized equipment/staffing, variable results, and a significant increase in cost to both the patient and healthcare system.

Purpose
A pilot study to evaluate the safety and efficacy of a multimodal pain management protocol without the need for nerve blocks in outpatient hip arthroscopy.

Methods
Our cohort included a consecutive series of patients who underwent arthroscopic hip surgery for femoroacetabular impingement (FAI) with labral repair. All procedures were performed in an outpatient setting under standard general anaesthesia, and patients were given a multi-modal protocol for pain management, including preoperative oral medications (Tylenol 1000mg/cyclobenzaprine 10mg/Celebrex 400mg/oxycodone 5mg), an intraoperative pericapsular anaesthetic injection (ketorolac 15mg/duramorph 15mg/ropivacaine 30mg), and postoperative IV ketorolac 15mg. Data included in statistical analysis included patient demographics, pre-operative radiographic findings, intraoperative details, patient-reported pain 1 hour following surgery, pain at discharge, time to discharge, and hospital readmission rate. This study was Institutional Review Board (IRB) approved.

Results
Twenty-five consecutive patients were included in this study, with a mean age of 36.1 years. There were no significant associations between postoperative pain levels or time to discharge and age, gender, LCEA, alpha angle, number of anchors, or traction time (p>0.05). There was, however, a trend towards significance between younger age and decreased pain at 1 hour (p=0.116), as well as decreased pain at discharge (p=0.082). There were no patients re-admitted following surgery, no postoperative nerve blocks required, and mean time to discharge was 127 minutes following surgery (SD 50.2).

Conclusion
The results of this study indicate that our multimodal regimen provides appropriate early postoperative pain management without the need for peripheral nerve blocks. Reducing surgical pain can lead to decreased narcotic consumption, increased patient satisfaction, and improved cost-effectiveness of hip arthroscopy.
EP16.13 Hip arthroscopy learning curve after training at high volume centre: A retrospective single-surgeon study

Moriyuki Noguchi, MD, PhD Soshi Uchida, MD, PhD Hiroomi Abe, MD, PhD Hirotaka Sano, MD, PhD Daizo Sasaki, MD, PhD Taichi Irie, MD, PhD Takashi Inawashiro, MD Hiroshi Yoshimura, MD Hirotaka Kurata, MD Ryoichi Kameyama

1 Department of orthopaedics, Sendai City hospital, Sendai City, Japan, 2 Department of orthopaedics, Wakamatsu Hospital for University of Occupational and Environmental Health, Kitakyusyu city, JAPAN

Biography
Moriyuki Noguchi, MD
Sendai city hospital, Orthopaedics surgery, JAPAN

Sub speciality: Hip & knee joint, Arthroplasty, Arthroscopic surgery for hip and knee joint, Rheumatoid arthritis

Background
Hip arthroscopy is generally considered a demanding procedure with long learning curve.

Purpose: To evaluate the learning curve of hip arthroscopic surgery for FAI using the log-linear model and based on clinical outcomes and complication rate.

Methods
60 hip (25 females and 35 males with mean age 42.3 years 14-75) undergoing hip arthroscopic FAI correction surgeries were enrolled in this study. Study cohorts were divided into 3 groups of 20 patients. Regression analysis was applied to predict the required operative time on the basis of the cumulative case volume after logarithmic transformation of statistics. Complication rate and clinical results based on MHHS and NAHS score were recorded for each group. Statistical analysis was performed using paired t-test.

Results
The mean required operative time was 183.6 (range 80 to 299) minutes. After logarithmic transformation, linear correlation was not significant between the required operative time and the cumulative case volume (p=0.08). The best-fit linear equation was calculated as log(y, estimated required operative time)=-0.1154logX+2.301, resulting in an estimated learning rate of 92.3% (2-0.115). There were no complications and found a statistically significant higher rate of minor complication treated conservatively at middle group (n=7>2, 2). Clinical outcomes were almost same among three groups (NAHS 71.5/65.3/69.4, MHHS 87.4/86.4/86.4) (P>0.05). There were significantly less operative times after 40 procedures (P=0.04), even though towards the end of the learning curve, more complex procedures were performed (187.1 min/198.5/165.5). The results showed an overall time reduction in hip arthroscopy for FAI in support of learning curve effect with an 92% learning rate, indicating that the required time for hip arthroscopy to FAI can decrease by ≤8% when the cumulative volume of cases has doubled.

Conclusion
At least 40 procedures are needed to gain advanced technical skills of hip arthroscopy if the surgeon got a training at high volume centre.
EP16.14 Opioid use in adolescents following hip arthroscopy

MD Crystal Perkins¹, BS Asahi Murata¹, MD S. Clifton Willimon¹
¹Children's Healthcare of Atlanta, Atlanta, United States

Biography
Following a fellowship at the Steadman Philippon Research Institute where he trained under leaders in sports medicine, Dr Willimon returned to Children’s Healthcare of Atlanta as a board-certified orthopaedic surgeon who specializes in disorders of the knee, hip, shoulder and elbow. He currently serves as the Medical Director for Orthopaedic Quality and Outcomes at Children’s Healthcare of Atlanta. He specializes in advanced arthroscopic and reconstructive surgical techniques for the treatment of complex orthopaedic disorders of the knee, hip, shoulder and elbow as well as sports injuries.

Throughout his career, Dr Willimon has cared for professional and Olympic athletes as well as collegiate, high school and recreational athletes. He serves as team physician for the East Cobb Yankees, Mount Vernon Presbyterian School and the Atlanta Ballet, as well as medical director of the Atlanta United Academy teams and team physician for the Atlanta United First Team. Dr Willimon currently collaborates with Georgia Institute of Technology for cartilage research and leads Children’s in several national study groups. He is a consulting associate for the Duke Department of Orthopaedic Surgery.

Background
The use and misuse of opioid medications has been declared an epidemic by the Centres for Disease Control. Pain control is an important component of care following orthopaedic surgery. The purpose of this study is to describe opioid use among adolescents following hip arthroscopy.

Methods
Patients less than 21 years of age undergoing hip arthroscopy by a single surgeon were prospectively enrolled. Hydrocodone-acetaminophen 5-325mg was prescribed for post-operative pain control. Patients and their families completed a logbook to track their use of pain medication and VAS pain scores. Risk factors for hydrocodone use following surgery were analysed, including demographics, surgical factors, and post-operative VAS pain scores.

Results
34 patients were enrolled, and 29 patients completed the medication logbook (85%), including 18 females and 11 males with a mean age of 16.6 years (range 14 – 20). Patients received a prescription for a mean of 29 hydrocodone tablets (range 25 – 30). Patients took an average of 7 pills (range 0 – 20), leaving an average of 73% of the prescribed medication unused. Mean VAS pain scores at the time the medication was taken was 6.4 (range 3 – 9.1). Female sex and higher VAS pain scores predicted greater use of hydrocodone. 24 patients (83%) were very satisfied or satisfied with their pain control. 17 patients (57%) reported one or more side effects from the hydrocodone, with the most common being drowsiness and constipation.

Conclusions
Opioid medication use in adolescents following hip arthroscopy is significantly less than the quantity of tablets prescribed, with 73% of the prescription remaining unused in the post-operative period. This study should guide surgeons in providing patients with reasonable expectations regarding post-operative pain and the amount of medication to prescribe. Orthopaedic surgeons must responsibly prescribe pain medications using evidence-based data or the results of their own experience monitoring medication consumption.
EP16.15 Can perioperative multimodal drug administration reduce the need for opioids following hip arthroscopy?

Dr James Calabrese¹, Dr Lauren Pierpoint¹, Dr Marc J. Philippon¹²

¹Steadman Phillipson Research Institute, Vail, United States, ²The Steadman Clinic, Vail, United States

Biography
Dr James A Calabrese, MD, is an Anaesthesiology specialist in Vail, Colorado. He received his MD from SUNY at Stony Brook, College of Medicine and completed residency at Duke University Medical Centre.

The opioid crisis has drawn much-needed attention to anaesthetic techniques aimed at reducing or eliminating perioperative opioid requirements. The directed use of regional anaesthetics combined with a full spectrum of non-opioid analgesics (multimodals) has been shown to significantly reduce intraoperative and postoperative opioid needs while improving postoperative analgesia. However, clinicians may be reluctant to use some multimodal protocols based on concerns regarding cost-effectiveness.

Here we discuss the potential costs and savings associated with the administration of perioperative multimodal protocols based on an example anaesthetic protocol for hip labrum repair surgery developed at The Steadman Clinic. The protocol involves a combination of regional anaesthetic techniques (a spinal, an epidural and a fascia iliaca catheter infusion) as well as nine different nonopioid multimodal analgesics given preoperatively, as intraoperative infusions and as scheduled postoperative analgesics. Opioids are available on a PRN basis, but, with this protocol, they are commonly not needed.

First, multimodals can reduce the need for intraoperative anaesthetics, such as Propofol and volatile anaesthetics. Second, post-operative opioid needs may be reduced or eliminated, thereby not only reducing/eliminating the direct cost of the opioid, but also the indirect costs associated with treating opioid side effects such as nausea, vomiting, and constipation. Third, there are several non-analgesic related benefits of multimodals, such as lowering intraoperative blood pressure and preventing arrhythmias, both of which may reduce anaesthetic-related complications. Finally, there are other potential cost savings that are difficult to quantify. For example, reduced nursing labour costs, reduced length of stay, reduced readmission rates and post-discharge ER visits, improved discharge times and improved patient satisfaction.

Additionally, the long-term savings from preventing a single opioid addiction, though difficult to estimate, are certainly vast, and sufficient reason for clinicians to carefully consider all proven efficacious and likely cost-effective opioid-sparing alternatives.
Resident involvement in hip arthroscopy is associated with longer operative times but no increased short-term risks

Roy Lan, Dr Linsen Samuel, Dr Assem Sultan, Daniel Grits, Dr Atul Kamath

1 University of Tennessee Health Science Centre, Memphis, United States of America, 2 Department of Orthopaedic Surgery, Cleveland Clinic Foundation, Cleveland, United States of America

Biography
Dr Atul Kamath is the Director of the Centre for Hip Preservation at the Cleveland Clinic. He specializes in open and arthroscopic treatment options for young adults with hip pain, including arthroscopy, AVN treatment, surgical dislocation, and periacetabular osteotomy. He completed his medical degree at Harvard, residency at Penn, and fellowships in adult reconstruction (Mayo Clinic) and hip preservation (Muller Foundation in Europe).

Purpose
To compare rates of adverse events and postoperative outcomes measures in hip arthroscopy cases assisted by residents versus cases performed solely by an orthopaedic attending.

Methods
This retrospective study utilized the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) registry from 2006-2012 to identify patients who underwent one of four common hip arthroscopy procedures. The Pearson chi-square test was utilized to compare perioperative patient demographic variables. Multivariate Poisson and linear regression with robust error variance was used to compare, by resident involvement, the rates of postoperative adverse events, readmission and reoperation within 30 days, and operative time.

Results
In total, 564 patients undergoing hip arthroscopy were included in the study, with 46.81% involving resident participation. Patients undergoing hip arthroscopies without a resident present were found to be older (p=0.021), more likely to have an ASA (American Society of Anaesthesiologists) class of 3 or higher (11.67% vs. 6.44%; p=0.032) and more likely to be diagnosed with hypertension (p=0.005). Hip arthroscopies with a resident involved were associated with a longer operative time (111.3 minutes vs. 89.2 minutes; p<0.001). However, these procedures were not associated with any significant difference in minor or severe adverse events.

Conclusions
Resident involvement in hip arthroscopy, including hip arthroscopy with labral debridement, was associated with longer operating times, but was not associated with an increase in adverse events. Further study is needed to characterize the role of resident involvement based on level of training experience, as well as methods to improve the learning curve to independence while reducing intra-operative surgical times.

Level of evidence
Retrospective comparative study; level of evidence, 3.
Resident involvement in periacetabular osteotomy is associated with longer operative times but no increased short-term risks

Mr. Roy Lan1, Dr Linsen Samuel2, Dr Assem Sultan2, Mr. Daniel Grits2, Dr Atul Kamath2

1University Of Tennessee Health Science Centre, Memphis, United States, 2Cleveland Clinic Foundation, Cleveland, United States

Purpose
To compare rates of adverse events, and additional postoperative outcome measures in periacetabular osteotomy (PAO) cases assisted by residents versus cases performed solely by an orthopaedic attending.

Methods
This retrospective study utilized the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) registry from 2006-2012 to identify patients who underwent periacetabular osteotomy procedures. The Pearson chi-square test was utilized to compare perioperative patient demographic variables. Multivariate Poisson and linear regression with robust error variance was used to compare, by resident involvement, the rates of postoperative adverse events, readmission and reoperation within 30 days, and operative time.

Results
In total, 73 patients undergoing periacetabular osteotomies were included in the study, with 76.71% involving resident participation. Patients undergoing periacetabular osteotomies without a resident present were found to be older (p=0.001), more likely to have an ASA (American Society of Anaesthesiologists) class of 3 or higher (35.29% vs. 7.14%; p=0.003) and more likely to be diagnosed with hypertension (11.94% vs. 4.17%; p=0.016). Periacetabular osteotomies with a resident involved were associated with a longer operative time (146.7 minutes vs. 94.5 minutes; p=0.041). However, these procedures were not associated with any significant difference in minor or severe adverse events.

Conclusions
Resident involvement in periacetabular osteotomy was associated with longer operating times; however, was not associated with an increase in adverse events. Further investigation is needed to characterize the role of resident involvement based on level of training experience, as well as methods to improve the learning curve to independence while reducing intra-operative surgical times.

Level of evidence
Retrospective comparative study; level of evidence, 3.
EP16.18 Comparative efficacy of pre-operative quadratus lumborum blocks in hip arthroscopy

Dr John M Ryan2,3, MD Ryan Blackwell1, MD Michael Kushelev1, DO John Norton1, MD W. Kelton Vasileff1
1Ohio State University, Columbus, United States, 2Ohio State University Department of Orthopaedics, Columbus, United States, 3Ohio State University Sports Medicine Research Institute, Columbus, United States

EP16 - Teamwork and training

Biography
Assistant Professor of Orthopaedic Surgery at Ohio State University Jameson Crane Sports Medicine institute specializing in Hip Preservation surgery and sports medicine. Fellowship trained in sports medicine and hip preservation surgery.

Introduction
Significant postoperative pain remains one of the most frequently cited negative effects of hip arthroscopy. With the current opioid epidemic and the rapidly increasing number of hip arthroscopy procedures performed in the outpatient setting, the balance between providing adequate analgesia while minimizing postoperative opioid consumption has become more important. Multimodal pain control algorithms form an important part of the hip arthroscopy peri-operative algorithm and helps to ensure the overall success of the procedure. The purpose of this study is to evaluate the effect of the single shot quadratus lumborum (QL) block versus the more traditional femoral and fascia iliacus (F/FI) blocks performed pre-operatively on immediate postoperative outcomes.

Methods
40 patients were retrospectively reviewed. 21 patients received preoperative QL blocks and 19 patients received preoperative femoral or fascia iliacus blocks. Intraoperative, post-anaesthesia care unit (PACU), and total morphine equivalents were analysed using unpaired t-test. Secondary outcome measures including total time in PACU and block-related complications were recorded and analysed as well.

Results
QL block patients required significantly lower total morphine equivalents (64.3 vs 84.4, p=0.02). The QL block patients also had shorter PACU stays (117 vs 147 minutes, p=0.01), and lower subjective pain scores at time of discharge (3.05 vs 5.38, p=0.003) compared to the F/FI block group. There were no significant differences in intraoperative opioids (p=0.17) or PACU opioids (p=0.06) given when analysed separately. One patient in the femoral nerve block group had noted a fall postoperatively. No patients in the QL block group had a block-related complication noted in the record.

Conclusion
Patients receiving a preoperative QL block for hip arthroscopy had lower total opioid requirements, shorter PACU stay, and lower pain scores at discharge than patients receiving preoperative F/FI blocks with no reported adverse events. This dataset suggests that further prospective data may be worthwhile to collect and analyse to further confirm the utility of QL blocks for hip arthroscopy surgery.
EP16.19 Factors associated with initial interest and treatment selection of patients with femoroacetabular impingement syndrome

PT, DPT, SCS Kathryn Glaws2, PT, DPT Lindsey Brown3, PT, DPT Matthew Pomeroy6, MD John Ryan1,2, MD Bryant Walrod2,4, PT, PhD OCS Stephanie Di Stasi2,5, MD William Vasileff1,2

1Ohio State University Department of Orthopaedics, Columbus, United States, 2Ohio State University Sports Medicine Research Institute, Columbus, United States, 3Ohio State University Health and Rehab Sciences Doctoral Program, Columbus, United States, 4Ohio State University Department of Internal Medicine, Columbus, United States, 5Ohio State University Division of Physical Therapy, Columbus, United States, 6Childrens Hospital Colorado Sports Medicine Centre, Aurora, United States

Biography
Assistant Professor of Orthopaedic Surgery at Ohio State University Jameson Crane Sports Medicine Institute specializing in Hip Preservation surgery and sports medicine. Fellowship trained in sports medicine and hip preservation surgery.

Background
Outcomes of operative and non-operative management of femoroacetabular impingement syndrome (FAIS) are variable. Gaining insight into the factors that inform treatment decisions of patients with FAIS may optimize outcomes.

Hypothesis
Higher pre-symptom activity level, worse patient-reported hip function, history of physical therapy (PT), initial interest in surgery, and disinterest in PT would be associated with electing surgery within 90-days of evaluation by an orthopaedic surgeon.

Study Design
Prospective observational cohort study

Level of Evidence
IV

Methods
After initial evaluation with an orthopaedic surgeon, participants reported treatment interest, symptom duration, pre-symptom and current activity level, pain severity and location, treatment history, and completed the International Hip Outcome Tool (iHOT33). Participants were categorized based on 90-day treatment decision (surgery or not). Variables of interest were compared between groups using Kruskal Wallis tests or chi-square tests as appropriate. Variables indicating group differences (P<0.10) were evaluated based on assumptions of a binomial logistic regression. Binomial logistic regression was used to identify significant predictors of surgery within 90 days of evaluation (P<0.05, 95% CI).

Results: Sixty-five participants were included. Participants indicated initial interest in surgery (n=24), PT (n=20), both (n=15), or neither (n=6). Thirty participants (46%) underwent surgery within 90 days. Surgery patients reported worse hip function (31.1±14.1) and were younger (32±12y) than those who did not pursue surgery (iHOT33: 41.7±17.8, p=0.006; age: 40±13y, p=0.01). Patients who pursued surgery had a higher prevalence of a labral tear diagnosis (46%), participating in previous PT (80%) and interest in surgery (90%) compared to the no-surgery group (labral tear: 17%, p=0.01; PT: 57%, p=0.04; interest in sx: 34%, p<0.001). Participants who reported initial interest in surgery had 10.7 greater odds to undergo surgery within 90 days of their initial evaluation (95% CI: 2.2,51.6).
Conclusions
Patients who underwent hip arthroscopy within 90 days of evaluation with an orthopaedic surgeon were younger, more active and reported worse hip function than those who did not undergo surgery. Interest in surgery after evaluation in clinic, and prior experience with PT were associated with surgical intervention within 90 days.
Improving perioperative communication in hip arthroscopy using an automated text messaging robot: A randomized-controlled trial

Dr Elizabeth Scott, Dr Chris Anthony, Dr Michaela O'Connor, Dr Michael Willey, Dr Thomas Sean Lynch, Dr Robert Westermann

1University Of Iowa, Iowa City, United States

Biography
Dr Westermann (Robby) is an Orthopaedic Surgeon and team physician University of Iowa. He went to medical school at the University of Washington in Seattle, WA and completed his residency in Iowa City. He completed a sports medicine fellowship at the Cleveland Clinic and was subsequently awarded the William Harris Award in Hip Preservation and completed a Traveling Fellowship with the ANCHOR Hip Preservation group spending time in St Louis, Michigan and Twin Cities, MN. He practices sports Medicine at the University of Iowa and treats athletic injuries of the knee, hip and shoulder. He is involved in cellular and biomechanics basic science research and Multi-centre clinical outcomes research through the MOON and ANCHOR groups.

Background
Perioperative communication between patient and surgeon is essential for education, counselling and coordination of care but is time and resource intensive. Mobile phone text messaging is nearly ubiquitous in the US population and can facilitate communication with minimal cost. We sought to evaluate the influence of an automated text messaging system delivered for 90 consecutive days to patients after hip arthroscopy. Outcomes included (a) the Hip Disability Osteoarthritis Outcome Score (HOOS-PS, HOOS-PAIN), (b) self-reported compliance with rehabilitation guidelines and (c) patient satisfaction with postoperative communication.

Methods
Thirty-eight patients of average age 28±8.4 years (51% female) undergoing hip arthroscopy at two academic institutions were prospectively enrolled prior to surgery and randomized to receive (1) standard perioperative communication or (2) additional daily automated mobile phone text messages. An automated mobile phone robot provided patients with daily text messages for 90 consecutive days, and included reminders to perform therapy exercises, and optional cognitive behavioural therapy exercises. At 90 days patients completed HOOS-PS, HOOS-PAIN and surveys on adherence to post-operative instructions and communication.

Results
There were statistically significant and clinically relevant improvement in HOOS-PS and HOOS-PAIN scores at 3 months for both groups (p<0.05). Patients receiving text message communication reported less pain at 3 months compared to the control group (HOOS-PAIN 73.7 versus 85.1, MCID = 8)(Table 1). Self-reported brace use and PT compliance trended towards significance (p=0.06, p=0.06). Patients receiving daily messages rated communication from their surgical team as significantly better (p=0.03).

Conclusions
Automated text messaging facilitates communication in a cost-effective manner and may have the ability to improve protocol adherence and pain after arthroscopic surgery. Our findings support further study of the ability of automated text messaging to improve protocol adherence and improve the postoperative experience for patients after arthroscopic surgery.
EP16.21 Objective measures of physical performance assess functional limitations of hip dysplasia

Dr Elizabeth Scott, Dr Jason Wilken, Dr Robert Westermann, Arthur Mercado, John Davison, Dr Michael Willey

1University Of Iowa Hospitals and Clinics, Iowa City, United States

Biography
Elizabeth Scott is an orthopaedic surgery resident at the University of Iowa. She is pursuing an academic career in sports medicine with a focus on hip surgery. Her research interests include using performance measures to improve assessment of interventions for musculoskeletal conditions and cognitive based therapy to improve surgical outcomes.

Objectives
Physical performance measures (PPMs) objectively quantify functional ability and are an attractive adjuvant to patient-reported outcome instruments (PROs) when assessing physical limitations of musculoskeletal conditions. The goals of this project were to 1) Assess the intra-rater and between-rater reliability of four PPMs and 2) Compare physical performance in young adults with dysplasia indicated for periacetabular osteotomy (PAO) to matched control subjects.

Methods
Twenty-four subjects age 15-39 years with hip dysplasia (LCEA <25°) indicated for periacetabular osteotomy (PAO) completed HOOS-PAIN, iHOT-12, mHHS, PROMIS PF-CAT as well as four physical function tests: (1) Timed Stair Ascent (TSA), (2) Self-Selected Walking Velocity (SSWV), (3) Four-Square Step Test (FFST) and (4) Sit-to-Stand Five Times Test (STS5). Twenty-one young asymptomatic adults ages 19-39 also underwent physical function testing. Inter-rater and intra-rater reliability were assessed by repeating the PPMs at a second visit within two weeks. Unpaired t-tests were used for between group comparisons, and intraclass correlation coefficients (ICCs) were used to assess reliability.

Results
Statistically significant differences between subjects with symptomatic hip dysplasia and asymptomatic controls were observed for all PRO measures (HOOS Pain 47.87 vs 99.21, iHOT-12 32.22 vs 99.27, mHHS 54.52 vs 90.61, PROMIS PF-CAT T-score vs 41.42 versus 65.61; all p<.001), and subjects with symptomatic hip dysplasia showed significant impairment in all four physical performance tests (p<0.001) compared to controls. All PPMs demonstrated excellent test-retest and between-rater reliability. Test-retest ICCs (95% CI range) for SSWV, TSA, STS5, and 4SST were 0.83 (0.69-0.91), 0.93 (0.87-0.96), 0.93 (0.87-0.96), and 0.90 (0.81-0.95) respectively. Between-rater ICCs were 0.99 (0.99-0.99), 0.99 (0.98-0.99), 0.99 (0.98-0.99) and 0.89 (0.80-0.95), respectively.

Conclusion
PPMs detect significant impairment in physical function in young adults with hip dysplasia and demonstrate high test-retest and between-rater reliability. PPMs may be a valuable adjunct to PRO measures when assessing disability and treatment outcomes of musculoskeletal conditions.
EP16.22 Comparing cost and outcomes for post-operative femoracetabular impingement (FAI) patients that utilize telehealth services for physical therapy: a matched-pair analysis.

Mrs Brandy Horton¹, Dr Jennifer Marland¹, Dr Hugh West¹, Dr James Wylie¹
¹The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

Background
Changing of healthcare plans and patients' lifestyles has resulted in the need to explore alternative options for rehabilitation to aid in cost and convenience strategies. Telehealth has become well studied in other avenues of healthcare however there is limited data in post-operative outpatient orthopaedic care. The purpose of the study was to compare the cost and patient reported outcomes using a transition to telehealth compared to in-person formal physical therapy (PT) during the 90-day postoperative global period after FAI surgery.

Methods
This retrospective study consisted of 36 patients (18 matched pairs) matched for age, gender, surgical procedure, surgeon and physical therapy assistant. Group 1 consisted of in person physical therapy visits only, group 2 consisted of in person with transition to telehealth visits. Post-operative information compared included the iHOT-12 score at 3 months as well as total post-operative PT charges for three months after surgery. Paired T-tests were used to compare differences between groups.

Results
There were 36 patients total consisting of 22 males and 14 females. The mean age was 34 years (range 15-53). Group 1 had more in-person PT visits (6.4 versus 3.7, p<0.001). Group 2 had a mean of 2.1 (Range 1-4) telehealth visits. Total in-person costs were higher in group 1 ($1540.95 versus $1000.24, p=0.007). There was no difference in total costs for the 90-day period for between groups but a trend toward lower cost in Group 2 (Group 1: $1540.94, Group 2: $1193.00, p=0.064). There was no difference in iHOT-12 score at 3 months between the groups (Group 1: 70.1, Group 2: 67.2, p=0.694).

Conclusion
Findings support a reduction in number of in-person PT visits and a trend towards decreased cost with similar functional outcomes at 3 months post-operatively with a transition to telehealth physical therapy.
EP17.1 Total hip replacement vs. hip resurfacing - which performs better following revision surgery? - A case - controlled study

**Miss Nurhan Abbud**
1 University Of Exeter Medical School, London, United Kingdom
2 Royal Cornwall Hospital Treliske, Truro, United Kingdom

**Biography**
My name is Nurhan, and I am a final year medical student studying at the University of Exeter Medical School, United Kingdom. I am currently taking a year out to complete an undergraduate degree in Anatomy at King’s College London. I have an interest in orthopaedics, particularly hand surgery.

**Background**
The outcome of revision total hip replacement (THA) surgery in young patients are known to be poor. Total surface replacement (TSR) is thought to allow patients a high level of function through replicating the normal biochemical axis of the hip joint. Literature postulates that due to TSR being a bone conserving procedure, it benefits the patient at time of revision surgery. To our knowledge there is no evidence to either support or refute this claim.

**Objectives**
To compare functional outcomes between matched revision TSR and revision THA patients.

**Methods**
This is a retrospective review of results from a single-centre high-volume TSR unit. All patients who underwent revision TSR were identified, and age and sex matched to a control group of those undergoing revision THA. All patients were reviewed with an up-to-date radiograph, Visual analogue scale (VAS), Oxford hip score (OHS), and SF12 questionnaire.

**Results**
132 patients were identified as having TSR revisions. 3 patients had died and 14 went on to have a further revision. The use of metal-on-metal bearing at revision was a significant predictor for a second revision (p=0.024). The mean patient age was 51 with a male: female ratio of 41:45. At final follow up, the Oxford Hip Score (OHS) was significantly better in the resurfacing group with a 7.08 difference (36.78, 29.70, p=0.002). Patients having revision for resurfacing had a postoperative length of stay 1.01 days less than that of the control group (4.86, 5.87, p=0.04), with significantly less postoperative transfusions (4%, 26%, p<0.001).

**Conclusions**
Our study indicates that revision of TSR is associated with shorter inpatient stay, reduced need for transfusion and better functional outcomes when compared with revision THA. To our knowledge; this is the first reported evidence that the bone preservation element of hip resurfacing may make for an easier, less traumatic revision procedure with a better functional outcome than a traditional stemmed hip replacement. While use of Hip resurfacing has seen a dramatic decline because of concerns regarding metallosis, this information may become more pertinent with the development of Ceramic hip resurfacing technology.
EP17.2 Clinical outcomes after arthroscopic iliopsoas release
Dr Ahmed Abdelazeem, Dr Mohamed Ghanem, Dr Mahmoud Abdelkarim, Prof. Dr Khaled Abdelkader

Biography
Assistant professor Ahmed H Abdelazeem belongs to Cairo university hip preservation group that is a part of pelvic traumatology and arthroplasty unit in Kasr Alainy hospital located in Cairo, Egypt.

The iliopsoas musculotendinous unit is a powerful hip flexor that is important for normal hip strength and function. Iliopsoas tendon tightness and impingement has been implicated as a cause of anterior labral inflammation and tears. Arthroscopic release has been described at three different locations with promising results, however, no reports have considered the assessment of the muscle power following this procedure. We carried this prospective study with the aim of assessment of functional outcome of this procedure using the modified Harris Hip Score (MHHS), as well as, manual iliopsoas muscle power assessment and scoring by a single assessor. Including 30 patients from February 2017 till November 2018, the procedure was done through the central compartment, under traction, in 28 patients. In one patient, it was done through the peripheral compartment and in one case, it was done in a combined fashion. Indications for surgery was internal snapping (26.67%), FAI associated with snapping (33.33%), labral tear extending to 3 o’clock (23.33%) and patients with flexion deformity (16.67%). The mean MHHS improved from 46.32 pre-operatively to 90.05 post-operatively at 6 months (p-value < 0.001). Full restoration of the iliopsoas muscle power (5/5) of flexion was completely restored at 6 months in 29 patients. Complications occurred in five cases: 4 patients with reversible nerve injury and one case developed deep venous thrombosis two months following the procedure. In conclusion, arthroscopic iliopsoas tenotomy is an effective procedure to treat the underlying iliopsoas tendon disorders without affecting the hip flexion muscle power.
EP17.3 Comparison of false profile radiographs and ultrasound for the screening of anterior inferior iliac spine type

Dr Eyal Amar, Dr Ron Rosenthal, Dr Ran Ankori, Dr Barak Haviv, Dr Shai Factor, Dr Mahder Yilma, Dr Ran Atzmon, Prof. Ehud Rath

1 Tel Aviv Medical Centre affiliated to Tel Aviv University, Tel Aviv, Israel, 2 Hasharon Hospital, Rabin Medical Centre, affiliated to Tel Aviv University, Petach Tikva, Israel, 3 Assuta Medical Centre, Ashdod, Israel

Purpose
To compare Ultrasound and false profile radiographs for the screening of anterior inferior iliac spine (AIIS) morphology.

Methods
False-profile and anteroposterior radiographs and Ultrasound were obtained on 51 hips (29 patients). The ilium wall between the caudad level of the AIIS and the acetabular rim was evaluated for bony prominences both on the false Profile view and Ultrasound for each hip. The AIIS type was graded according to Hetsroni classification by two independent reviewers according to both imaging modalities. Inter-rater reliability analyses were performed for both methods in addition to an intermethod agreement.

Results
The radiographic false-profile view had the highest interrater agreement (kappa = 0.944, P < 0.0001). The interrater agreement for ultrasound demonstrated strong level of agreement (kappa = 0.882, P < 0.0001). Intermethod analysis showed strong level of agreement (kappa = 0.827 and 0.869 for the two reviewers, P < 0.0001).

Conclusions
AIIS morphology evaluated by ultrasound is in strong agreement with the radiographic AIIS morphology.

Clinical relevance
Sonographic evaluation may be a valuable tool in the screening of AIIS morphology.
**EP17.4 Outcome following core decompression for non-traumatic avascular necrosis of the femoral head: A systematic review**

**MD Octavian Andronic**\(^1,2\), MD, DIC, MPH Haitham Shoman\(^2,3\), MD Ori Weiss\(^2,4\), MD, MA, MSc, FRCS(Orth) Vikas Khanduja\(^2\)

\(^1\)Department of Orthopaedics, Balgrist University Hospital, Forchstrasse 340, 8008, Switzerland, \(^2\)Department of Trauma and Orthopaedics, Addenbrooke’s - Cambridge University Hospitals NHS Foundation Trust, Hills Road, Cambridge, CB2 0QQ, United Kingdom, \(^3\)Department of Global Health and Social Medicine, Harvard Medical School, Boston, USA, \(^4\)Department of Orthopaedic Surgery, Meir Medical Centre, Kfar-Saba, Israel

**Biography**

Octavian Andronic is currently working as an orthopaedic surgery resident in his first year of training at the Balgrist University Hospital in Zurich, Switzerland (Medical Director - Prof. Mazda Farshad).

He was born and raised in Republic of Moldova and completed his medical school at the University of Pharmacy and Medicine "Grigore T. Popa" in Iasi, Romania. He subsequently completed his Internship year in General surgery and Traumatology in Lachen, Switzerland.

As a medical student, Octavian had the chance to travel for clinical clerkships in different countries:
- Charite, Berlin, Germany; (Prof. Markus Scheibel)
- Balgrist University Hospital, Zurich, Switzerland; (Prof. Christian Gerber)
- Hospital for Special Surgery, New York City, USA (Scott Wolfe M.D.)

and finally, Addenbrooke’s University Hospital in Cambridge, UK, under the lead of Mr. Vikas Khanduja, where he developed a special interest for hip preservation surgery.

**Background**

Core decompression of the femoral head is a surgical procedure that is performed to preserve the hip in the early stages of avascular necrosis (AVN) of the femoral head. The eventual clinical and radiological outcome following this procedure is not well known and differs based on the medical centre and the technique. Also, the time to total hip replacement (THR) and the percentage of patients subsequently undergoing THR is controversial.

**Methods**

The systematic review was registered in the international prospective register of systematic reviews (PROSPERO) and followed the PRISMA guidelines. The search included articles from CENTRAL (Cochrane Central Register of Controlled Trials), MEDLINE, EMBASE, Scopus, AMED and Web of Science Core Collection. Databases were scanned for studies reporting outcome for core decompression for AVN. Studies using additional implants, vascularised grafts or any type of augmentation were excluded. Articles including patients with sickle cell disease were excluded. Studies with a minimum Level IV of evidence were considered eligible. Quality assessment was performed using the Joanna Briggs Institute Critical Appraisal Checklist (JBI CAC).

**Results**

A total of 44 studies were included in the review. The mean follow-up time was 61 months and the mean age at surgery of patients was 40 years. The main aetiologies of AVN included the following: usage of corticosteroids (53.5%), idiopathic (23.1%) and alcohol abuse (22.5%). An accentuated heterogeneity was found among the classification systems for disease staging. The majority of studies - 20(45%) used the original “Ficat” classification. Eight studies (18%) followed the “Modified Ficat” classification and other eight (18%) used the ARCO system. Finally, nine studies (20%) applied the “Steinberg/University of Pennsylvania” classification. The average time of hips undergoing total hip replacement was 24.2 months (range 7.8 - 62.5 months), which could be calculated from fifteen studies. These analysed 35.7% of failures that ultimately
underwent THA (from a total of 893 hips). The preoperative stages, clinical improvement rates and radiographic progression were also analysed and discussed.
EP17.6 Extra-articular hip impingement

MD Antônio Augusto Guimarães Barros¹, Rafael Baroni Carvalho¹, Victor Atsushi Kasuya Barbosa¹, André Gomes Ribeiro¹, Fernando Henrique Ferreira Garrido¹, MD Lincoln Paiva Costa¹, **MD Carlos Cesar Vassalo¹**

¹Hospital Madre Teresa, Belo Horizonte, Brazil

**Biography**


**Introduction**

The extra-articular hip impingement involves a group of recently recognized lesions, commonly underdiagnosed and poorly understood by many orthopaedic specialists. However, these lesions are capable of leading to pain and important functional decline in the affected patients. The correct diagnosis of these conditions is primal. It involves the need for an adequate knowledge of its pathogenesis and clinical evaluation through specific physical examination manoeuvres, as well as correct interpretation of the imaging exams. Objective: To update medical professionals, physiotherapists, physical educators or any others who work in direct contact with the affected patients.

**Material and methods**

A review of the literature was conducted on the PubMed and Birene / Lilacs databases on regard of anatomy, pathogenesis, clinical findings, imaging and treatment of the main causes of extra-articular hip impingement.

**Results**

The most cited extra-articular impingement syndromes in the literature are the ischiofemoral, sub spinal, trochanteric and iliopsoas impingements. These syndromes are dynamic conditions and the diagnosis must be done observing the presence of anatomical abnormalities, positive clinical examination and confirmation by imaging exams or intraoperative finding. Because they are lesions with a low prevalence reported, there is little evidence regarding these conditions and more studies are needed.

**Conclusion**

Knowledge of extra-articular hip impingement syndromes is essential in the evaluation of patients with hip pain and should be part of the differential diagnosis.

**Keywords**

Hip pain; Extra-articular hip impingement; Ischiofemoral impingement; Sub spine impingement; Greater trochanteric Pelvic impingement; Psoas impingement.
EP17.7 Survivorship of hip arthroscopy for femoroacetabular impingement syndrome performed with modern surgical techniques and predictors of clinical failure

Dr Shane Nho1, Dr Edward Beck2, Dr Benedict Nwachukwu1, Dr Gregory Cvetanovich3, Dr William Neal1, Dr Joshua Harris4, Dr Alexander Weber5, Dr Richard Mather6

1Rush University Medical Centre, Chicago, IL, USA, 2Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US, 3Department of Orthopaedics, The Ohio State University Wexner Medical Centre, Columbus, US, 4Department of Orthopaedic Surgery, Houston Methodist University, Houston, US, 5Department of Orthopaedic Surgery, University of Southern California, Los Angeles, US, 6Department of Orthopaedic Surgery, Duke University, Durham, USA

Biography

Dr Shane Nho is an orthopaedic surgeon specializing in sports medicine at rush university medical centre in Chicago, IL, USA. his surgical interests include hip arthroscopy and treatment of femoroacetabular impingement. during residency at the hospital for special surgery, Dr Nho was introduced to arthroscopic correction of FAI and pao by Dr Buly, at a time when few surgeons were treating the disease. Dr Nho completed his sports medicine fellowship at rush, working with Charles Bush-Joseph who was performing most hip arthroscopy procedures in Chicago. during this time, Dr Nho was selected as a Herodicus traveling fellow, working with Marc Philippon, Thomas Byrd, and Bryan Kelly to develop his arthroscopic surgical technique.

Currently, 80% of his clinical practice is devoted to arthroscopy and hip preservation. he is currently the director of young adult hip surgery at rush university medical centre.

In his time off, Dr Nho enjoys spending time with his wife, Sloan York, an ob-gyn physician at rush, and their 2-year-old boy Connor. he also passionate about hockey, and cheers for his alma mater, north western, where he was captain of the men’s hockey team. he is also the team orthopaedic surgeon for the Chicago fire soccer club.

Purpose
To analyse predictors of clinical failure and inferior clinical outcomes in patients undergoing hip arthroscopy for treatment of femoroacetabular impingement syndrome (FAIS).

Methods
Data was collected and analysed from consecutive patients who underwent primary hip arthroscopy with routine capsular closure for the treatment of FAIS from a single fellowship-trained surgeon between January 2012 and November 2015. Baseline data, postoperative patient-reported outcomes (PROs), and rates of clinical failure and inferior clinical outcomes were recorded at 2-years postoperatively. Clinical failure was defined by revision hip arthroscopy or conversion to total hip arthroplasty (THA). Inferior clinical outcome was defined as not reaching Minimally Clinical Important Difference (MCID) or Patient Acceptable Symptomatic State (PASS) for Hip Outcome Score-Activities of Daily Living Subscale (HOS-ADL). A multivariate logistic regression analysis was used to identify significant predictors of clinical failure and inferior clinical outcome.

Results
Out of 1,161 eligible patients, 935 (80.5%) completed 2-year postoperative PROs. The average age was 33.3±12.3years with a mean BMI of 25.4±8.2 kg/m2. The overall clinical failure rate was 3.6% (n=31) including 23 cases (2.5%) who underwent revision hip arthroscopy and 11 cases of conversion to THA. Predictors of clinical failure were lower preoperative iHOT-12 score (p=0.016), chronic preoperative pain (p=0.001), and chondromalacia in the affected hip (p=0.04). The inferior clinical outcome group consisting of
patients who failed to reach MCID for HOS-ADL included 187 patients (27.4%). Predictors of inferior clinical outcomes were Tonnis grade>1 (p=0.01), worker’s compensation (p<0.001), and increased BMI (p=0.02).

Conclusion
This study demonstrates that 73% all-comers treated for symptomatic FAIS with primary hip arthroscopy and routine capsular closure achieved MCID. Clinical failure is predicted by a number of both modifiable and non-modifiable factors including chronic preoperative pain and presence of chondromalacia. The current study updates the mid-term failure rates and outcomes achievable with hip arthroscopy for FAIS.
EP17.9 Multi-centre analysis of changes in patient satisfaction and self-reported functional outcomes between year-1 and year-2 following hip preservation surgery

**Dr. Dominic Carreira**, Dr. Benjamin Kivlan, Dr. Dean Matsuda, Dr. John Christoforetti, Dr. Andy Wolff, Dr. Shane Nho, Dr. Misty Suri, Dr. Al Stubbs, Dr. Geoffrey van Thiel, Dr. John Salvo, Steven Garden


**Biography**

Dominic S. Carreira, M.D., a board-certified orthopaedic surgeon and arthroscopy specialist with advanced training from three orthopaedic fellowship programs, specializes in foot and ankle, young adult and adolescent hip preservation, and sports medicine.

Following his orthopaedic residency training, Dr. Carreira completed a Foot and Ankle Fellowship with Dr. Mark Myerson and Clifford Jeng at the Institute for Foot and Ankle Reconstruction, Baltimore, Maryland. He also completed a Foot and Ankle and Arthroscopy Fellowship in Seattle, Washington, and a Sports Medicine and Hip Arthroscopy Fellowship with the Steadman-Hawkins Clinic in Vail, Colorado.

Active in medical research, Dr. Carreira has presented his work on minimally invasive arthroscopic techniques and outcomes both nationally and internationally and has been published in numerous medical publications including Foot and Ankle International and the American Journal of Sports Medicine. He is the President and Founder of the Multicentre Arthroscopy Study of the Hip (MASH) and a Founder of the Multicentre Arthroscopy Study of the Ankle and Foot (MASTAF).

**Purpose**

The measure of successful surgical outcomes is often based on a minimum of 2-year post-surgery outcomes. A paucity in the literature exists regarding how patient outcomes change within the first two years following hip arthroscopy. The purpose of this study was to compare patient reported outcomes of pain, function, and satisfaction at 1-year and 2-years following hip preservation surgery.

**Subjects**

A cohort of 467 patients (61% female) from a multi-centred hip arthroscopy registry were analysed for the purpose of this study. Subjects ranged from 18-72 years of age, averaged 161 pounds and were 67 inches tall. Patients had an average Tonnis Angle of 3.3, an alpha angle of 64.2, and a lateral centre edge angle of 33.1. Surgical procedures included 183 (39.2%) chondroplasties, 13 (2.8%) acetabular microfractures, acetabuloplasties, 180 (38.5%), 81 (17.3%) femoral chondroplasties, 261 (55.9%) femoroplasties, 259 (55.5%) synovectomies, 233 (49.9%) labral repairs, 65 (8.1%) labral reconstructions, and 19 (4.1%) labral debridement’s.

**Methods**

De-identified patient data from a multi-centred hip arthroscopy registry was analysed. The data was collected from 7 high volume surgical practices. Paired T-tests with an a priori alpha set at 0.05 determined if a significant change occurred for the International Hip Outcome Tool-12 (iHOT-12) and Visual Analog Scale (0-100) for patient satisfaction at 1-year versus 2-years post hip preservation surgery.
Results
The 1-year functional outcomes for the iHOT-12 averaged 69.7 (SD=25.4), with 52.2.% of patients exceeding the PASS cut-off score (>74) for the iHOT-12. At the 2-year follow-up, 55.9% of subjects reached the PASS score for the iHOT-12 with an average score of 71.5 (SD=25.0). The Paired T-test showed no statistical difference in iHOT-12 scores at the 1-year follow-up compared to the 2-year follow-up (p=0.056). Patients reported 77.8% (SD=27.9) satisfaction with their hip preservation surgery at 1-year follow-up which increased to 80.1% satisfaction (SD=26.5%) at 2-year follow-up (p=0.05)

Conclusions
The results of this study show that patients reach a relatively high level of satisfaction and function at 1-year after surgery and this is maintained at follow-up at 2-years post-operatively.
EP17.10 The effect of cam impingement on severity of synovitis; A multi-centre descriptive study

Dr Dominic Carreira, Dr Benjamin Kivlan, Dr Dean Matsuda, Dr John Christoforetti, Dr Andy Wolff, Dr John Salvo, Dr Shane Nho, Dr Al Stubbs, Dr Geoffrey van Thiel, Dr Misty Suri, Steven Garden

1Peachtree Orthopaedics, Atlanta, United States

Biography
Dominic S. Carreira, M.D., a board-certified orthopaedic surgeon and arthroscopy specialist with advanced training from three orthopaedic fellowship programs, specializes in foot and ankle, young adult and adolescent hip preservation, and sports medicine.

Following his orthopaedic residency training, Dr Carreira completed a Foot and Ankle Fellowship with Dr Mark Myerson and Clifford Jeng at the Institute for Foot and Ankle Reconstruction, Baltimore, Maryland. He also completed a Foot and Ankle and Arthroscopy Fellowship in Seattle, Washington, and a Sports Medicine and Hip Arthroscopy Fellowship with the Steadman-Hawkins Clinic in Vail, Colorado. Dr Carreira serves as a consultant for both hip, and foot and ankle injuries for Atlanta United and the Atlanta Ballet.

Active in medical research, Dr Carreira has presented his work on minimally invasive arthroscopic techniques and outcomes both nationally and internationally and has been published in numerous medical publications including Foot and Ankle International and the American Journal of Sports Medicine. He is the President and Founder of the Multicentre Arthroscopy Study of the Hip (MASH) and a Founder of the Multicentre Arthroscopy Study of the Ankle and Foot (MASTAF).

Purpose
Synovitis is a pathology associated with femoroacetabular impingement. It is unknown how the magnitude of abnormalities of the femur and the acetabulum effect the severity of synovitis. This study reports the effect of alpha angle on the severity synovitis from findings in patients undergoing hip arthroscopy at multiple centres across the U.S.

Number of Subjects
A total of 3162 patients from 10 select surgical hip centres that had hip arthroscopy for labral pathology between January 1, 2015 – March 1, 2018 were analysed for the purpose of this study.

Methods
De-identified data was collected from 10 high volume surgeon practices. An anterior-posterior view establishing the alpha angle of the involved hip was recorded for each patient. Patients were then grouped by severity of synovitis identified during arthroscopic evaluation. An analysis of variance (ANOVA) tested the effect of radiographic alpha angle of the observed synovitis during arthroscopy. The magnitude of the differences between the groups of patients based on synovitis severity were established by a Tukey’s post hoc analysis. Synovitis was defined on the following scale: Grade 0, no evidence of erythema or hypertrophy of the synovial membrane and absence of villi; Grade I, some erythema or hypertrophy of the synovial membrane and low density villi; Grade II, severe erythema that is contained or patchy and moderate presence of villi; Grade III, Diffuse erythema and hypertrophy throughout the membrane as well as high density of villi.

Results
The 3162 patients (1138 male; 2024 female) averaged 34.05 (SD: 11.3) years of age, 25.2 (SD: 3.6) BMI, a 40.8 (SD:20.4) pre-op pain VAS, and 34.07 (SD: 17.9) pre-op iHOT-12. Analysis of variance confirmed an effect of alpha angle on synovitis, F(3)=12.3, p<0.001. The post hoc analysis showed that alpha angles were
different (p<0.05) between each of the synovitis groups: Grade 0 (57 ; SD:12), Grade I (59 ; SD 13) Grade II (61;SD: 14), and Grade III (66; SD: 14).

Conclusions
The results of this study show that patients with more significant synovitis findings during arthroscopically have greater alpha angle values.
Purpose
to evaluate and document intra-abdominal pressure changes during hip arthroscopy and define its relationship with other patient related variables.

Materials and methods
A prospective multicentre study evaluating intra-abdominal Pressure (IAP) in patients undergoing arthroscopic treatment of femoroacetabular impingement (FAI) was performed. The IAP was measured indirectly by a bladder catheter (AbViser® Autovalve® Intra-abdominal pressure monitor) and documented every 30 minutes during the entire procedure. The following risk factors were analysed: traction time, duration surgery, previous abdominal surgery, repair of the capsule, psoas tenotomy and surgical approach.

Results
One hundred and five patients with symptomatic FAI and underwent for hip arthroscopy met the inclusion criteria. There were significant differences in the IAP between the pre-operative measurement of IAP and the IAP at different time points during surgery (p<0.01). The IAP increased continuously from the commencement of surgery (considered as time point from portal establishment) until the first 60 minutes. After first 60 minutes of surgery the IAP did not increase significantly. There were no significant associations between increased IAP and the risk factors analysed

Conclusion
Intra-abdominal pressure increases significantly in the first 60 minutes of the hip arthroscopy, then are stabilizes for the duration of surgery prior to decreasing just after the completion of surgery. The highest recorded IAPs were not associated with additional complications. Hip arthroscopy is generally safe, and no symptomatic intra-abdominal hypertension was documented. Finally, patient specific and procedure specific risk factors did not predict IAP
EP17.12 Early results of osteonecrosis of the femoral head treated with core decompression and hyaluronic acid-based cell-free scaffolds soaked in concentration of autologous bone marrow aspirate

MD Ahmet Fırat1, MD Şahin Çepni1, MD Enejd Veizi1, MD Alper Murat Ulaşlı2, MD Kasım Kılıçarslan1
1Ankara City Hospital, Ankara, Turkey, 2Lokman Hekim Hospital, Ankara, Turkey

Biography:
Name, Surname: Ahmet Fırat
Birth date: 24.11.1977
Address: Dumlupınar Avenue, Fatih Sultan Mah., 375 A/20 Etimesgut/Ankara
Mobile phone: +905054002676
Education:
Medical Degree: Gazi University School of Medicine 1994-2001
Residency: Ankara Atatürk Research and Development Hospital 2001 - 2006
Work Experience:

Scientific Societies Memberships
Türk Ortopedi ve Travmatoloji Birliği Derneği (TOTBID)
Kalça Diz Artroplasti Derneği
TOTBİD Ortopedik Travma Şubesi
SICOT, Société Internationale de Chirurgie Orthopédique et de Traumatologie
Aim
Core decompression and intraosseous bone marrow aspiration concentrate (BMAC) injection are well known treatment options for early-stage, pre-collapse osteonecrosis of the femoral head (ONFH). However, there is a dilemma on how the stem cells of BMAC remain attached to the pathologic area. The aim of our study is to report the early results of patients with Ficat I – IIA ONFH treated with core decompression and hyaluronic acid-based cell-free scaffolds soaked in BMAC.

Materials
13 patients with a mean age of 43.6 operated for ONFH between January 2017 – April 2018 were included. 2 patients had a history of chronic alcoholism, 4 were due to corticosteroid use and 6 were idiopathic. 1 patient was Ficat stage I and the other 12 were Ficat IIA. The patients were placed supine under general anaesthesia and fluoroscopy was used. BMAC was harvested from the iliac crest. An incision was made on the lateral femur and a 2.4 mm trochar pin was advanced towards the necrotic region in multiple ways. The lesion was centralised under fluoroscopy guidance and a 7mm drill was advanced. The necrotic area was curetted. The scaffold with BMAC is then placed. The tunnel entrance was closed with bone wax and BMAC was injected using a long needle. Standard rehabilitation program was performed. Harris Hip Score (HHS), Visual Analog Scale (VAS) and an MRI were used to evaluate the patients preoperatively and 1 year later.

Results: HHS and VAS scores were 48.2 (34 – 58) and 7.4 (4 – 9) preoperatively and 76.6 (34-89 ) and 2.4 (0-5) at 1-year follow-up, respectively. The difference was statistically significant. 1 patient underwent hip arthroplasty.

Conclusion
In the treatment of ONFH, core decompression and BMAC-soaked hyaluronic-based scaffold placement can be a promising technique resulting in improved outcomes. Studies with a longer follow up period and higher number of cases are needed for future perspective.
Comparison of patient outcomes and satisfaction levels between arthroscopic debridement and conservative treatment of adhesive capsulitis of the hip

MD Jae-Young Lim¹, **MD Yoshi Pratama Djaja**¹², MD Yoo-Sun Won³, MD, PhD Eui-Chan Jang¹, MD, PhD Jae Yoon Kim¹, MD, PhD Yong-Chan Ha¹

¹Chung-Ang University College of Medicine, Seoul, South Korea, ²Fatmawati General Hospital, Jakarta, Indonesia

Biography
Dr Djaja is a Hip and Pelvis specialist practicing in Fatmawati Central General Hospital, Jakarta, which is one of the main national hospital for Orthopaedic in Indonesia.

Background
Treatments of adhesive capsulitis of the hip are still controversial. The purpose of this case-control study was to retrospectively compare the clinical outcomes of patients with adhesive capsulitis between arthroscopic and conservative treatment.

Methods
From 2010 to 2017, 35 hips (32 patients: 10 men and 22 women) diagnosed with adhesive capsulitis were enrolled. Arthroscopic surgery was performed in 17 patients (20 hips, operation group) and conservative treatment was performed in 15 patients (control group). Follow up period was 2 years at minimum. Outcomes were measured with the visual analogue scale (VAS), University of California Los Angeles (UCLA) scale, modified Harris hip score (mHHS), and the hip’s range of motion (ROM).

Results
The patients in the arthroscopic group were younger than those in the control group (mean age, 36.6 vs 46.2, p=0.032). The VAS scores in the operation group were significantly lower than those in the control group at the 2-week, 6-week, and 24-month follow-up. Although the UCLA scale and mHHS in the operation group showed better trends, no statistical differences were found during the final follow-up. The improvements of external rotation in the operation group were better at the 6-week evaluation. Three patients complained of transient pudendal nerve palsy but recovered within 6 weeks.

Conclusions
All patients with adhesive capsulitis of the hip showed improvement of pain, UCLA scale, mHHS, and ROM at a minimum 2-year follow-up. However, surgical intervention is helpful to reduce symptom durations and for early recovery of ROM.

Keywords
Adhesive capsulitis; arthroscopy; conservative treatment; hip; clinical outcome
EP17.14 is diabetes mellitus a negative prognostic factor for patients undergoing hip arthroscopy? A matched-controlled study

Dr Itay Perets1, Edwin Chaharbakhshi2, Dr Gal Barkay3, Brian Mu4, Dr Ajay Lall5, Dr Benjamin Domb5
1Hadassah Hebrew University Hospital, Jerusalem, Israel, 2Loyola Stritch College of Medicine, Maywood, United States, 3Sheba Medical Centre, Ramat Gan, Israel, 4Rosalind Franklin University of Medicine and Science, North Chicago, United States, 5American Hip Institute, Chicago, United States

Biography
Dr Itay Perets is an orthopaedic surgeon at Hadassah Hebrew University Hospital who specializes in joint replacement and hip arthroscopy

Background
Although diabetes mellitus (DM) and hip arthroscopy have both become increasingly common, the impact of DM on hip arthroscopy outcomes has not been studied. We hypothesized that patients with DM undergoing hip arthroscopy for labral tears have inferior outcomes at ≥ 2 years postoperatively compared to patients without DM.

Methods
Data were prospectively collected and retrospectively reviewed on patients that underwent hip arthroscopy between 2/2008 and 12/2014. The inclusion criteria were patients with DM that underwent hip arthroscopy for the treatment of femoro-acetabular impingement (FAI) and labral tears, and had preoperative modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcome Score – Sports Specific Subscale (HOS-SSS), and Visual Analogue Scale (VAS). The exclusion criteria were preoperative Tönnis grade > 1, previous hip conditions and/or ipsilateral hip surgery. All patients with DM were matched in a 1:2 ratio to control patients without DM. The matching criteria were age at surgery ± 8 years, gender, BMI ± 5, Worker’s Compensation claim, capsular treatment (release vs. closure), and acetabular Outer bridge grade 0 or 1 vs. 2, 3, or 4.

Results
Of 29 eligible patients with DM, 26 (89.7%) had minimum two-year follow-up. Twenty-six patients with DM were matched and compared to 52 patients without DM. Acetabuloplasty was performed more frequently in the control group (p=0.01). There were no other statistically significant differences detected in terms of demographics, preoperative radiographic imaging, intraoperative findings, procedures, preoperative scores, follow-up scores, revision rates, conversion rates to total hip arthroplasty (THA), or complication rates.

Conclusions
Patients with DM demonstrate similar and favourable improvements at ≥ 2 years after arthroscopic labral treatment when compared to a matched control group without DM. However, the DM group demonstrated a non-statistically significant trend towards inferior outcomes in all PROs, VAS, and satisfaction.
EP17.15 Mid-term outcomes of Iliopsoas Fractional Lengthening (IFL) for internal snapping as a part of hip arthroscopy

Dr Itay Perets1, Edwin Chaharbakhshi2, Dr Yosif Mansor3, Dr Lyall Ashberg4, Brian Mu5, Muriel Battaglia6, Dr Benjamin Domb7

1Hadassah Hebrew University Hospital, Jerusalem, Israel, 2Loyola Stritch College of Medicine, Maywood, United States, 3Chaim Sheba Medical Centre at Tel Hashomer, Ramat Gan, Israel, 4Atlantis Orthopaedics, Atlantis, United States, 5Rosalind Franklin University of Medicine and Science, North Chicago, United States, 6The University of Chicago Pritzker School of Medicine, Chicago, United States, 7American Hip Institute, Chicago, United States

Background
Long-term outcomes have not yet been reported for treatment of painful internal snapping of the hip with arthroscopic iliopsoas fractional lengthening (IFL).

Hypothesis/Purpose
To report minimum five-year outcomes, durability, and painful snapping resolution for patients that underwent hip arthroscopy for treatment of femoro-acetabular impingement (FAI) and labral tears with concomitant IFL. We hypothesized that IFL during hip arthroscopy would be safe, would demonstrate a high rate of painful snapping resolution, and would demonstrate favourable mid-term outcomes that would remain durable relative to short-term outcomes.

Methods
The study period was defined as February 2008 to January 2011. Inclusion criteria were patient that underwent hip arthroscopy for the treatment of FAI and labral tears with concomitant IFL for painful snapping, and had preoperative baseline scores for the modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcome Score – Sports Specific Subscale (HOS-SSS), and Visual Analog Scale (VAS). The exclusion criteria for this study were preoperative Tönnis grade > 0, Workman’s Compensation, or previous ipsilateral hip conditions. Minimum five-year outcomes were reported.

Results
Seventy-one cases (64 patients) were eligible for review (81.6% follow-up). Mean follow-up time was 69.1 months. All outcomes demonstrated significant mean improvements at latest follow-up: mHHS (64.1, 83.3), NAHS (62.4, 85.4), HOS-SSS (46.6, 76.6), and VAS (6.4, 2.3). Mean satisfaction was 8.3/10. Improvement in all outcomes remained constant between two-year and minimum five-year follow-up. Painful snapping was resolved in 83.8% of cases. Eleven hips (15.5%) required secondary arthroscopy at a mean of 30.0 months. Three hips (4.2%) required total hip arthroplasty at a mean of 63.1 months. Risk factors for poor outcomes (mHHS <70) included older age, higher BMI, and lower preoperative NAHS. Three cases (4.2%) had minor postoperative complications.

Conclusions
IFL as part of hip arthroscopy for treatment of FAI and labral tears is safe, successfully eliminates most cases of painful internal snapping, and demonstrated favourable outcomes at short-term and mid-term follow-up.

Biography
Dr Itay Perets is an orthopaedic surgeon at Hadassah Hebrew University Hospital who specializes in joint replacement and hip arthroscopy.
EP17.17 Radiographic predictive factors of hip osteoarthritis: A systematic review

Dr Jacob Shapira\textsuperscript{1}, Jeffrey Chen\textsuperscript{1}, Dr Ajay Lall\textsuperscript{1}, Dr Philip Rosinsky\textsuperscript{1}, Dr David Maldonado\textsuperscript{1}, Dr Benjamin Domb\textsuperscript{1}
\textsuperscript{1}American Hip Institute, Chicago, United States

Biography:
Dr Jacob Shapira is an orthopaedic surgeon who specializes in joint replacement and hip arthroscopy.

Background
A large body of literature evinces the success of hip arthroscopy in treating non-arthritic hip pain. The outcomes of hip arthroscopy have been shown to be inversely related to the level of arthritis. Thus, the ability to identify radiographic risk factors for hip osteoarthritis (OA) may lead to renewed consideration for management of these patients. The purpose of this study was to outline factors that contribute to the appearance of hip OA. Secondarily, this study aims to describe radiographic factors that increase progression of the arthritic hip.

Methods
Article Search: PubMed/MEDLINE, and Embase were searched in November 2019 for radiographic risk factors for hip OA. Articles included were either level of evidence 3 or 4 and focused on hip X-rays and OA. Included articles were assessed for quality using the Methodological Index for Non-randomized Studies (MINORS). Demographic characteristics of the study cohort, stated definition of OA, baseline OA of the cohort, and factors for prediction or progression of OA were recorded for each article.

Results
A total of 126 articles were found, 22 of which were considered for full-text review. The average MINORS was 18.9. Nine articles were included into this review. The most common descriptors for OA were dysplasia and cam impingement. Six articles reported radiographic measures of OA patients that indicated acetabular under coverage. Four studies provided measures of femoral neck morphology indicating cam morphology. Longitudinal studies that used logistic models to assess the development of OA were analyse for factors that contribute to the development of OA. Six of nine found acetabular under coverage to be a significant predictor for developing OA. Four articles found cam type femoroacetabular impingement as a predictive factor. Finally, four articles commented on the prediction of progression to more severe grades of OA. All articles reporting on risk factors for OA progression exclusively reported on acetabular under coverage.

Conclusion
This systematic review found dysplasia and cam impingement were the strongest predictors for the development and the progression of OA.
The evolution of hip arthroscopy: What has changed between 2008 and 2018 - a single surgeon’s experience

Dr Philip Rosinsky1, Sarah Chen1, Dr Jacob Shapira1, Dr David Maldonado1, Dr Ajay Lall1, Dr Benjamin Domb1

1American Hip Institute, Chicago, United States

Biography
Dr Philip Rosinsky is an orthopaedic surgeon at the American Hip Institute who specializes in joint replacement and hip arthroscopy.

Background
The expansion of hip arthroscopy over the last decade has been dramatic and the growing body of knowledge and surgeon experience has led to differences in patient selection and management.

Purpose
To compare a single surgeon’s first 200 cases of hip arthroscopy to the last 200 cases with regard to patient demographics, indications for surgeries, intraoperative findings, procedures performed, and patient reported outcomes (PROs).

Methods
Data was prospectively collected and retrospectively reviewed between February 2008 and February 2018 for all patients undergoing primary hip arthroscopy by a single surgeon. Of over 4000 patients, the first 200 (Group A) and last 200 (Group B) eligible for minimum two-year follow up were included in our analysis. Patient demographics, preoperative imaging, intraoperative procedures, PROs, and complications were collected and compared.

Results
Follow-up was available for 192/200 (96.0%) and 189/200 (94.5%) patients in groups A and B, respectively. The groups were similar in age, sex, and body mass index (P>0.05). In Group A, there were significantly more patients with Tönnis Grade 1 and preoperative chondral damage on magnetic resonance imaging (38% vs 30%; 30.5% vs. 7.0%, respectively) (P<0.001). Group B consisted of significantly more (P<0.001) labral reconstructions (9.5% vs 0%), capsular closures (71.5% vs 31%), gluteus medius repairs (17.5% vs 3%), and iliopsoas fractional lengthening procedures (45% vs 29.5%). Femoroplasty was performed for smaller cam lesions and resulted in smaller postoperative alpha angles (45.9°±8.2° vs 42.4°±6.3°, P<0.001). With regard to PROs, Group B exhibited significantly higher mHHS, NAHS, HOS-SSS scores at minimum 2 year follow up (P<0.05).

Conclusion
The results of this study demonstrate the significant evolution in patient management and procedures that has occurred in hip arthroscopy over the past decade. Stringent patient selection has resulted in fewer hip arthroscopies in arthritic patients. Intraoperatively, the transition from labral debridement to repair and reconstruction reflects a greater biomechanical understanding of the hip and the novel procedures that have emerged. Growing awareness of hip micro instability has led to increased appreciation for the importance of restoring capsular anatomy. These changes have resulted in superior PROs and lower revision rates and conversion to THA.
EP17.20 Outcomes for open and arthroscopic rectus femoris ossification excision short term results and treatment algorithm

Dr Filippo Randelli, Dr Daniele Priano, Dr Mauro Magnani, Dr Fabrizio Pace, Drss Sara Favilla, Dr Alberto Fioruzzi, Drss Daniela Maglione

1Irccs Policlinico San Donato, San Donato Milanese, Italy

Introduction
Heterotopic ossifications of the rectus femoris are a rare cause of extraarticular hip impingement. This work aims to present the short-term results of arthroscopic and open surgery excision of rectus femoris ossifications and to propose a treatment flowchart.

Materials and methods
Ten patients who underwent excision of ossifications of the rectus femoris were retrospectively studied. Five patients underwent arthroscopic surgery while the other five underwent open surgery. The differences were analysed with a t-test for paired samples between the preoperative and the last follow-up in the UCLA Activity score and the Hip Disability and Osteoarthritis Outcome Score (HOOS) in the validated Italian versions.

Results
All patients were male with a mean age of 35.2 years (range 15-51), mean follow-up was 47.7 months (range 10-105). All patients had an excellent functional recovery with complete recovery and complete recovery of range of motion. The mean values of the UCLA Activity score went from 4.4 to 8.2 (p = 0.024) while the HOOS values from 71 in the preoperative to 91 in the postoperative period (p = 0.015). No complications occurred, and no recurrence of the disease was observed. We did not show statistically significant differences in the results obtained with arthroscopic resection compared to open surgery.

Discussion
Both solutions have shown excellent results in terms of functional outcome of the patient, but a correct preoperative study is essential to provide the right indication and propose the correct surgical resection technique.

Conclusions
The proposed flow chart of treatment allows providing the correct surgical indication obtaining excellent results in the absence of recurrences.
Localized contact pressure on the femoral head increases due to inversion of the acetabular labrum: A biomechanical study

Dr Kiyokazu Fukui1, Dr Xipeng Wang2, Dr Ayumi Kaneuji1, Dr Norio Kawahara1
1Kanazawa Medical University, Uchinada-machi, Kahoku-gun, Japan, 2The Second Affiliated Hospital Nantong University, Nantong, China

Introduction
Although studies suggest that subchondral insufficiency fracture (SIF) of the femoral head may cause rapidly progressive osteoarthritis of the hip (RPOA), the mechanism of that relationship remains unclear. Our biomechanical study aimed to provide more data in this area by quantifying pressure distribution on the femoral head for normal and inverted hips and by determining the effects of labral inversion on pressure distribution across the joint, focusing on types of fracture under load.

Methods
We used mid-size fourth-generation composite femurs with a solid cancellous bone density of 0.13g/cm3. Specimens were fixed in a tensile testing machine with a custom steel jig and were aligned to 15° of adduction in the coronal plane. We then loaded the specimens to failure at a displacement-controlled rate of 1 mm/min and observed fracture patterns. Additionally, single loads (3000 N) were applied using Prescale film (Fujifilm Corp., Tokyo, Japan) to investigate pressure distribution on the femoral head, with or without silicone rubber representing entrapment of an inverted acetabular labrum between a spherical metallic platen and composite femoral head. We measured mean pressure on the area of silicone rubber in the normal, 10×5 mm and 10×20 mm specimens.

Results
In all 8 specimens without silicone rubber, fractures occurred in the posterior femoral neck. However, fractures occurred in the anterior femoral head in all 8 specimens with 10×5 mm silicone rubber. In tests using a load of 3000 N, we found that the presence or absence of silicone rubber resulted in considerable difference in stress values and stress distribution on the surface of the femoral head. In the presence of the 10×5 mm silicone rubber, mean pressure was 11.09 MPa, approximately 5.7-fold higher than in the absence of the silicone rubber in the normal samples (1.94 MPa).

Clinical relevance
Our results suggest that presence of an inverted acetabular labrum could be an important factor in the development of subchondral fractures. Such fractures, in turn, contribute greatly to the path mechanism of RPOA. If procedures can be devised for the early detection and treatment of inversion of the acetabular labrum arthroscopically, it may be possible to prevent RPOA.
EP17.22 Femoro-acetabular impingement in femoral neck stress fractures

Dr Esteban Javier Garces Burbano, Dr María José Del Pozo Zuñiga
1Military Hospital HE1 Orthopaedics and Traumatology Department, QUITO, Ecuador

Introduction

Femoroacetabular impingement is an anatomical alteration. This impact between the acetabular rim and femoral neck causes injuries in acetabular area and femoral neck which leads to impact cyst formation.

Femoral neck stress fractures are an uncommon fracture which accounts to 8% of neck fractures. They are related to high impact physical activity, which is the main reason this injury is common to athletes and military personnel.

In this study, we tried to establish a direct relationship between femoral neck stress fractures and the presence of femoro-acetabular impingement in a group of military aspirants, where they are forced the most in training.

Materials and methods

Twelve stress fractures were evaluated in a five years period, between August 2011 and August 2017. Five of the participants were men and seven of those women. Mean age was 22.5 years (19-29). Metabolic, endocrine and nutritional problems were ruled out. In two cases fractures were bilateral. In all of the patients studied X Rays and CT scans were performed.

Results

In X Ray analysis, an extrusion index was elevated and coxa profunda was seen in 92% of cases. Cross over sign was present in 67% of cases. X Ray evaluation of femoral neck and head showed a CAM type deformity in 83% and offset sign in 92% of cases. In CT scan, acetabular anteversion less than 15 degrees was 42% and femoral anteversion higher than 21 degrees was 33%.

Conclusions

It is shown that most of patients that had femoral neck stress fractures also had altered radiological measurements compatible to those who have femoro-acetabular impingement.
EP17.24 An understanding of patient factors and hip arthroscopy intraoperative findings in patients with self-reported trouble with sexual activity

Dr Misty Suri, Dr Brian Godshaw¹, Mr Arjun Verma¹
¹Ochsner Sports Medicine Institute, New Orleans, United States

Biography
Brian Godshaw is an orthopaedic resident at the Ochsner Clinic Foundation who will complete his residency training in July 2020. Afterwards he will begin a sports medicine fellowship.

Background
Patient reported sexual limitations due to hip pain is becoming an interesting reality for orthopaedic surgeon performing hip arthroscopy. The goal of this retrospective study was to determine the potential relationship of patient reported sexual function and hip arthroscopy by measuring the occurrence of perioperative surgical and clinical findings.

Methods
Our entire hip patient database (N=3378) was filtered to include only patients who scored ≤ 40 on question nine on the International Hip Outcomes Tool (iHOT) hip scale. 370 patient entries (327 patients) were retrospectively evaluated to determine the presence of risk factors to elucidate the relationship of hip sex dysfunction and arthroscopy. Patients were organized in pre and post-operative groups measured against demographics, benchmarks including the Modified Harris Hip score (MHH), Short 12 forms and intraoperative findings.

Results
The analysis found that our patient population had significant associations with Age (P=.0399), Chondromalacia Size Area (P=.0003), Female Sex (P=.0262), Bursal Work (P=.0196), Psoas Tenotomy (P=.0005), and Total Hip Arthroplasty (P=.0255). In addition, we found significant associations in several iHOT and HH questions pertaining actions requiring hip flexion but not the overall scores.

Conclusion
As the indications for hip arthroscopy rapidly continue to expand. The need for better understanding of the risk factors, treatment indications, and surgical procedures for patient experiencing hip pain during sexual intercourse will become more of a focus. Our results that several areas of treatment and range of motions issue should be explored moving forward.

Level of Evidence
Retrospective chart review level IV
Dr. Takashi Hirase, Mr. Jason Mallett, Ms. Lindsay Barter, Mr. David Dong, Dr. Patrick McCulloch, Dr. Joshua Harris

1Houston Methodist Hospital, Houston, United States

Biography
Dr. Joshua Harris is an orthopaedic surgeon who specializes in sports medicine and arthroscopy. Dr. Harris obtained his undergraduate degree from Wright State University in Dayton, Ohio, and he completed both his medical degree and orthopaedic residency at Ohio State University College of Medicine in Columbus. He then completed a fellowship in sports medicine at Rush Medical Centre in Chicago where he was assistant team physician for the Chicago Bulls, White Sox, and DePaul University. Dr. Harris’ special interests include sports-related injuries including hip arthroscopy, patellofemoral disorders, multiligamentous knee injuries, knee joint preservation, and platelet-rich plasma (PRP).

Purpose
To perform a systematic review of biomechanical and clinical studies to determine if the iliopsoas muscle is a true femoral head stabilizer.

Methods
A systematic review was conducted in February 2019 using PubMed, Ovid MEDLINE, and SCOPUS. Inclusion criteria were studies published in the English language, human and cadaveric studies on the biomechanics of the iliopsoas muscle in relation to the hip, and levels I-IV clinical outcomes studies of procedures involving the iliopsoas muscle. Study methodological quality for clinical outcomes studies were analysed using the Modified Coleman Methodology Score (MCMS).

Results
Six articles met inclusion criteria. Three biomechanical (35 cadavers and 18 healthy subjects) and 3 clinical outcomes studies (535 subjects, 206 iliopsoas tenotomies) were included in analysis. Two biomedical studies utilized EMG readings on the hip flexor muscles on healthy human subjects to illustrate the role of the iliopsoas as a hip stabilizer in the frontal plane. Similarly, use of tension loading on the psoas muscle in human cadavers identified the psoas muscle as a femoral head stabilizer at 0 degrees to 15 degrees of hip flexion. All clinical outcomes studies investigated the effect of femoral version on the outcomes of primary hip arthroscopy. Patients with increased femoral version had a significantly higher rate of “need” for iliopsoas tenotomy (p = 0.005), as well as a significantly lower modified Harris Hip Score (mHHS) post-operatively (p = 0.031. One study found that femoral version did not significantly affect post-operative outcomes nor the need for iliopsoas tenotomy.

Conclusions
Evidence from biomechanical and clinical studies strongly suggest that the iliopsoas muscle is a dynamic anterior femoral head stabilizer. Further biomechanical studies are necessary to determine the exact magnitude of stability provided by the iliopsoas.
EP17.26 Comparing different hip physical examination methods on the diagnosis of labral tear

Kourosh Kalachi, Dr Farshad Adib
1University of Maryland School of Medicine, Baltimore, United States

Biography
Farshad Adib, MD, is an Assistant Professor of Orthopaedics at the University of Maryland School of Medicine. He specializes in sports medicine and total joint care. His focus is on the care of pediatric and adult patients with hip and knee disorders.

Dr Adib serves as the Medical Director at the Across the Bridge 10K Chesapeake Bay Run and was a Finish Line Physician for the Boston Marathon in 2013, 2014, 2015, and 2016. He is the author of several peer-reviewed scientific articles and book chapters on the topics of hip arthroscopy and other hip and knee surgeries. In addition, he has presented his research at national and international conferences.

Introduction
Although the Magnetic Resonance Angiogram (MRA) is considered the gold standard for hip labral tears, accurate physical examination remains an essential component due to the cost constraints and invasive nature of MRA. We developed the “Twist Test” as a quick and easy test to administer with the patient in the functional, weight bearing position. The purpose of this study was to compare the effectiveness of the McCarthy, Impingement, and Twist tests alone, then in combination with each other in correctly predicting labral tears in a cohort of patients.

Methods
A series of 292 patients were seen in our office for chief complaint of anterior hip pain (inclusion criteria). 288 had MRA of the affected hip. 109 with CAM lesions. 79 with PINCER lesions. Average patient age was 37.66 years. Physical examination results were recorded and compared to MRA results. Diagnostic values were calculated using a 2 x 2 table for sensitivity, specificity, PPV, and NPV. Significance set at P < 0.05.

Results
We found the McCarthy Test was the most sensitive at 93 percent. The Twist Test was the most specific at 72 percent with the highest PPV at 97 percent. A combination of the McCarthy Test and Twist Test was more sensitive (93 percent) than the Twist Test alone (69 percent), and with a higher PPV (96 percent) than the McCarthy Test alone (95 percent). A combination of the McCarthy Test and Impingement Test was more sensitive and accurate than the Impingement test alone.

Discussion
The diagnosis of labral tears is difficult. The Twist Test can be added to improve with this diagnosis. Our results show that a combination of physical exams along with a core knowledge of patient history, X-ray, and advanced imaging studies will lead to more accurate diagnoses and better patient outcomes.
EP17.27 Accuracy of magnetic resonance imaging measurement of labral width compared to intra-operative assessment  
Dr Daniel Kaplan1, Dr Mohammad Samim1, Dr Christopher Burke1, Dr Robert Meislin1, Dr Thomas Youm1  
1New York University Langone Medical Centre, New York, United States  

Purpose  
Magnetic resonance imaging (MRI) modalities are currently the diagnostic gold standard for hip labrum pre-operative evaluation, though no study has validated it as a tool to measure labrum width. Accurate labral measurement pre-operatively could assist in surgical decision-making and potentially be a predictor of future outcome.

Methods  
Consecutively enrolled patients between the ages of 18-65 indicated for hip arthroscopy for femoracetabular impingement were included between 12/2017-06/2018. Intra-operative labral measurements were taken at standardized locations using an established acetabular “clockface” paradigm. Measurement was performed utilizing a calibrated probe. MRI measurements were taken by two blinded musculoskeletal fellowship-trained radiologists at the same positions using either a 1.5T or 3T MRI or 3T MRA. The study was double-blinded. Intraoperative and radiographic labral width measurements were compared using an intraclass correlation coefficients (ICC), absolute-agreement, and two-way random effects model. The two radiologists’ measurements were compared for interrater reliability using the same ICC model.

Results  
Fifty-one patients were included (30 females, 26 right hips). Average labrum width at the 3, 11:30, and 1:30 o’clock positions by arthroscopic measurement were 5.8 mm (+/-1.4), 6.3 mm (+/-1.5) and 6.0 mm (+/-1.5), and by MRI were 6.3 mm (+/-1.5), 6.7 mm (+/-1.4), and 6.1 mm (+/-1.6), respectively. All ICC agreements were good to excellent both between surgeon and radiologist (0.63-0.89), as well as between radiologists (0.68-0.98), regardless of modality. ICC values were not significantly different between MRI and MRA, or between 1.5T, 3T MRI and MRA subgroupings. P-values for ICC values were significant for all agreement assessments.

Conclusion  
This study found strong agreement between radiologic and arthroscopic measurement of labrum width when using MRI, suggesting MRI is an accurate way to measure labral width. There was not a significant difference between different MRI modalities. Accurately measuring labral width preoperatively with MRI may aid in surgical decision making.
EP17.28 MRI assessment of sub spine impingement: Features beyond the anterior inferior iliac spine
Dr Mohammad Samim¹, Dr William Walter¹, Dr Soterios Gyftopoulos¹, Dr Lazaros Poultsides¹, Dr Thomas Youm¹
¹New York University Langone Medical Centre, New York City, United States

Biography
Dr Thomas Youm is a board-certified Orthopaedic surgeon that completed his residency at NYU Hospital for Joint diseases, before completing a sports fellowship at Kerlan-Jobe Orthopaedic Clinic in Los Angeles, California.

Purpose
To assess the MRI findings associated with sub spine impingement (SSI) including the osseous morphology of the anterior inferior iliac spine (AIIS) and femoral cam and associated soft tissue injuries.

Materials and Methods
We performed a retrospective study of symptomatic patients who underwent arthroscopic treatment for femoroacetabular impingement (FAI) between December 2014 and March 2017. The SSI group included patients with clinical and intraoperative findings of SSI and remaining of the patients made the non-SSI group. The inclusion criteria consisted of clinical and imaging diagnosis of FAI, arthroscopic treatment for FAI, and preoperative MRI within 6 months prior to surgery. Preoperative MRI was assessed by two radiologists independently and blinded to clinical information for AIIS morphology, presence of distal cam (defined as bump more distal to the head neck junction), signs of impingent on the distal femoral neck (IDFN) including sclerosis, edema, or cystic changes of the femoral neck and femoral neck synovial edema, edema of the superior capsule and rectus femoris tendon at the AIIS level, and presence and location of chondrolabral lesions. The inter-reader agreement was also assessed.

Results
Total of 62 patients with FAI met the inclusion criteria. 20 patients out of 62 (32%) were diagnosed with SSI. The mean time difference between the MRI and arthroscopy was 4.1 ± 1.8 months. Distal cam was present in 78% of patients with SSI and in 19% of patients with non-SSI (p<0.001). We found no significant difference in AIIS morphology variants between the two groups. There was statistically significant difference in presence of IDFN between SSI (77%) and non-SSI (18%) groups respectively (p<0.001). Superior capsular edema was present in 80% in SSI and 29% in non-SSI group (p<0.05). No significant difference was between two groups regarding rectus femoris tendon edema and presence or location of chondrolabral lesions. There was substantial agreement between readers for detecting distal cam (kappa=0.80) and anterior chondral lesions (kappa=0.62), and moderate agreement for IDFN, anterior labral and superior chondral lesions.

Conclusion
Our study showed osseous findings, other than AIIS morphology, and soft tissue injuries which can be used to improve the accuracy of SSI diagnosis.
**Purpose**
To evaluate differences in short term complications in patients treated with open arthrotomy or arthroscopy for native hip septic arthritis (SA). We hypothesize that there is no difference in short term perioperative complications between patients treated with arthroscopy and arthrotomy.

**Methods**
Patients who underwent hip arthrotomy or arthroscopy between 2007 and 2017q1 were queried in the Humana insurance database, using relevant Current Procedural Terminology (CPT) and International Classification of Diseases, Ninth and Tenth Revision (ICD-9/10) codes. Basic demographics and various 30-day perioperative complications, including return to operating room (ROR) were compared between the two cohorts. Multivariate analysis was performed for ROR within 30 days following arthroscopy and arthrotomy.

**Results**
We identified 421 patients with SA of the native hip, of which 387 (91.9%) and 34 (8.1%) were treated with open arthrotomy and arthroscopy, respectively. There were no significant differences in demographic variables between groups. On univariate analysis, the incidence of total adverse events (Arthrotomy: 75.7% vs Arthroscopy: 52.94%, P = 0.0038) was significantly higher in the open arthrotomy cohort. Multivariate analysis identified preoperative systemic infection (Odds Ratio [OR]: 1.90, 95% Confidence Interval [CI]: 1.25-2.89, P =0.0026) as a significant risk factor for ROR within 30 days after surgery. Neither arthrotomy (OR: 4.93, 95% CI: 0.42-115.2, P = 0.2174) nor arthroscopy (OR: 3.55, 95% CI: 0.33-78.01, P= 0.3077) were significant risk factors to ROR within 30 days.

**Conclusions**
Patients with SA of the hip had similar short-term complication rates and return to operating room regardless of open arthrotomy or arthroscopic management. This suggests that arthroscopic management is a safe alternative for the treatment of SA of the hip with potentially limited morbidity.
EP17.30 Risk factors and rate of prolonged opioid consumption after hip arthroscopy in opioid naïve patients

Zain Khazi1, Dr Alan Shamrock1, Dr Kyle Duchman1, Dr Robert Westermann1

1University Of Iowa Hospitals and Clinics, Iowa City, United States

Purpose
To determine (1) the rate of postoperative opioid use, and (2) risk factors for prolonged opioid consumption among opioid naïve patients undergoing hip arthroscopy.

Methods
Patients that underwent primary HA between 2007 and 2017q1 were identified within the Humana Inc. administrative claims database using relevant Current Procedural Terminology (CPT) codes. Patients with prior total hip and hemiarthroplasty, and history of septic arthritis of the hip were excluded. Patients with subsequent ipsilateral or contralateral hip arthroscopy within 1-year of index surgery were also excluded. Subsequently, patients were categorized as opioid naïve if they did not fill opioid prescriptions during the 6 months prior to the index surgery. In this cohort, rates of postoperative opioid utilization were longitudinally tracked for 12 months, and prolonged opioid use was defined as opioid utilization at ≥3 months following HA. Preoperative tramadol use was not used to screen opioid naïve patients but was included as an independent study variable. Multivariate logistic regression models were used to identify risk factors associated with prolonged opioid use at 3, 6, 9, and 12 months postoperatively.

Results
In total, 1,274 opioid naïve patients that underwent hip arthroscopy met our inclusion criteria. Rates of postoperative opioid use declined precipitously after the first postoperative month, with only 5% and 3.3% of patients using opioids at 3 and 12 months, respectively. The most significant risk factor for prolonged opioid use was preoperative tramadol use (Odds Ratio [OR]: 1.97, 95% CI: 1.01-3.87, p=.0486) at 3 months, obesity (OR: 2.55, 95% CI: 1.1-5.95, p=.0298) at 6 months, tobacco use (OR: 2.95, 95% CI: 1.13-7.7, p=.0275) at 9 months, and high Charlson Comorbidity Index (OR: 1.38, 95% CI: 1.13-1.70, p=.0018) at 12 months following index surgery.

Conclusion
Among opioid naïve patients, prolonged opioid use after hip arthroscopy was low, however, preoperative tramadol use, obesity, tobacco use, and high Charlson Comorbidity Index were independently associated with prolonged opioid use following hip arthroscopy.
EP17.31 Multi-centre analysis of changes in patient satisfaction and self-reported functional outcomes between year-1 and year-2 following hip preservation surgery

Dr Benjamin Kivlan¹, Dr Rob Roy Martin², Dr John Christoforetti², Dr Andrew Wolff³, Dr John Salvo⁵, Dr Shane Nho⁴, Dr Dean Matsuda⁶, Dr Geoff Van Thiel⁴, Dr Dominic Carreira⁷

¹Duquesne University, Pittsburgh, USA, ²Texas Health Sports Medicine, Allen, USA, ³Washington Orthopaedics and Sports Medicine, Washington, USA, ⁴Rush University Medical Centre, Chicago, USA, ⁵Rothman Institute, Philadelphia, USA, ⁶DISC Sports and Spine Centre, Marina del Rey, USA, ⁷Peachtree Orthopaedics, Atlanta, USA

Biography
Dr Kivlan is a graduate of Elon College's Exercise/Sport Science Program, the University of Pittsburgh's Physical Therapy Program, and completed his PhD studies in Rehabilitation Science at Duquesne University. Dr Kivlan serves on the faculty of the Physical Therapy Department at Duquesne University as an assistant professor of Human Anatomy and Orthopaedic Science. Dr Kivlan has published over 20 peer reviewed journal articles and several book chapters on the topic of musculo-skeletal anatomy, functional performance testing, and post-operative rehabilitation and outcomes of the hip joint. Dr Kivlan is also recognized as a Board-Certified Specialist in Sports and Orthopaedic Physical and enjoys treating patients with various sports and orthopaedic injuries.

Purpose
The purpose of this study was to compare patient reported outcomes of pain, function, and satisfaction at 1-year and 2-years following hip preservation surgery.

Subjects
A cohort of 467 patients (61% female) from a multi-centred hip arthroscopy registry were analysed for the purpose of this study. Subjects ranged from 18-72 years of age, averaged 161 pounds and were 67 inches tall. Surgical procedures included 183 (39.2%) chondroplasties, 13 (2.8%) acetabular microfractures, acetabuloplasties, 180 (38.5%), 81 (17.3%) femoral chondroplasties, 261 (55.9%) femoroplasties, 259 (55.5%) synovectomies, 233 (49.9%) labral repairs, 65 (8.1%) labral reconstructions, and 19 (4.1%) labral debridement’s.

Methods
De-identified patient data from a multi-centred hip arthroscopy registry was analysed. Paired T-tests with an a priori alpha set at 0.05 determined if a significant change occurred for the International Hip Outcome Tool-12 (iHOT-12) and Visual Analog Scale (0-100) for patient satisfaction at 1-year versus 2-years post hip preservation surgery. The frequency of patients that surpassed the Patient Acceptable Symptomatic State (PASS) for the iHOT-12 (>74) were also reported and compared at 1-year and 2-years after hip preservation surgery.

Results
The 1-year functional outcomes for the iHOT-12 averaged 69.7 (SD=25.4), with 52.2.% of patients exceeding the PASS cut-off score (>74) for the iHOT-12. At the 2-year follow-up, 55.9% of subjects reached the PASS score for the iHOT-12 with an average score of 71.5 (SD=25.0) with no statistical difference to the 1-year follow-up scores (p=0.056). Patients reported 77.8% (SD=27.9) 1-year satisfaction with their hip preservation surgery which increased to 80.1% satisfaction (SD=26.5%) at 2-year follow-up (p=0.05). 43 subjects reached PASS at 1 year but did not reach PASS at 2 year. Conversely, 60 subjects did not achieve PASS at 1 year, but surpassed the PASS score at 2-year follow-up.
Conclusions
Patients commonly reach a high level of satisfaction and function at 1-year after surgery which is maintained at follow-up at 2-years post-operatively. Surgeons and clinicians may advise patients that their level of satisfaction and functional outcome following hip arthroscopy is likely to be maximized by 1-year after surgery and remain relatively stable up to 2 years after hip preservation surgery.
EP17.32 Adverse correlations between alpha angle and signal intensity of subchondral bone on 3-dimensional magnetic resonance imaging for the evaluation of cam morphology

Associate Professor Naomi Kobayashi1, Dr Yohei Yukisawa1, Dr Takayuki Oishi1, Dr Shu Takagawa1, Dr Shota Higashihiira2, Dr Yuichi Mochida1, Professor Yutaka Inaba2

1Yokohama City University Medical Centre, Urahune-cho, Minimi-ku, Yokohama, Japan, 2Yokohama City University, Fukuura, Kanazawa-ku, Yokohama, Japan

Biography

Present position (2019): Director of department of Orthopaedic surgery, Yokohama City University Medical Centre

2010-2019: Lecture, Yokohama City University
2006-2010: Assistant professor, Yokohama City University
2003-2006: Research fellow in Cleveland Clinic Foundation
1999-2003: Postgraduate school of medicine, Yokohama City University
1997-1999: Clinical resident in Fujisawa City Hospital
1991-1997: Yamagata University, school of medicine

Special qualification: Japanese Hip Society approved hip arthroscopic surgeon

Particular field of research: Computer simulation analysis of FAI, Imaging analysis of FAI, Computer navigation hip arthroscopy

Background

Recent studies revealed a close relationship between mechanical stress and subchondral bone pathology. MRI findings have a role in understanding the implications of such bone pathology. In this study, we aimed to reveal the difference of signal intensity of MRI at cam lesion between femoracetabular impingement (FAI) and borderline developmental dysplastic hip (BDDH). Our hypothesis is that there may be some positive or negative correlation between radial alpha angle and signal intensity at cam lesion, enhancing the status of subchondral bone.

Patients and Methods

A total of 42 hips from 39 patients were analysed, including 22 FAI and 20 BDDH. Radial images were reconstructed from 3-D multiple-echo recombined gradient-echo (MERGE) MRI. The radial alpha angle and signal intensity of MERGE MRI were measured in plane at 0° (anterior, 9 o'clock position), 15°, 40°, 65°, and 90°. Correlation between maximum alpha angle and signal intensity on MRI were investigated, including subdivisions according to age and gender.

Results

In patients aged 30 years or less (younger age group), a weak negative correlation between the alpha angle and signal intensity on radial MRI was found (r = −0.36, p = 0.021). To the contrary, in those patients aged 50 years or more (older age group), a weak positive correlation between the alpha angle and signal intensity on radial MRI was found (r = 0.33, p = 0.008). These correlations were more prominent in younger-age male FAI patients (r = −0.48, p = 0.034) and older-age female BDDH patients (r = 0.60, p = 0.0064). The average signal intensity ratio in the older age group was significantly higher than in the younger age group (p < 0.001).

Discussion and conclusion

A negative correlation was found between radial alpha angle and signal intensity of subchondral bone in cam lesion on MRI in the younger age group, particularly in male FAI subjects, whereas a positive correlation was found in the older age group, particularly in female BDDH subjects. This difference of signal intensity
property probably reflects the difference of subchondral bone status due to mechanical stress in the cam lesion between FAI and BDDH.
EP17.34 Endoscopic management of proximal rectus femoris avulsion injury

Dr Robert Kollmorgen\textsuperscript{1}, Dr Eduardo Salazar\textsuperscript{1}
\textsuperscript{1}University Of California San Francisco Fresno, Fresno, United States

Introduction
Proximal rectus femoris avulsions (PRFA) are uncommon injuries most often seen in sprinting and kicking athletes during forceful eccentric muscle action. In the sports medicine and hip preservation literature, PRFA are uncommonly reported injuries with only a few case reports and series. Conventional treatment ranges from reported success with nonoperative management and surgical treatment with open techniques. Currently, there are no reported cases of endoscopic repair of these rare injuries. Methods: A systematic review of available literature was performed according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA). The systematic review was registered in the PROSPERO. Search was completed using the MEDLINE and Cochrane databases. Diagnosis included: subtotal and total avulsions of the origin of the rectus femoris muscle. Intraoperative and postoperative complications recorded were also reported. Descriptive statistics were calculated. Individual subject data was used when reported. All information was extracted directly from the studies.

Case report
We present a 29-year-old female nurse who presented with right hip pain 6 weeks after a jet-skiing injury. Hip arthroscopy was performed in the supine position utilizing post less distraction. Briefly, the patient was placed in the supine position on a Hana table utilizing the pink pad positioning device. Labrum was repaired as well as rectus avulsion. Results of Review: The independent searches yielded 11 articles that met inclusion criteria after review of abstracts. This yielded 63 patients and 64 proximal rectus femoris injuries. 1 patient had bilateral injuries. 52 (81\%) of the reported injuries were treated operatively, and 12 (19\%) of the reported injuries were treated non-operatively. All were treated with open techniques. 33 injuries (51\% of the overall series, 63\% of injuries treated operatively) were treated with suture anchor repair to the origin, 10 (16\% of the overall series, 19\% of injuries treated operatively) were treated with excision of the injured tendon stump, and 7 (11\% of the overall series, 13\% of injuries treated operatively) were treated with direct suture repair. Complications included wound and lateral femoral cutaneous nerve injury.

Conclusion
We report on the only known case of PRFA treated endoscopically.
Arthroscopic treatment of intra-articular hip tumours

Dr Fernando Leal, Dr Jorge Cruz de Melo, Enf Manuel Padin, Dr Tiago Pato

Porto Hip Unit, Porto, Portugal

Introduction
Intracapsular benign tumours of the hip are a particularly rare entity. Due to the complex hip anatomy and approaches, an open procedure is usually associated with some sequelae. To overcome this, hip arthroscopy as evolved and has shown great promise as a valid technique, with at least the same results as an open procedure, without its morbidity. This work aims to show the feasibility, surgical technique and key points in the approach and treatment of these tumours by hip arthroscopy.

Material and Methods
A retrospective, transverse study was conducted regarding hip arthroscopy for the treatment of patients with a diagnosed intracapsular benign tumour between January 2014 and December 2017. All patients were treated by the same surgeon and were submitted to VAS, WOMAC and subjective satisfaction scores. Hip arthroscopy was conducted by a trans capsular approach in dorsal decubitus and a traction table.

Results
Five patients were included in this study: 3 female and 2 males, with a mean age of 33y (19 - 57y). Mean time of symptoms was 1.5y (2m – 7y). Three cases were diagnosed with an osteochondroma, one case with an enchondroma and the last one with a villonodular synovitis. VAS improved from a mean 6.9 (6 - 10) to 0.7 (0 - 2), and WOMAC score from a mean 46.4 (37.3 - 81.8) to 84.8 (76.3 - 100). Subjectively, 3 patients were very satisfied, 2 satisfied.

Discussion/Conclusion
Hip arthroscopy is a valid alternative to the classic open procedures, allowing the surgical resection of the intracapsular tumours and treatment of concomitant hip pathology, while being minimally invasive, and thus providing less morbidity and greater patient satisfaction.
EP17.36 Iliopsoas tenotomy in patients undergoing hip arthroscopy: clinical outcomes at 4 years follow-up

MD, PhD Mattia Loppini, Md Francesco La Camera, MD Rocco Cannata, MD Carmine Fabio Bruno, Professor Guido Grappiolo, MD Federico Della Rocca

1 Humanitas Clinical and Research Centre, Rozzano, Italy; 2 Humanitas University, Pieve Emanuele, Italy, 3 Università “Magna Graecia” di Catanzaro, Catanzaro, 3

Biography
Clinical research to improve the current techniques and to develop innovative techniques in replacement and arthroscopic surgery of the hip and knee joints; to improve the outcome of patients undergoing hip and knee replacement surgery; to develop innovative techniques to improve the position of prosthetic components in hip and knee replacement; to develop protocols for rapid post-operative recovery (“fast track” in replacement surgery); to improve the diagnostic-therapeutic approach for periprosthetic infections.

Clinical research to improve the current surgical techniques and to develop innovative surgical techniques and to improve the outcome of patients undergoing surgery for the management of tendinopathies, tendon rupture, ligament and muscular injuries; to develop score systems for sport injury prevention and rehabilitation protocols.

Objectives
To evaluate the mid-term clinical outcomes of patients undergoing iliopsoas tenotomy in hip arthroscopy.

Methods
In this retrospective study, we included patients undergoing partial intracapsular tenotomy of iliopsoas alone or in association with correction of the femoro-acetabular impingement (FAI) in the period 2012-2015. Clinical evaluation was performed using modified Harris Hip Score (mHHS) and Hip Disability and Osteoarthritis Outcome Score (HOOS) preoperatively, 1 month after surgery and at the last available follow-up.

Results
20 patients (M:F=6:14) were included with an average age of 34 years (25-44). In all patients there was impingement of iliopsoas with the acetabular labrum. The partial intracapsular tenotomy of iliopsoas was performed as the only procedure in 6 patients and was associated with correction of FAI in 14. The mean follow-up was 4.4 years (3-6). The mean value of mHHS increased from 63.7±5.9 to 88.3±6.2 at the last control (<0.001), while the mean value of HOOS increased from 71.5±7.2 to 86.7±5.9 (<0.001). The satisfaction after surgery was very good in 8 patients, good in 11, poor in 1. No patient underwent arthroscopic revision.

Conclusions
In patients with impingement of iliopsoas with or without FAI, the partial intracapsular tenotomy of iliopsoas provides good clinical results in the mid-term follow-up.
Arthroscopic reduction and internal fixation of femoral neck fracture: Technical note

Dr Jeong-Kil Lee\textsuperscript{1}, Dr Jung-Mo Hwang\textsuperscript{1}, Dr Deuk-Soo Hwang\textsuperscript{1}, Dr Young-Cheol Park\textsuperscript{1}

\textsuperscript{1}Chungnam National University School of Medicine, Daejeon, South Korea

**Biography**

I have trained by expert hip arthroscopic surgeon, Deuk-Soo Hwang. Femoral neck fractures of the hip are common and are usually treated by closed reduction or open reduction technique. Hip arthroscopy can be a valuable treatment option for the management of femoral neck fractures. Arthroscopy allows for a less invasive option when compared with open reduction technique and can allow removal of interposed soft tissue in the fracture gap. Also, arthroscopy allows stimulation of bone healing by bone grafting at the fracture site and faster recovery with minimal soft-tissue injury. There are many techniques for closed reduction, we describe an arthroscopic reduction and internal fixation of femoral neck fractures with a detailed stepwise description of the surgical technique, including technical pearls and pitfalls, potential complications, and advantages and disadvantages. We believe arthroscopic guided technique for femoral neck fracture is easy, reproducible and successful in achieving good anatomical reduction.
Clinical observation of arthroscopic surgery for posterior dislocation of hip with labral tears

Dr Chunbao Li1, Dr Chenhui Dong2, Dr Chao Shi3, Dr Zhigang Wang1, Dr Yujie Liu1, Dr Zhongli Li1

1The Sport Medicine Centre of orthopaedics department of the Chinese PLA General Hospital (301 hospital), Beijing, China, 2Sports medicine department of the 940th hospital of the Chinese PLA Joint Logistics Support Force, Beijing, China, 3Qitai County Hospital, Qitai Town, China

Methods
The clinical effects of arthroscopic treatment of 3 patients with posterior dislocation of hip with labral tears treated in the orthopaedics department of the Chinese PLA general hospital from May 2016 to December 2018 were analysed retrospectively. The degree of intraarticular cartilage and labral injury was evaluated according to imaging examination and hip arthroscopic surgery was performed at selected time. The patients were followed up preoperatively, half a year after operation and 1 year after operation, respectively. Pain score (VAS), modified Harris Hip Score (mHHS) and patient satisfaction were used to evaluate the clinical efficacy. The mean follow-up time was 26.67 ±2.52 (24-29 months).

Results
The mHHS scores were 44.33 ±7.09, 86.34 ±8.38, 91.34 ±5.51 ±1.53, 3.66 ±1.52, 2.5 ±1.9 before operation, half a year after operation and 1 year after operation, respectively. There was no significant difference in mHHS, VAS scores and patient satisfaction between 6 months and 1 year after surgery (p=0.244).

Conclusion
Hip arthroscopic surgery for the treatment of posterior dislocation of hip with labral tears, especially for patients with the formation of loose body in the articular cavity, has a significant advantage over traditional open surgery. It can effectively relieve symptoms and maximize the recovery of hip joint function.
EP17.40 The clinical efficacy of arthroscopy application in hip brucella septic arthritis treatment and outcome follow-up

Dr Dong Chenhui1, Dr Chunbao Li1
1The Sport Medicine Centre of orthopaedics department of the Chinese PLA General Hospital (301 hospital), Beijing, China

Objective
To retrospectively analyse the efficacy of arthroscopic minimally invasive treatment of patients underwent the hip brucella septic arthritis.

Methods
From February 2015 to December 2018, all patients diagnosed with the hip brucella septic arthritis who underwent arthroscopic lavage with continuous irrigation or open arthrotomy with continuous irrigation were included. Data were collected regarding the surgical outcomes, degree of postoperative pain (assessed via the visual analogue scale (VAS)), hospitalization duration, and modified Harris hip score at 6, 12, and 24 months postoperatively.

Results
All 8 patients were followed up for an average of 27.4±4.6 months. The age ranged from 12 to 53 years. Among them, 6 patients were cured by hip arthroscopy combined with 6 weeks of drug therapy. The unhealed patients continued to extend to 3 months after 2 months. Get a cure. At the last follow-up, the patient’s generalized hypothermia disappeared, local pain disappeared or significantly reduced, and ESR and CRP decreased to normal. The preoperative mHHS score was 48.25±8.87, and the preoperative VAS score was 5.63±1.06. The 1-year postoperative mHHS score was 82±11.42; the postoperative 1-year VAS score was 2.13±1.24, and the 1-year postoperative patient satisfaction was 7.3±1.3. The 2-year mHHS score was 87.75±6.79, the VAS score was 1.25±0.71, and the patient satisfaction was 8.38±0.92.

Conclusion
Early surgical intervention with hip arthroscopy is recommended to prevent further joint destruction. Arthroscopic surgery for the treatment of brucella septic arthritis of the hip could achieve satisfactory results.
Abductor muscles increase hip stability against rotational and distractive forces: A quantitative study

Daniel Lim¹, Lionel Lazaro¹, Trevor Nelson², Samuel Eberlein², Michael Banffy¹, Melodie Metzger²

¹Kerlan-Jobe Institute, Cedars-Sinai, Los Angeles, United States, ²Cedars-Sinai, Los Angeles, United States

Introduction
The importance of the gluteus medius (GMed) and gluteus minimus (GMin) to hip function is widely accepted, but quantitative data on their contribution is currently limited. Restoring hip abductor function is the focus of operative and non-operative treatments for many hip conditions. Therefore, an improved understanding of the abductors contribution to hip stability can better guide treatment. The purpose of this study is to determine the role of the GMed and GMin complex in stabilizing the native hip, and to establish a reproducible model of the abductor complex.

Methods
Hemi-pelvises were tested in four muscle states: GMed and GMin, GMed only, GMin only, and no muscles. Simulated muscle forces were applied via cables and pulleys attached to the tendon replicating the anatomic trajectory. The pelvis was secured to a metal plate and the femur was potted and attached to a multi-axial hip jig. Specimens were loaded along the long axis of the femur (distraction), internal rotation (IR) and external rotation (ER) at 0, 15, 30, 60, and 90 degrees of flexion while displacements and rotations were recorded using a motion tracking system.

Results
Both GMed and GMin contributed significantly to hip stability against an applied distractive force at all angles of flexion and were most effective at higher angles of flexion. GMin and GMax had the greatest contribution to IR stability at lower angles of flexion (0 and 15 degrees, p<0.05). In ER, GMin did not significantly contribute to stability, whereas GMed alone effectively reduced hip ER, significantly at 30-90 degrees (p<0.05).

Conclusion
To the best of our knowledge, this is the first study to analyse native hip abductor kinematics in a cadaveric model. Our results indicate that GMed provides the majority of stability against excessive IR and ER, whereas both GMed and GMin work synergistically to resist distractive forces as a function of hip flexion.
EP17.42 Multiple iliopsoas tendons and its implications in internal snapping hip syndrome

Dr Benjamin Lin\textsuperscript{1}, Dr Jonathan Bartlett\textsuperscript{2}, Mr Thomas Lloyd\textsuperscript{1}, Mr Dimitris Challoumas\textsuperscript{1}, Ms Cecilia Brassett\textsuperscript{1}, Mr Vikas Khanduja\textsuperscript{2}

\textsuperscript{1}Human Anatomy Teaching Group, University of Cambridge, Cambridge, United Kingdom, \textsuperscript{2}Department of Trauma & Orthopaedics, Addenbrooke's Hospital, Cambridge, United Kingdom

\textbf{Biography}

Cambridge University Graduate. Current Foundation Programme Trainee with an interest in surgery

\textbf{Aims}

This cadaveric study aims to describe the anatomical variations of the iliopsoas complex in 28 subjects, in an attempt to elucidate the pathology of internal snapping hip syndrome (ISHS) and to propose appropriate surgical management of the same.

\textbf{Methods}

The iliopsoas complex was dissected unilaterally in 28 formalin-embalmed cadavers and the number and courses of the iliacus and psoas major tendons were determined. The following measurements were taken from the mid-inguinal point: the distance to the point of union of the psoas major and iliacus tendon; and the distance to the most distal insertion of iliopsoas. Along with the course of the tendon with its multiple insertions was carefully studied and described.

\textbf{Results}

The presence of single, double and triple tendon insertions of iliopsoas were found in 12, 12 and 4 of the 28 specimens respectively. The average length of the iliopsoas muscle from the mid-inguinal point to the most distal attachment at the lesser trochanter was 122.25±12.96mm. The iliacus muscle bulk merged with psoas major at an average distance of 24.89±17.91mm proximal to the mid-inguinal point. In all cases, the lateral-most fibres of Iliacus yielded a non-tendinous insertion on to the anterior surface of the lesser trochanter and in the infratrochanteric region of the femoral shaft, rather than joining onto the main iliopsoas tendon(s). The average total width of the psoas major tendon decreased with an increasing number of tendons: 14.56±2.17mm (single tendon), 8.215±2.95mm (2 tendons present) and 5.88±1.14mm (3 tendons present).

\textbf{Conclusions}

The high incidence of multiple iliopsoas tendons suggests a potential cause of persistence of snapping and symptoms post-tenotomy in patients with ISHS. We therefore propose that complete release at the lesser trochanter will ensure that all tendons will be incised, whilst preserving some iliopsoas function via the direct insertions of iliacus onto the anterior femoral shaft.

\textbf{Clinical Relevance:} The results of this study suggest that multiple tendons are a potential cause for patients with ISHS not improving post-tenotomy and are present in over 50% of the population.
EP17.43 Comparison of avascular necrosis methods in murine model

Dr Vladislav Lobashov¹, Prof Ildar Akhtiamov¹, Dr Leisan Aminova¹
¹Kazan State Medical University, Kazan, Russian Federation

Introduction

Animal model of avascular necrosis could develop new treatment approach in case of efficiency and reproducibility.

Aim

Reproduce and evaluate 4 most common methods of initiation of avascular necrosis among murine. Study was carried out with local ethical committee agreement. 20 Adult white rats (6_+1,5 month) were operated by 4 different surgical methods. Each group contains 5 rats. Effectiveness of methods was proved by radiological, clinical and histological methods. 1 group were undergoing periosteum electrocoagulation of femoral neck (Kuroda Y,2010). Femoral neck of 2nd group were sutured by ligature (Kim HK, 2002). In 3d group were cutted femoral neck periosteum with drilling of femoral head (Peled 2013), while in 4th group only femoral neck periosteum was cutted (Peled 2009).

Results

Group 1. These rats have the most painful syndrome. According histology 3 rats has necrotic changes( one case has mushroom deformity, two cases had inflammation and necrotic changes of femoral head). Radiological changes seen in two cases.

Group 2. 3 of 5 hips has sign of AVN. Two hips have necrotic of subchondral zone and decreasing of cartilage. One has pathological neck fracture. Radiological changes were noted in 2 cases.

Group 3. Necrotic changes weren’t so noticeable as previous 2 groups. It two cases has small area of destruction, while 3 hips have significant increasing osteoclasts.

Group 4. 1 case is chemical changes by histology and no radiological changes of hip joint.

Summary

1. Although electrocoagulation and ligature of the femoral neck were most effective, non on the methods could guarantee necrosis in 100% cases.

2. Radioilocal methods misdiagnosed cases without femoral head deformation.
EP17.44 Motor vehicle collisions and labral tears?

MD Michael Muldoon1,2, Research Coordinator Robert Healey1,2, Research Associate Austin Long1,2

1Hip Preservation Centre of Excellence, San Diego, United States, 2Sharp Healthcare, San Diego, United States

Biography
Dr Muldoon is a graduate of the United States Naval Academy and the Uniformed Services, University of the Health Sciences. Dr Muldoon completed his residency in Orthopaedic Surgery at the Naval Medical Centre, San Diego. He went on to complete a fellowship in Adult Reconstructive Surgery at the Mayo Clinic in Rochester, Minnesota.

At the Naval Medical Centre, San Diego, Dr Muldoon was the Director of the Hip and Knee Service for 7 years and served as the Assistant Chairman of the Department of Orthopaedics.

Dr Muldoon has extensive experience in hip, knee and shoulder replacement surgery as well as complex hip and knee revisions. His particular area of expertise is arthroscopic hip surgery for traumatic and degenerative conditions. Dr Muldoon has a special interest in hip and knee problems in young active patients. Dr Muldoon has published numerous papers on reconstructive surgery and continues to be active in research and teaching at Orthopaedic Medical Group.

Introduction
Hip related pain following a motor vehicle collision (MVC) has been associated with fractures, dislocations, and contusions. The contribution of labral tear (LT) and other intra-articular pathology is often overlooked as a cause of chronic hip pain following an MVC and little has been published on the subject. LTs may or may not have been present, symptomatically or asymptotically, prior to an MVC, making it difficult to determine causation. This pilot study looks at LTs and their association with MVC-related hip pain.

Methods
A retrospective patient population referred for hip pain following an MVC over a 25-month period was studied. All patients were evaluated clinically, and treatments were recommended according to patient presentation. Chart notes were analysed to determine presentation of symptoms, mode of care, and outcomes. All patients with possibly symptomatic labral tears, underwent diagnostic injections. All patients underwent structured physical therapy and most injection therapy (cortisone or PRP)

Results
Of the 38 patients referred, 20 subjects diagnosed with labral tears were included (11 females, 9 males, age 42.3±18.4 years) representing 3.3% of new patients to this clinic. Time until office visit averaged 276.4±217.3 days with an average Harris Hip Score of 49.1±15.4. Rear-end collisions were associated with 60% of the LTs and T-bones associated with 40%. 88% of patients with LT had coexisting FAI morphology. Patient reporting relief post treatment was 75% in rear-end collisions and 62.5% in T-bones (p=0.187). Conservative treatment (100% population) reported 70% relief at early follow-up. Arthroscopically treated (40% population) patients reported 100% relief at early follow-up.

Conclusions
Patients with refractory hip pain after an MVC should be assessed for LTs with underlying FAI. Injection tests are helpful in confirming location of pain generator. Patients that do not respond to conservative treatment can benefit from arthroscopic intervention.
EP17.45 Hip arthroscopy trends and outcomes: A national multicentre study

MD Oliver Marin-Pena1, MD Mohammed Abd El-Radi8, MD Raul Torres-Eguia2, MD Jesus Mas-Martinez3, MD Javier Sanz-Reig3, MD Juan Ribera4, MD Marc Tey-Pons5, MD Luis Perez-Carro6, MD Boris Garcia-Benitez7

1University Hospital Infanta Leonor, Madrid, Spain, 2Clinica CEMTRO, Madrid, Spain, 3Hospital HLA Vistahermosa, Alicante, Spain, 4Hospital Viamed Santa Angela de la Cruz, Sevilla, Spain, 5Hospital del Mar y la Esperanza, Barcelona, Spain, 6Clinica Mompia, Santander, Spain, 7Hospital San Juan de Dios Aljarafe, Sevilla, Spain, 8Assiut University Hospital, Assiut, Egypt

Purpose
Main objective was to analyse trends in arthroscopic management for intra-articular hip pathologies in Spanish population.

Methods
A retrospective study was conducted including 483 patients undergone arthroscopic treatment from a prospectively collected database of 617 patients from six specialized centres covering public and private systems in Spain. Exclusion criteria included revision scopes and refusal to participate in the study.

Results
Our study included 347 males and 136 females with age range from 15 to 62 years (mean 37.8 years). FAI classified as 188 Cam cases, 56 Pincer cases and 239 mixed type. Tönnis classification enrolled (two separate observers’ agreement) as grade 0 and I in 356 cases, grade II in 60 cases of 426 plain radiographs. Labral tear was found in 370 magnetic resonance arthrography (MRA) reports of 397 MRA enrolled of which revealed 97 chondral lesions. Alpha angle was measured by single observer preoperatively in 423 plain axial view with range of 50-89 degrees (mean 65.30 degree) and postoperatively in 371 plain axial views with range of 31-69 degrees (mean 51.64 degree). Illizaturri zones for labral lesions conducted in 426 videos of patients enrolled, showed 335 videos illustrating lesions in zones two and three and 117 for chondral lesions in same zones. Labrum was sutured in 252 cases, Psoas partial tenotomy done in 46 cases for impingement. Microfractures were indicated in 86 patients of 117 cases of chondral lesions. Mean improvement of Hip Outcome Score (HOS) at one year was 17.39 points with preoperative mean of 61.36 points and postoperatively 78.75 points. Mean Follow-up was 14.52 months (range 6.02-97.67 months). Revision surgeries were in 12 cases of re-arthroscopy (2.48%) and 5 cases of total hip replacement conversion (1.03%).
Conclusions
Arthroscopic treatment of intra-articular hip pathologies has good clinical results with low complication rates.
EP17.47 Standardizing the diagnostic evaluation of non-arthritic hip disorders through the Delphi method

Dr Michael Mcclincy
1 University Of Pittsburgh School of Medicine, Pittsburgh, United States, 2 Intermountain Healthcare, Salt Lake City, United States, 3 Boston Children’s Hospital, Boston, United States

Biography:
Dr McClincy is an attending orthopaedic surgeon at Children’s Hospital of Pittsburgh focussing on sports medicine and hip preservation, using both arthroscopic and open approaches. Significant variability exists in the diagnostic evaluation of patients with non-arthritic hip pain, and little literature is available to help standardize this process. Non-standardized diagnostic evaluations can impact clinical decision-making. The aims of this Delphi study were to establish consensus on diagnostic areas and to understand areas where consensus could not be achieved in order to develop a standardized diagnostic evaluation for patients presenting with non-arthritic hip pain.

A three-step Delphi method was used to establish consensus. Eighteen experts trained in arthroscopic or open hip preservation consented to participate. They were presented with four clinical vignettes representing a spectrum of non-arthritic hip pain patients. Consensus was defined as >66% and areas of disagreement were explored as equally important. In round 1, experts provided a detailed description of their routine patient evaluation strategy. In rounds 2 and 3, experts were iteratively presented with the modal (>=50%) responses generated from the previous rounds and were asked to “agree” or “disagree” with the modal response and suggest additions and/or subtractions.

All experts completed each survey. Consensus was achieved in 75% of the total questions (18/24). Experts agreed that historical features of pain location, pain character/severity, aggravating/alleviating factors, and previous treatments were important in each vignette. Agreement was reached on physical examination including hip flexion, hip internal/external rotation in flexion, FADIR, FABER, gait evaluation, and prone internal/external rotation for all vignettes. Radiographic examination was agreed upon to include standing AP pelvis, 45 Dunn lateral, and false profile series, and relevant radiographic measurements were defined LCEA, Tonnis roof index, femoral alpha angle, and ACEA. Agreed upon areas for cross-sectional imaging were magnetic resonance arthrography and 3D CT scan for all vignettes. Diagnostic injections were recommended in the majority of vignettes. Areas with highest levels of disagreement consistently involved protocols for cross-sectional imaging, with femoral version assessment showing controversy across three of four vignettes.

Non-arthritic hip pain is increasingly recognized as a cause of pain and dysfunction. This diagnostic guideline will help standardize the diagnostic evaluation of these patients and hopefully improve clinical decision-making during their episode of care.
EP17.48 The Passive Flexion External Rotation (PFER) test for Femoro-Acetabular Impingement (FIA) syndrome: A retrospective exploratory study

Dr Nicholas MOHTADI1, Denise Chan1, Dana Hunter1, David Lindsay1, Dr Alex Rezansoff1

1University of Calgary Sport Medicine Centre, Calgary, Canada

Introduction
Diagnosing FAI syndrome by using clinical signs is challenging. Clinicians are reliant on imaging to both make and confirm the diagnosis. The Flexion Adduction Internal Rotation (FADDIR) “impingement test” is used ubiquitously. The predictive value of this sign is questionable due to a high level of bias in the literature. The PFER is performed by an examiner who passively flexes the patient’s hip to 90°; while maintaining the thigh in a sagittal plane. The hip will assume its “preferred” or “natural” rotational position. An externally rotated hip represents a positive PFER test and would suggest that the diagnosis of anterior FAI syndrome is probable.

Methods
124 patients presented with hip related problems over the course of one year. The electronic medical record was searched to determine the patients’ confirmed diagnoses and whether the PFER and FADDIR tests were performed. Sensitivity, specificity, positive and negative predictive values for FAI were calculated.

Results
100 patients had both tests performed, 114 had the FADDIR and 10 neither test. Sixty-four patients had a final diagnosis of FAI and 60 represented multiple other hip related disorders. The sensitivity of the FADDIR test was 95% and positive predictive value 52%; the specificity of the FADDIR test was 11%; and a negative predictive value 67%. The sensitivity of the PFER was 76 %, with a positive predictive value of 81%; a specificity of 78%, and a negative predictive value of 73%.

Discussion
Several systematic reviews and meta-analyses have demonstrated that the clinical signs of FAI are less than optimal. The PFER demonstrates both a positive and negative diagnostic predictive value that outperforms the FADDIR test in this population.
Conclusions
This retrospective and exploratory evaluation of the PFER test suggests promise as an additional clinical sign to aid clinicians in the diagnosis of Femoro-Aacetabular Impingement. Further prospective research to address intra and inter-rater reliability in a representative population of hip disorder patients is needed to fully validate this promising sign of FAI syndrome.
EP17.49 Minimum 2-year follow-up results of hip arthroscopy for symptomatic collapsed osteonecrosis of the femoral head

Dr Jae-Youn Yoon1, Dr Jun-ki Moon1, Dr Chul-Ho Kim1, CNS Mi Yeon Jeong1, Dr Sun Hyung Lee2, Prof. Hee Joong Kim2, Prof. Pil Whan Yoon1

1Asan Medical Centre, Seoul, South Korea, 2Seoul National University Hospital, Seoul, South Korea

Biography
Pil Whan Yoon, M.D., Ph.D. is associate professor of orthopaedic surgery in Asan medical centre in South Korea. He is specialized in surgery for hip and pelvis, including arthroplasty, arthroscopy and hip preservation surgery. Professor Yoon has been making considerable contributions for research of hip and pelvis surgery as an academic editor of Plos One journal, as a member of International Society for Hip Arthroscopy, as a member of American Academy of Orthopaedic Surgeons and as a member of editorial board of Hip and Pelvis journal.

Introduction
The purpose of this study is to report the minimum 2-year follow-up results of hip arthroscopy for symptomatic osteonecrosis of the femoral head (ONFH) with moderate femoral head collapse.

Materials and Methods
We retrospectively analysed medical data of the patients who underwent hip arthroscopy between 2011 and 2017. We found 16 patients (19 hips) with a moderate collapse of the femoral head due to ONFH, fifteen of which had a history of joint-preserving surgeries of the affected hip. There were thirteen men and three women with a mean age of 32.5 years (range, 21 to 60 years). Standard hip arthroscopy techniques were used to address associated pathology. Plain radiographs were taken every 3 months. Outcome scores including hip outcome score activities of daily living (HOS ADL), modified Harris hip score (mHHS) were obtained preoperatively and at the latest follow-up. Patient satisfaction was measured using a numerical rating scale (NRS; 0-10) at the final follow-up.

Results
During follow-up, two hips (10.5%) required conversion to total hip arthroplasty at 1.4 and 3.4 years after hip arthroscopy. The remaining 17 hips completed follow-up assessment with a minimum 2-year follow-up (2 to 8 years). The mean HOS ADL and mHHS increased from 32 and 58 to 72 and 78 at the final follow-up, respectively. Radiographically, joint space narrowing progressed <2 mm in three hips and four patients complained of mild limping. The mean patient satisfaction score was 7 (6 to 10).

Conclusion
Although hip arthroscopy did not show the best outcome for symptomatic ONFH with moderate femoral head collapse, it could be a reasonable option for a selected patient group who want to delay or avoid total hip arthroplasty with a favourable patient satisfaction score.
EP17.5 Multiple psychiatric comorbidities preoperatively increases costs for patients undergoing hip arthroscopy for labral repair

Ms. Jacqueline E. Baron1, Mr. Zain M. Khazi1, Dr. Kyle Duchman1, Dr. Qiang An1, Dr. Michael Willey1, Dr. Robert W. Westermann1

1Department Of Orthopaedics and Rehabilitation, Iowa City, IA, United States

Purpose
To investigate the prevalence of preoperative psychiatric comorbidities including depression, anxiety, bipolar disorder, schizophrenia, and substance-use disorders, among patients undergoing arthroscopic hip labral repair and its impact on cost.

Methods
The Humana claims administrative database was queried (CPT 29916) to assess for patients undergoing arthroscopic hip labral repair. Patients were stratified by preoperative diagnoses of depression, anxiety, bipolar disorder, or schizophrenia. Patients with ≥1 psychiatric co-morbidity were defined as All Psychiatric vs. those without psychiatric comorbidities [No Psychiatric]. Patients were assessed for diagnosed substance-abuse disorders, including alcohol use disorder, opioid use disorder, or tobacco use disorder. Trends for patients with ≥1 psychiatric co-morbidity were analysed using Poisson log-linear regression. Differences across groups were assessed utilizing paired t-tests for costs between those with ≥1 psychiatric co-morbidity vs. no psychiatric co-morbidities. Analyses were conducted (SAS software version 9.4; SAS Institute, Inc., Cary, NC), with significance defined as p < 0.05.

Results
The prevalence of psychiatric co-morbidities among patients (n=1060) undergoing arthroscopic hip labral repair included depression (185, 17.5 %), anxiety (212, 20.0%), bipolar disorder (<11), and schizophrenia (<11). Patients were diagnosed with substance-abuse disorder (<11), alcohol use disorder (<11), opioid use disorder (24, 2.3%), or tobacco use disorder (109, 10.3%). In total, 289 (27.3%) of patients undergoing hip arthroscopy had ≥1 diagnosed psychiatric comorbidity preoperatively compared to a prevalence of 10.31% [All Psychiatric] for the Humana claims database. Patients with ≥1 psychiatric comorbidity had a per capita cost of $8,016.18 compared to patients without psychiatric co-morbidities ($4,065.91; p=0.039). From 2006-2016, there was a significant increase in patients with ≥1 psychiatric co-morbidity preoperatively (p<0.0001) undergoing hip arthroscopy.

Conclusion
The prevalence of preoperatively diagnosed psychiatric comorbidities among patients undergoing labral repair via hip arthroscopy (27.3%) is significantly elevated as compared to baseline prevalence rates of 10.31%. The presence of psychiatric comorbidities preoperatively was associated with increased costs for hip arthroscopy patients undergoing labral repair.
Multiple drilling and multiple matchstick-like bone allograft for large osteonecrotic lesions of the femoral head: An average 3-year follow-up study

Dr Jun-Ki Moon¹, Dr Chul-Ho Kim¹, Dr Jae-Youn Yoon¹, CNS Mi Yeon Jeong¹, Dr Sun Hyung Lee², Prof. Hee Joong Kim², Prof. Pil Whan Yoon¹

¹Asan Medical Centre, Seoul, South Korea, ²Seoul National University Hospital, Seoul, South Korea

Biography
Pil Whan Yoon, M.D., Ph.D. is associate professor of orthopaedic surgery in Asan medical centre in South Korea. He is specialized in surgery for hip and pelvis, including arthroplasty, arthroscopy and hip preservation surgery. Professor Yoon has been making considerable contributions for research of hip and pelvis surgery as an academic editor of Plos One journal, as a member of International Society for Hip Arthroscopy, as a member of American Academy of Orthopaedic Surgeons and as a member of editorial board of Hip and Pelvis journal.

Aims
We aimed to present the clinical outcome of multiple drilling and multiple matchstick-like bone allograft for large osteonecrotic lesions of the femoral head as a joint preserving surgery.

Patients and Methods
Between March 2014 and May 2018, sixty-seven hips in 47 patients with symptomatic, nontraumatic osteonecrosis of the femoral head (ONFH) with a necrotic area of ≥30% were enrolled. Radial direction multiple drillings followed by matchstick-like bone allograft insertion were performed through a single hole of the femur. Harris hip scores (HHS) and WOMAC were obtained preoperatively and at the latest follow-up. Plain radiographs were taken every 3 months. Femoral head collapse ≥2mm was defined as a radiological failure and conversion to total hip arthroplasty (THA) was regarded as a clinical failure.

Results
Seven hips became lost to follow-up. Nineteen hips (28.4%) required conversion to THA at mean 21.6 (range, 4.8 to 42) months postoperatively. The remaining 41 hips (30 patients) completed follow-up assessments with an average follow-up of 3 years (1.3 to 4.5 years). There were 20 males and 10 females with a mean age of 35.4 years (19 to 64 years). The mean HHS and WOMAC improved from 63 and 31.3 to 80.6 and 16.3 at the final follow-up, respectively (P<0.001). The radiological failure occurred in 4 hips (6%), of which mean preoperative HHS and WOMAC improved from 69.5 and 21.5 to 85 and 15.3, respectively. The overall failure rate was 38.3% (23/60 hips) and the mean survival duration to failure was 21.2 months (4.8 to 42 months).

Conclusion
Multiple drilling and multiple matchstick-like bone allograft showed a relatively high failure rate of 38.3% for the treatment of large osteonecrotic lesions of the femoral head at an average 3-year of follow-up. This procedure could be another treatment option for the limited purpose to alleviate the symptoms in the selected patients who want to preserve their hips.
EP17.51 In-office ultrasound-guided intra-articular hip injection vs. radiology and operating room-based fluoroscopic-guided intra-articular hip injection: A cost minimization analysis

Dr Michael Palmer¹, Victoria Das², Jessica Pykosz¹, Dr Michael Ellman², Dr Sanjeev Bhatia⁴
¹The Christ Hospital, Cincinnati, United States, ²Panorama Orthopaedic and Spine Centre, Denver, United States, ³Cincinnati Sports Medicine & Orthopaedic Centre, Bon Secours Mercy Health, Cincinnati, United States, ⁴Hip and Knee Joint Preservation Centre, Northwestern Medicine, Warrenville, United States

Introduction
Diagnostic and therapeutic injections are routinely provided as in office procedures for many areas of the body. Not all orthopaedic offices are equipped with fluoroscopic or ultrasound guidance to effectively and efficiently provide hip injections for patients. This often necessitates referral to a hospital-based radiology department or the orthopaedic surgeon providing the service in the operating room during OR block time. The purpose of this study was to compare cost data of in office ultrasound guided intra-articular injections with hospital based fluoroscopic intra-articular injections performed by the radiology department or in the operating room. It was hypothesized that in-office ultrasound guidance of hip injections would have the most minimized cost while also providing excellent visualization and real time needle positioning.

Methods
A survey of cost data from all hospitals within one of the largest accountable care (ACO) organizations in the United States was gathered. Data was cross-checked with billing personnel to ensure accuracy across the health system. Specifically, all costs related to office-based ultrasound guided injection were compared to costs associated with the same procedure when performed by a radiologist in the fluoroscopy suite as well as by a surgeon in the operating room.

Results
The cost to the patient for an ultrasound guided intra-articular hip injection provided in the office setting was $145. Specifically, this reflected CPT Code 20611 billed in the office setting. The cost to the patient for a fluoroscopic guided intra-articular hip injection performed in the radiology suite of a hospital in the ACO was $654, reflective of CPT codes 20610 and 77002 billed within the hospital setting. Lastly, the combined costs for a fluoroscopic guided intra-articular hip injection performed in the operating room with portable C-arm was $2362 which was the sum of the fixed OR costs for 15 minutes of use, anaesthesia cost, and the procedural costs.
Discussion
Ultrasound guided hip injections greatly reduced the cost of intra-articular hip injections, as compared with hospital based fluoroscopic injections performed by the radiology department or in the operating room, this health setting.
EP17.52 Statistical fragility and the role of P values in the hip arthroscopy literature

Dr Robert Parisien1, Dr David Trofa2, Michaela O’Connor2, Brock Knapp3, Emily Curry4, Dr T. Sean Lynch2, Dr Paul Tornetta III3, Dr Xinning Li3

1University of Pennsylvania, Philadelphia, United States, 2Columbia University Medical Centre, New York, United States, 3Boston University Medical Centre, Boston, United States, 4Boston University School of Public Health, Boston, United States

Biography

Dr Robert L. Parisien is currently pursuing his fellowship in Orthopaedic Sports Medicine and Cartilage Restoration at the University of Pennsylvania. Following his fellowship with Penn Medicine, Dr Parisien will then pursue additional sub-specialty training in the Harvard Hip Preservation Program.

Dr Parisien has published over 50 scientific manuscripts, reviews and book chapters and his research has been presented at over 65 national and regional orthopaedic meetings. In recognition of his research, Dr Parisien has been the recipient of the Kilfoyle Award, Arciero-Warner Award, Eastern Orthopaedic Association Research Award and the New England Orthopaedic Society Research Award. Dr Parisien also currently serves as a research reviewer for The Bone & Joint Journal and Arthroscopy: The Journal of Arthroscopic and Related Surgery. Dr Parisien previously served on the Board of Directors of the Massachusetts Orthopaedic Association as a Resident and Fellow Board Member and is a candidate member of the American Orthopaedic Society for Sports Medicine, the Arthroscopy Association of North America, the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine and the New England Orthopaedic Society.

Purpose

Comparative trials evaluating categorical outcomes are broadly utilized in evidenced-based decision-making, however, a small number of outcome event reversals have the potential to drastically change study significance. The purpose of this study was to critically examine the statistical stability of the published hip arthroscopy literature.

Methods

Comparative studies in the hip arthroscopy literature were analysed in the Journal of Bone and Joint Surgery, American Journal of Sports Medicine, Arthroscopy: The Journal of Arthroscopic and Related Surgery, Knee Surgery-Sports Traumatology-Arthroscopy and the Journal of Hip Preservation Surgery between 2008-2018. The Fragility Index for each study outcome was determined by the number of event reversals required to change the P value to either greater or less than 0.05, thus changing study conclusions. The associated Fragility Quotient was determined by dividing the Fragility Index by the total population comprising a particular outcome.

Results

Of the 4520 studies evaluated, 52 comparative studies met inclusion criteria consisting of a total of 150 outcome events. There were 7 randomized controlled trials and 45 non-randomized trials. Of the 150 total outcome events, 33 were initially reported as significant and 34 represented primary outcomes. The Fragility Index for the entire study was only 3.5 with an associated Fragility Quotient of 0.032. There was no difference appreciated between events initially reported as significant versus non-significant. Randomized trials were found to be less fragile than non-randomized trials with an associated Fragility Index of 6 and 3, respectively.
Conclusions
Comparative studies in the hip arthroscopy literature may not be as stable as previously thought as the utilization of a single discreet P value cut-off has proven misleading. We therefore recommend adoption of both the Fragility Index and associated Fragility Quotient, in conjunction with P value analysis, to aid in the evaluation and interpretation of statistical stability and quantitative significance in future comparative hip arthroscopy studies.
Ep17.53 A ganglion arising from the teres ligament associated with an anterior labral tear of the hip. Case report

**MD PHD LUIS PEREZ-CARRO**¹, RN NATALIA FERNANDEZ-ESCAJADILLO¹, RN LINDA FERNANDEZ-ESCAJADILLO¹, MD CARLOS RODRIGO ARRIAZA-GUTIERREZ², MD MANUEL SUMILLERA GARCIA², MD PHD ANA ALFONSO FERNANDEZ²

¹Hospital Clinica Mompia. Santander. Spain, Santander, España

**Biography**
Dr Luis Perez-Carro (MD, PhD) is an orthopaedic surgeon specializing in Sports Medicine and Arthroscopy of all joints at the Department of Orthopaedic and Trauma Surgery at the Hospital Clinica Mompia in Santander (Spain). He also performs surgery for primary and revision THR and TKR. He is the chairman of the Santander Hip Meeting (Santander-Spain). He has published over 65 international and 50 national journal articles and now research in the hip arthroscopy field. Active member of AAOS, ISAKOS, ESKA and ISHA. Co-Chairman of the 2019 ISHA meeting.

**Introduction**
Cystic lesions around the hip are rare and usually asymptomatic but may be observed incidentally on imaging examinations, such as computed tomography and magnetic resonance imaging and may become symptomatic because of compression of surrounding structures. We report a case of a patient with a ganglion cyst arising from the teres ligament associated with an anterior labral tear of the hip. As far as we know this is the first report of this condition.

**Material and methods**
A 22-year-old woman presented in our clinic with a 6-month history of dull pain in the right buttock and groin that was aggravated by weight bearing and walking, and by flexion and abduction of the hip.

Radiographic evaluation showed a nonarthritic joint with cross over sign and sub spine impingement with an alpha angle of 48º. Magnetic resonance imaging showed an anterosuperior labral rupture and a cystic lesion arising from the teres ligament and a ganglion cyst was suspected. Excision of the ganglion was performed easily with a shaver and radiofrequency under direct arthroscopic visualization. Anterior labral repair and sub spine decompression were also done.

**Results**
The patient followed the usual post-operative rehabilitation of labral repair and osteocondroplasty. He did not register any postoperative complications. There was no ganglion recurrence at one-year follow-up, no hip pain and the patient had complete resolution of her symptoms.

**Discussion**
Ganglion cyst may be related to any structure vulnerable to the process of degeneration and can be asymptomatic. Groin or thigh pain usually comprise the clinical presentation in some patients and the symptoms are related to alteration of biomechanics if the ganglion is intra-articular. Treatment for symptomatic cystic lesions around the hip joint includes rest, nonsteroidal anti-inflammatory drug administration, needle aspiration, and surgical excision. In our case we considered surgical excision due to the intraarticular location and association of a labral rupture.

**Conclusion**
Imaging evaluation of the ligamentum teres lesions may contribute to improve diagnosis prior to the arthroscopy. As far as we know this is the first report of a ganglion arising from the teres ligament associated with an anterior labral tear of the hip.
EP17.54 Physical examination of the hip: Current practices and future directions

Dr Hal Martin1, Dr Lauren Pierpoint2, Dr Anthony Khoury3, Dr Marc J. Philippon2

1Baylor Scott & White Hip Preservation Centre at BUMC Dallas, Dallas, USA, 2Steadman Phillipon Research Institute, Vail, USA

Biography

Hal David Martin, DO is an orthopaedic surgeon specializing in sport medicine/hip disorders. He received his medical degree from Oklahoma State University, College of Osteopathic Medicine, Tulsa, OK. Dr Martin completed his postdoctoral training at the following institutions: One-year Fellowship, University of Pittsburgh Medical Centre, Sports Medicine/Hip Disorders, Ilizarov Fellowship, Lecco Italy, Orthopaedic Surgery Intern/Resident, Doctor’s Hospital, Ohio University, Columbus, Ohio. He also served as an Orthopaedic Surgery Resident with Children’s Hospital Medical Centre, Cincinnati, Ohio and Boston Children’s Hospital, Boston Massachusetts. Dr Martin is a national and international lecturer and has written numerous book chapters and articles on the hip. He has served on many faculties as an instructor on sports medicine, hip pathology, disorders and hip arthroscopy. Hal David Martin, DO is the Medical and Research Director of the Hip Preservation Centre at Baylor University Medical Centre at Dallas. He is a respected surgeon dedicated to delivering quality care to patients suffering with hip pain. Dr Martin is pleased to welcome new patients.

The established physical examination protocols published by the MAHORN group, in conjunction with recent physical examination publications, provide a solid foundation for a global protocol standardization. Our main objective is to discuss the importance of the physical exam of the hip/spinopelvic core, its basic current components, and provide the foundation for future progression and standardization. We also aim to discuss re-evaluating the standardized hip examination protocol developed by MAHORN and provide suggestions on modernizing the protocol with the most recent physical exam and investigator experience. As the understanding of biomechanics and anatomy of the hip evolves, so does the physical examination. The intricate relationship between the hip and its surrounding structures requires a thorough understanding of the anatomy and biomechanics that are established in orthopaedic surgical training. Hip complaints are often complex, requiring a thorough assessment to identify the source of pain, associated pathology, and frequently observed comorbidities. Misdiagnosis is common with both intra- and extra-articular complaints but can be avoided with an examination of the joint above and below the hip. An organized comprehensive history and physical examination should be performed to assess spine, pelvis, hip and core relationships and function.

Broadly, the comprehensive examination evaluation of patient physical symptoms can be organized into gait, standing, sitting, supine, lateral, and prone. At each phase, evaluation of the osseous, capsulolabral, musculotendinous and neurovascular layers is important for understanding how each layer functions independently of and relative to others. Understanding of the kinematic chain is critical due to the load transfer responsibilities of the hip joint at the centre axis of the body. Such understanding will help the clinician to better assess the hip, spine, and abdominal core to identify pathological involvement at each layer.

A global standardization of the battery of tests such as those published by the MAHORN group is required to diagnose hip pathology ensures reliability and efficiency. Future work should focus on creating and disseminating a standardized physical exam protocol that can be adopted internationally.
The association between mental health status and patient-reported outcomes following hip arthroscopy for FAI

Dr Parag Jaiswal¹, Karen Briggs², Dr Lauren Pierpoint³, Dr Marc J. Philippon²

¹Royal Free London NHS Foundation Trust, London, United Kingdom, ²Steadman Philippon Research Institute, Vail, USA

Introduction
Several studies have identified poor prognostic factors and reasons for failure following hip arthroscopy. Low mental health (LMH) status may be associated with poorer outcomes following hip arthroscopy.

Purpose
To determine if preoperative mental health status is related to patient-reported outcomes following hip arthroscopy.

Methods
Patients who underwent hip arthroscopy between 2008-2015 with ≥2 years of follow up data were included. Patients completed modified Harris Hip (mHHS), HOS-ADL and SF-12 questionnaires before surgery at follow-up. An MCS ≤42 was the cut-off point for patients with LMH. General linear models controlling for age, sex, and length of follow up were run to investigate the relationship between preoperative mental health status and change scores for each outcome.

Results
A total of 566 consecutive patients were included (mean age=36.7 years; range=18-69; 48.6% female). All pre-op scores were lower in LMH group for MCS (34.9 vs. 56.3, p<0.001); HOS-ADL (62.3 vs. 72.6, p<0.001); mHHS (56.7 vs. 66.0, p<0.001). Both groups experienced significant increases in mHHS and HOS-ADL scores following surgery, although improvements were greater in LMH patients for mHHS (24.7 vs. 17.9, p<0.001) and HOS-ADL (21.2 vs. 15.3, p=0.05). The mean increase in MCS was 15.2 in the LMH group compared to 1.6 (p<0.001). However, postoperative outcomes were still lower in the LMH group for MCS (50.0 vs. 54.6; p<0.001); HOS-ADL (82.9 vs. 88.0; p<0.01); and mHHS (80.9 vs 84.1, p=0.06).

Conclusion
The results of this study show that hip arthroscopy for treating patients with FAI is associated with improved physical function and mental well-being in patients with LMH. Therefore, LMH should not be considered a relative contraindication to surgery, though future studies should address the effect of raising mental health prior to surgery, as post-operative scores were still lower in the LMH group.

Biography
Lauren Pierpoint is the Hip Research Manager at the Steadman Philippon Research Institute. She received her MS in Integrative Physiology from CU Boulder in 2011 and her PhD in Epidemiology from the Colorado School of Public Health in 2018.
The M. sartorius is a very specific muscle, whose biomechanical and fascial features are often underrated in the physiotherapeutic treatment. The muscle plays an important role in terms of stability and the movement of the hip and the knee. So, the whole statics is also based on functionality of this muscle. Fascial links interact with the deep muscles of the capsule. The capsular pain pattern of the hip performs the opposite way to the functional movement of the Sartorius. But there is no real discussion over dysfunctionality in the conservative treatment. If we take a further look at the micro instability of a FAI hip, mostly the movements ABD, FLEX and AR create problems. These movements are also directly performed by the M. sartorius. During a HASK surgery, one of the portals often penetrated the muscle. Another problem is the flush of the hip during surgery, which can cause inactivity. But there is no recommendation for any treatment after surgery. Considering functionality and stability of the hip after surgery, a closer look at this muscle is essential. We must ask ourselves the questions. Why does the muscle act the way it does? What are the consequences of wrong treatment? What is its role in the conservative treatment and its importance? I want to give insights into these questions and demonstrate alternative ways to deal with these problems.
A parcellar fracture of the femoral head is an infrequent injury. Its surgical treatment involves a technically complex intraarticular approach. It is not without serious complications. Therefore, conservative treatment is, in most cases, the most used. (However new technics, such as hip arthroscopy is emerging as alternative options. The aim here is to present a rare case of arthroscopically assisted treatment.

We present the case of a 50-year-old man who suffered a coxofemoral dislocation due to a motorcycle accident. After an urgent closed reduction, new radiographs and a CT scan were performed. A Pipkin type II fracture of the right femoral head with a free fragment that affected 40% of the femoral head was observed. The fracture line went from antero-lateral to postero-medial on the axial plane and from superior-medial to inferior-lateral on the coronal.

Osteosynthesis was performed 24 hours after the trauma. For this purpose, an arthroscopic technique using the anterior medial and the proximal femoral accessory portals without traction was used. An anterior-superior longitudinal capsulotomy was performed to make for optimal visual access to the fracture site. Under direct vision, the reduction manoeuvres were carried out to obtain the best possible reduction.

The postero-lateral portal was used because it was the most optimal for compression of the fracture. By means of this access, 2 headless compression screws (Acutrack 2® 4.7x40mm and 4.7x45mm) were inserted under x-ray and visual control. After osteosynthesis, stability was verified under direct vision of the fracture. After OS traction was applied and the central compartment of the joint was examined. No free fragments were found.

After surgery, CT scan was performed assessing the correct screws placement and optimal reduction of the fracture. The patient was discharged 48 hours after the intervention. At 10 weeks, the patient started progressive partial loading. Twelve months after surgery X-rays and CT scan showed radiological consolidation of the fracture without signs of avascular necrosis of the femoral head.

Treatment of fractures of the femoral head is conservative in Pipkin type I and non-displaced type II fractures. They both require a long treatment period and present the risk of secondary displacement of the fragment or sub-optimal consolidation.
Proximal rectus femoris tendon avulsions are a rare occurrence with a paucity of research surrounding the topic. These injuries are often managed with non-operative care; however, this technical note describes two cases of surgical management of complete tendinous avulsions of the direct head of the rectus femoris in high-performance athletes. The symptomatology of this injury and diagnostic workup are explored including magnetic resonance imaging (MRI). The anatomy and the nuances of the anterior inferior iliac spine are highlighted with a strong emphasis on the surgical technique employed for repair using suture anchors. The postoperative rehabilitation protocol adhered to from the post-operative care unit to eventual return to play is outlined. Finally, a current literature review of the topic is summarized, exploring the outcomes of the various treatment options implemented in similar injury patterns.
EP17.59 Hip preservation outcomes in subchondral insufficiency fractures of the femoral head: A systemic review
Michael Gaudiani1, Dr Linsen Samuel2, Dr Assem Sultan2, Dr Atul Kamath2
1 Case Western Reserve University School of Medicine, Cleveland, United States, 2 Cleveland Clinic Foundation, Cleveland, United States

Biography
Dr Atul Kamath is the Director of the Centre for Hip Preservation at the Cleveland Clinic. He specializes in open and arthroscopic treatment options for young adults with hip pain, including arthroscopy, AVN treatment, surgical dislocation, and periacetabular osteotomy. He completed his medical degree at Harvard, residency at Penn, and fellowships in adult reconstruction (Mayo Clinic) and hip preservation (Muller Foundation in Europe).

Introduction
Subchondral insufficiency fractures of the femoral head (SIFFH) is a cause of femoral collapse due to bone fragility which can lead to degeneration. This rare pathology has been seen predominantly in older patients, however recently SIFFH has been recently reported and operatively managed in younger patients. The purpose of our study is to systematically review the literature to determine the role of hip preservation techniques in SIFFH and post-operative outcomes.

Methods
A systematic review was conducted according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines. All peer-reviewed publications related to SIFFH published from January 1999 to January 2019 was using the following databases: Medline, EMBASE, Scopus, and Web of Science. Each search included the following terms: subchondral AND insufficiency AND fracture AND femoral AND head AND hip preservation. Inclusion criteria consisted of English language or articles with English translations, studies with patients’ gender and age with SIFFH, and reporting of treatment SIFFH with postoperative follow-up.

Results
The systematic review identified 5 articles including 24 patients, 17 males and 7 females with 24 hips diagnosed with SIFFH and treated with hip preservation techniques. Mean age was 33.9±13.8 years and mean body mass index (BMI) was 22.1±2.0 kg/m2. Surgical management performed were: 11 (46%) trans trochanteric anterior rotational osteotomy (TARO), 9 (38%) hip arthroscopy, 2 (8%) coring with bone filler, and 2 (8%) drilling. Mean post-operative follow up was 4.26±2.43 years. No complications or revisions were reported. Mean Harris hip score (HHS) at last follow-up was 93.9±4.2.

Discussion
Hip preservation techniques have shown promising early results in the treatment of SIFFH in younger patients. More research is needed to fully understand which hip preservation techniques are superior over the course of long-term follow-up.
Is hip arthroscopy cost-effective for the treatment of Femoroacetabular Impingement (FAI)? A systematic review of economic evaluations

Dr Haitham Shoman¹, Dr Ori Weiss¹, Mr. Vikas Khanduja³

¹Cambridge University Hospitals Addenbrookes, Cambridge, United Kingdom

Background
Femoroacetabular impingement (FAI) was first described by Ganz and his co-workers in Switzerland just over two decades ago. In simple terms it equates to abutment of the femoral head-neck junction against the acetabular rim during the physiological range of movement of the hip joint. This mechanical process leads to a progressive breakdown of the chondro-labral junction, which in turn may lead to osteoarthritis (OA) necessitating a total hip replacement (THR). Arthroscopic management of FAI which has proven to be safe and efficacious, has grown in popularity and is focussed on abolishing symptoms as well as reducing the risk of development of OA. This paper details the protocol for a systematic review of economic evaluation of whether hip arthroscopy is a cost-effective intervention for the treatment of patients with FAI.

Methods
This study is developed by following the PRISMA statement. The study is registered in PROSPERO: CRD42019118529. The articles included will be gathered from Medline, Scopus, Embase, Cochrane, EBSCO, Web of Science Core Collection and Google Scholar databases. Articles will then be exported to Mendeley reference manager software. All records will be screened for eligibility and data will be extracted into a spreadsheet. The studies will be assessed for quality using the Joanna Briggs Institute Critical Appraisal Checklist for Economic Evaluations. The cumulative confidence in evidence will be evaluated using the GRADE tool.

Results
Four articles were found to estimate the cost effectiveness of hip arthroscopy. Three were from the US and one from the UK. The three US articles scored 90% in study strength while the study from the UK scored 77% and it did not use adequate economic evaluation models but was based on statistical analysis. The four study had a minimum willingness of pay (WTP) of around 50,000 USD and the UK study WTP was 30,000 GBP. All four studies showed the hip arthroscopy is a cost-effective procedure compared to conservative and open surgery.

Biography
Haitham earned his MBBCh from Ain Shams University, Cairo where he started his orthopaedic rotations. In parallel, he founded projects for the disabled community in Egypt for which he has won several awards from the UN and King Abdullah II Award from Jordan and helped develop innovative health education activities. He then got his Diploma and Masters in Public Health from Imperial College London through the UK Government’s Chevening Scholarship award. His global health experience spans across health economics, health policy and strengthening health systems post-emergencies from his published work. He worked for the European Commission’s Joint Research Centre and WHO. As a Paul Farmer Global Surgery Research Fellow at Harvard Medical School he focuses on, global orthopaedic surgery and locally, surgical site infections with mHealth technologies and national surgical planning in Rwanda along with strengthening surgical systems projects in Pakistan. He is also a research fellow at Addenbrooke’s Cambridge University Hospital. His is committed to using cost effective surgery for health systems development through education, innovation and outcomes-based research in low-resource settings. Haitham is also a research associate with Paris Descartes University – Laboratory of applied health economics research (LIRAES) – Sorbonne and a Global Burden of Diseases Collaborator.
Conclusion
Hip arthroscopy is considered a cost-effective procedure for patients with FAI in North America. However, more studies are required in Europe and other regions to appreciate economic differences.
EP17.61 The brief resilience scale correlates with pre and post-operative outcomes following hip arthroscopy

Ariel Silverman¹, Dr Steven DeFroda¹, Matthew Quinn¹, Dr Brian Cohen¹, Dr Ramin Tabaddor¹
¹Alpert Medical School, Brown University, Providence, United States

Biography
Ariel Silverman is a student at Brown University, doing clinical research with the Orthopaedic Department of The Warren Alpert Medical School.

Background
Despite improving diagnostic and surgical techniques, some patients do not respond as well as others following hip arthroscopy. In most musculoskeletal studies, predictors for surgical outcomes focus solely on physical health prior to surgery. However, there likely exists a relationship between a patient’s mental health and their post-operative patient reported outcome measures (PROMs).

Methods
Patients were included if they met indications for hip arthroscopy. All patients completed a baseline Brief Resilience Scale (BRS) and the following six PROMs pre and post-operatively: Modified Harris Hip Score (mHHS), Visual Analog Scale for Pain (VAS), Hip Outcomes Score for Activities of Daily Living (HOS-ADL), and Hip Outcomes Score for Sports-Related Activities (HOS-Sports). Patients were stratified into a Low Resilience (LR), Normal Resilience (NR), and High Resilience (HR) to determine differences in PROMs. Resiliency groups were determined by BRS score tertiles (LR < 22, NR 22-24, HR >24).

Results
In comparing the LR and HR groups, there was a significant positive correlation with resilience and all PROMs both pre-operatively and post-operatively (p<0.050), with the exception of the HOS-Sports (p=0.055/p=0.258). Resilience was not related to the amount of improvement between the pre-operative and post-operative evaluation. At 6-month follow up, 57% of the LR group, 82% of the NR group, and 100% of the HR group had returned to sport (p=0.017). Additionally, anxiety/depression were negatively related to resilience (p=0.039).

Conclusion
The higher a patient’s resilience, the more likely they are to return to sport 6-months post-operatively. Additionally, those with high resilience can be expected to report better PROMs pre and post operatively. Additionally, they are less likely to have a history of anxiety/depression. The BRS is a simple screening tool to help counsel patients on their expected outcomes.
EP17.63 Differences in radiographic measurements on standing versus supine pelvic radiographs

Dr Andrea Spiker1, Dr Ryan Graf1, Sean Duminie1, Dr Stephanie Kliethermes1, Dr David Goodspeed1

1University Of Wisconsin - Madison, Madison, United States

Purpose
Accurate pelvic radiographic measurements is of clear clinical importance, as these measurements can drive the indications for surgery, the surgical approach utilized, and/or the degree of correction during hip preservation surgery. Currently, there are a large number of measurements available and reported on the literature when referencing anterior-posterior (AP) pelvic radiographs. However, there is no standardization of whether these pelvic radiographs are obtained in the standing or supine position. Our goal was to determine the differences in standing versus supine pelvic radiographs in our population of hip preservation patients.

Methods
All new patients who presented for evaluation of hip pain between September 2016 and July 2018 were retrospectively reviewed. Inclusion criteria included age 18-50, no prior hip surgery/injury, and both standing and supine AP pelvis radiographs dated within 2 years of each other. Measurements were obtained on 26 radiographs (52 hips), blinded to patient demographics and standing versus supine radiograph. Measurements included minimum joint space, lateral centre edge angle (LCEA), acetabular depth, acetabular inclination, Tonnis Grade, crossover sign, posterior wall sign, ischial spine sign.

Results
Standing films resulted in significantly lower LCEA and acetabular depth measurements, and higher acetabular inclination. Supine measurements for crossover sign were 5.69 times more likely to be positive than standing measurements. Similarly, supine measurements for ischial spine were 7.93 times more likely to be positive.

Conclusion
Based on our study, supine films are almost 6 times more likely to give a positive crossover sign and almost 8 times more likely to give a positive ischial spine sign than a standing film in the same patient. Additionally, LCEA, acetabular depth will be lower and acetabular inclination will be higher on standing films. As such, our recommendation is to obtain standing AP pelvis radiographs to obtain the most accurate pelvic radiographic measurements in hip preservation patients.
Nonoperative management of posterior wall fractures of the acetabulum in NFL players

Mr. James Spratt, Dr Brian Samuelsen, Dr Matthew Crawford, Dr Marc Philippon

Steadman Philippon Research Institute, Atlanta, United States

Biography

Originally from Northeast Pennsylvania, Dr Samuelsen graduated from Union College in Schenectady, NY with a B.S. in Biology and a minor in Economics. In college, he was a four-year member of the men’s varsity crew team. After college, he earned a Masters of Business Administration with a focus on healthcare management at Union University, and subsequently worked for two years as a Health Systems Specialist at the Albany VA Medical Centre. He attended Temple University School of Medicine in Philadelphia, Pennsylvania, where he graduated with honours while discovering his interest in orthopaedics.

Dr Samuelsen completed his residency at the Mayo Clinic in Rochester, Minnesota where he was also chosen as an American Orthopaedic Association (AOA) resident leader and emerging leader. While at the Mayo Clinic, he provided physician coverage for the John Marshall high school football team, the Rochester Ice Hawks junior league hockey team, and assisted with both Minnesota Timberwolves and Minnesota Twins coverage. His research interests at the Mayo Clinic included anterior cruciate ligament injuries, meniscus repair, and shoulder arthroplasty. This research has been presented both nationally and internationally.

While acetabular fractures are rare occurrences in contact sports, management of the ensuing pathology presents a myriad of challenges for the treating physician, especially in the professional athlete. Time off directly impacts patients’ livelihoods and a speedy return to play must be balanced with restoration of joint congruity and rehabilitation of the surrounding musculature. The additional trauma of surgery plus the additional convalescence time must be carefully weighed when deciding between operative and nonoperative management. This series presents the cases of four NFL football players who were treated nonoperatively for posterior wall acetabular fractures.

A running back, wide receiver, line backer, and place kicker suffered posterior wall fractures due to various forces placed on a flexed hip in a game or during training. All patients were evaluated by the senior author with a CT or MRI. Fragment depth ranged from 15-20% using the Keith method and 18-23% using the Moed method. Two players with concerning displacement underwent exam under anaesthesia (EUA) to confirm stability of the fragment.

While no players required reduction and fixation of the fragment, one player underwent labral repair and loose body removal via hip arthroscopy a month after the injury. Players were monitored with serial radiography of the hip and managed with partial weightbearing and physical therapy. All players injured during the season returned to play the following season. One player injured prior to training camp was able to return before the start of the season. All players were able to return to preinjury levels of statistical production following the injury.

This case series demonstrates that carefully selected patients with posterior wall fractures of the acetabulum can be managed nonoperatively to good effect.
EP17.65 Medial joint space may be a predictor of arthritic changes following hip arthroscopy for symptomatic labral tears.

Dr Yoshinori Takashima¹, Dr Shingo Hashimoto¹, Dr Tomoyuki Matsumoto¹, Dr Shinya Hayashi¹, Dr Koji Takayama¹, Dr Yuichi Kuroda¹, Dr Masanori Tsubosaka¹, Dr Tomoyuki Kamenaga¹, Prof Ryosuke Kuroda¹

¹Kobe University Graduate School of Medicine, Kobe Tyuouku kusunoki cho 7-5-1, Japan

Introduction
Arthritic change following hip arthroscopy for femoroacetabular impingement (FAI) and symptomatic labral tears leads to lower clinical outcomes. The purpose of this study was to report clinical outcomes and arthritic changes two-years after arthroscopy treatment for symptomatic labral tears.

Patients and Methods
In this study, we analysed 43 hips treated with arthroscopy for symptomatic labral tears retrospectively. The patients were followed for a minimum of two years after surgery. Anteroposterior pelvic radiographs were used to measure the joint spaces at three locations (medial: above the level of the fovea, centre: middle of the sourcil, lateral: the lateral edge). We compared preoperative joint space to those at two years after surgery each three locations. We divided them into two groups: one is 24 hips with no change of the joint space (group A) and the other is 19 hips with joint narrowing at least one location (group B). Tönnis grade,
bone sclerosis, acetabular osteophytes, radiological index of FAI and acetabular dysplasia were compared between the two groups. The range of motion, Modified Harris Hip Score (MHHS) and complications at two years after surgery were also statistically compared between the two groups.

Results
The mean age of group B was significantly older than that of group A (p=0.007). Preoperative Tönnis grade of group B and two years after surgery was significantly higher than that of group A (p=0.01 and 0.004). Medial joint space at before and two years after surgery of group B was smaller than that of group A (p=0.007 and 0.003), while no significantly differences in centre and lateral joint spaces. There was no significant difference in ROM, MHHS and other radiographically measurements between the two groups. Three hips (7.0%) were converted to THA and 1 hip (2.3%) underwent revision hip arthroscopy within two years.

Conclusions
The major finding of this study is that the patients who proceeded osteoarthritis after arthroscopy were older patients and smaller medial joint space. Medial joint narrowing might be a risk factor that affects clinical results after arthroscopy. We have to pay attention to not only centre joint narrowing but also medial joint narrowing.
EP17.66 Outcomes of hip arthroscopy in pre-operative opioid users
MD Mikhail Zusmanovich¹, BS MBA Kamali Thompson¹, MD Abigail Campbell¹, MD Thomas Youm¹
¹Nyu Langone Health, New York, USA

Biography
Dr Thomas Youm is a Board-Certified Orthopaedic Surgeon who specializes in the treatment of athletic injuries and performs arthroscopic and reconstructive surgery of the hip, shoulder, elbow and knee. Dr Youm has published over 50 articles and has over 50 presentations at numerous national meetings on the topics of orthopaedic sports medicine. He is a Clinical Assistant Professor at the NYU School of Medicine where he teaches both medical students and orthopaedic residents. Dr Youm has twice won the Teacher of the Year Award which is voted and determined by the graduating class of orthopaedic chief residents. He is one of the main instructors for the sports medicine fellows at NYU Langone Orthopaedic Hospital. He is currently Director of Hip Arthroscopy and, in this role, he runs the clinical research for hip arthroscopy at NYU. He is a member of the Hip Centre and the Sports Medicine department at the NYU Langone Orthopaedic Hospital.

Background
The opioid epidemic has become an increasingly significant cause of morbidity and mortality throughout the United States. Unfortunately, opioids have been increasingly misused in healthcare, resulting in the negative effects of dependence and deadly overdoses. The purpose of this study is to compare patient reported outcomes between opioid naïve hip arthroscopy patients and preoperative opioid users to determine the effects of prolonged usage.

Methods
This is a single-centre, retrospective analysis comparing pre- and postoperative patient reported outcome scores between preoperative opioid users and opioid naïve patients. Medical records were reviewed for demographics, operative variables, and preoperative pain scores. The modified Harris Hip Score (MMHS) and Nonarthritic Hip Score (NAHS) were recorded from the preoperative, 1–month, 6-month, 1 and 2-year visits. The visual analogue scale (VAS) was recorded from the 2-week, 6-month, and 1-year visits.

Results
Forty-two patients who underwent hip arthroscopy between November 2010 and October 2016 were enrolled. Twenty-one patients (52.0 ± 9.4years) were preoperative opioid users and 21 opioid naïve patients (50.5 ± 12.6years) were age and sex matched. The control cohort had a higher VAS preoperatively (\(p<0.01\)), however the study cohort had a higher VAS at the 6-month (\(p<0.01\)) and 1-year visits (\(p<0.01\)). Notably, the study cohort was prescribed higher levels of oral morphine equivalents pre-operatively (\(p<0.01\)), and 1-year (\(p<0.01\)) and 2-year postoperatively (\(p<0.01\)). The opioid naïve cohort reported a lower NAHS score and more pain preoperatively (less than \(p=0.01\)). Following surgery, the control cohort reported higher NAHS scores at all time points. The control cohort demonstrated lower MMHS scores preoperatively, but increased postoperatively, especially at the 2-year visit (\(p<0.01\)). After 2 years, 3 patients (14.3%) in the control cohort were using opioids, while 13 previous opioid users (62%) had at least 1 active opioid prescription.

Discussion/Conclusion
Opioid naïve patients undergoing hip arthroscopy may have higher pain and disability preoperatively but surpass their counterparts in self-reported outcomes scores postoperatively. Additionally, preoperative opioid users are likely to continue using opioid medications postoperatively at significantly higher doses. As a result, institutions should continue to standardize algorithms and provide adjunct medications to limit narcotic use.
EP17.67 Pelvofemoral flexion test- Hip deep flexion with pelvic posterior tilting is associated with preoperative patient-related outcomes and hip flexion strength: A cohort study

PT Satoshi Tateishi1, PT Makoto Takahashi1, PT Shuto Higuchi1, Dr Akiko Hachisuka1, Dr Hajime Utsunomiya1, Dr Soshi Uchida1
1Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu, Japan

Biography
In my first period of professional career (14 years), I had been working as a physical therapist. I have specialized in sports medicine from 2011 to 2019. I performed physical therapy for groin pain patients. The subjects were postoperative patients and conservative care patients. For athletes, the goal is to get a quick return and a physical function to avoid recurrence. In addition, I have involved in clinical researches about Femoroacetabular impingement and sub spine impingement. The manuscript on the relationship between sub spine impingement and muscle strength was published in KSSTA 2018.

Background
In the pelvifemoral rhythm, it has been reported that posterior pelvic tilting contributes 20 to 30% of total hip flexion angle. Hip flexion larger than 120° can be achieved by adequate pelvic tilt, which may result in higher performance of the hip.

Hypothesis
Patients who can flex hip larger than 120° have better preoperative patient-related outcome scores (PROSs) and flexion strength.

Methods
202 patients undergoing hip arthroscopy between 2015 and 2018 were enrolled. Patients with lateral centre edge angle less than 25 degrees, osteoarthritis (Tönnis grade >1), osteochondromatosis, trauma, and with previous ipsilateral hip surgery, were excluded. Pelvifemoral flexion test (PFT) was devised; hip flexion was examined in the lateral decubitus position, and total hip flexion angle less than 120° was diagnosed positive. Hip flexion strength was measured preoperatively using a handheld dynamometer. Preoperative modified Harris Hip Score (mHHS), Nonarthritic Hip Score (NHS), and a short version of the International Hip Outcome Tool (iHOT-12) were obtained preoperatively. Data was presented by mean [SD] and Student t-test was used.

Results
92 patients (57 males and 35 females, 31.6[15.9] year-old) were investigated. PFT was positive (<120°) in 39 patients (42%). PFT positive patients had significantly weaker hip strength on the affected side than PFT negative patients (N/kg, 1.9[0.8] v 2.8[1.1], p=0.001). Preoperative PROSs in PFT positive patients were significantly lower compared to those in PTF negative patients (mHHS, 63.9[16.9] v 79.2[16.3], p<0.001, NHS, 57.9[20.1] v 73.6[16.4], p<0.001, iHOT-12, 37.5[23.5] v 49.7[20.9], p=0.016). There were no differences between PFT positive and negative regarding radiographic measurements.

Conclusion
Patients who can flex hip larger than 120° preoperatively had stronger flexion power and better PROSs preoperatively compared to those whose flexion angle less than 120°. PFT is an efficient tool to diagnose an adequate pelvofemoral rhythm, which is associated with higher PROSs and hip flexion strength.
The Iliocapsularis muscle adjoins the medial branch of the iliofemoral ligament: A histologic anatomy study

Dr Hajime Utsunomiya1, Mr Masahiro Tsutsumi2, Ms Alex Scibetta1, Dr Akimoto Nimura2, Dr Soshi Uchida3, Dr Johnny Huard1, Dr Keiichi Akita2, Dr Marc J Philippon1

1Steadman Philippon Research Institute, Vail, United States, 2Tokyo Medical and Dental University, Tokyo, Japan, 3Wakamatsu Hospital of University of Occupational and Environmental Health, Kitakyushu, Japan

Biography
In my first period of professional career, I had been working as an orthopaedic surgeon including my PhD school years. After basic training of orthopaedics including trauma, joint replacement, and spine surgery, I have specialized in sports medicine from 2009. In 2013, I earned PhD degree in Medical Science. As an MD PhD researcher, I have worked on dozens of sports medicine-related clinical studies and researches for translational medicine. As an international research fellow at Steadman Philippon Research Institute between 2016 and 2019, I had been working on hip arthroscopy-related biomechanical studies and clinical outcome studies. From April 2019, I started to practice at Wakamatsu hospital of University of Occupational and Environmental Health, Kitakyushu, Japan.

Background
Hips with acetabular dysplasia or borderline acetabular dysplasia have thicker iliocapsularis muscles (ICMs) than normal hips. However, the hip’s anatomical and histological patterns of ICM insertion are not fully understood.

Hypothesis
The ICM adjoins the layer of the joint capsule histologically and contributes to the dynamic stability of the hip.

Methods
We used 10 hemi-pelvises in this study. Hips with acetabular dysplasia and femoroacetabular impingement-related bony morphology were excluded. The iliacus muscle and psoas muscle were identified and removed, and the ICM was isolated. The relationship between the ICM and hip capsule was macroscopically evaluated. The joint capsule of the hip under the ICM, obturator externus muscle (OeM), and obturator internus conjoint muscles (OiM) was histologically analysed and evaluated to determine if these muscles directly merge into the capsular fibre.

Results
Macroscopically, the ICM was observed in all hips and attached to the hip capsule along the medial branch of iliofemoral ligament. The medial branch of iliofemoral ligament appeared to extend to the zona orbicularis (ZO). Histologically, the ICM integrated into the capsular fibre in 21 out of 24 regions of interest (87.5%). The OeM and OiM also closely contacted the hip capsule macroscopically; however, there was a clear transition layer between the muscles and capsule in more than half of the specimens (compared to ICM, OeM, p = 0.02, OiM, p = 0.02, respectively, Fisher’s exact test).

Discussion/Conclusion
The ICM attached to the anterior hip capsule along the medial branch of iliofemoral ligament and histology demonstrated that the ICM adjoined the hip capsule. Based on the anatomical relationship between the medial branch of the iliofemoral ligament and ZO, the ICM may contribute to the active constriction force of the hip through the ZO. Further studies are required to identify biomechanically whether the dynamic constriction force exists and is maintained after an extended inter-portal capsulotomy anteriorly into the medial branch of the iliofemoral ligament and/or a T-capsulotomy during hip arthroscopy.
EP17.70 Exploring the validation of a Japanese version of the International Hip Outcome Tool 12: Reliability, validity, and responsiveness

Dr Nobuyuki Watanabe1,2, Dr Satona Murakami2,3, Prof. Soshi Uchida4, PT Satoshi Tateishi5, Dr Hidetsugu Ohara6, Prof Yasuhiro Yamamoto7, Dr Taiki Kojima8

1Tosei General Hospital, Seto, Japan, 2Department of Orthopaedic Surgery, Graduate School of Medical Sciences, Nagoya City University, Nagoya, Japan, 3Department of Rehabilitation Medicine, Graduate School of Medical Sciences, Nagoya City University, Nagoya, Japan, 4Department of Orthopaedic Surgery, Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu, Japan, 5Department of Rehabilitation Medicine, Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu, Japan, 6Department of Orthopaedic Surgery, Hirakata City Hospital, Hirakata, Japan, 7Department of Occupational Therapy, Health Science University, Minamitsuru-gun, Japan, 8Department of Anaesthesiology, Cincinnati Children’s Hospital Medical Centre, Cincinnati, USA

Background

The International Hip Outcome Tool 12 (iHOT12) was authorized by the Multicentre Arthroscopy of the Hip Outcomes Research Network (MAHORN). iHOT12 is increasingly being adopted in orthopaedic studies to report patient outcomes. This study aimed to develop a Japanese version of the International Hip Outcome Tools “iHOT12J”, and to establish its reliability, validity, and responsiveness.

Methods

To assess test-retest reliability, an identical set of patients reported outcome measures with five qualitative scoring measures including iHOT12; these were filled out by each patient twice. Reliability was explored using Cronbach’s alpha and intraclass correlation coefficient. The Bland-Altman plot was used to explore the absolute agreement. To evaluate validity, we examined the relationships between SF36 and iHOT12. Responsiveness was assessed by comparing the smallest detectable change to the minimal important change by applying an anchor-based approach.

Results

Fifty patients (51 joints) were analysed from March 2016 to October 2017 in Japanese four facility. The Cronbach α coefficient was 0.90 and the average value of intraclass coefficient (ICC) was 0.89. Bland-Altman plot analysis showed a solid agreement. Regarding the validity, the Spearman rank correlation coefficients were strong with PF (r = 0.69, p < 0.01), BP (r = 0.71, p < 0.01) and PCS (r = 0.69, p < 0.01). The smallest detectable change (3.19) was smaller than the minimum important change (12.40).
Conclusions
We developed iHOT12J, which seems to show sufficient reliability, validity, and responsiveness. We believe that this patient reported outcome measure is beneficial in studying Japanese patients with femoroacetabular impingement.
The best technique for leg length measurements pre and post total hip arthroplasty: What is the current evidence?

Dr Ori Weiss¹, Dr Sathisvaran Kanavathy², Dr Vikas Khanduja¹

¹Department of Trauma and Orthopaedics, Addenbrooke's Hospital, Cambridge University Hospitals NHS Foundation Trust, Box 37, Hills Road, Cambridge, CB2 0QQ, UK, ²Royal Melbourne Hospital, Melbourne, Australia.

Background

Leg-length (LL) discrepancy is one of the complications of THAs and has been a controversial subject of debate for decades. Currently, there are various techniques to measure the LL – without any consensus for the preferred method. The aim of the study was to systematically evaluate and summarise for the best LL measurement techniques pre and post total hip arthroplasty.

Methods

Following the PRISMA guidelines, computerized search was performed from inception until 1st November 2018 using major databases. A total of 47 studies were returned, representing 4402 patients that described and evaluated specific LL measurement methods used in pre and/or post total hip arthroplasty measurement.

Results

Clinical methods of measurement of LL are inexpensive, quick and easy to perform with good reliability. Other radiographic methods such as the Orth roentgenogram and tele roentgenogram that were described for LLD measurements required expertise that was more technical and increased the chance of errors attributable by magnification or distortion. The acquisition of LL measurement from some radiographic methods, like the EOS imaging, also required special scanners and equipment that were not practical and cost-efficient. The CT and MRI scanograms had the highest reliability and accuracy of measurement of LL. CT scanograms are obtained from a scout view that was relatively inexpensive, had a short study acquisition time and able to visualize long bones, factor in contractures and limb rotation.

Conclusions

Our study shows that the CT scanogram, providing excellent reliability and reproducibility, should be the preferred method for assessing LLD pre and/or post total hip arthroplasty whilst AP radiographs remain more prevalent in clinical use given its increased accessibility. Clinical methods, in addition to physical examination and gait analysis, should also be adopted. In patients deemed to have no LLD preoperatively, a plain AP pelvic radiography may be sufficient to compare postoperatively LLD changes.
Patients with femoroacetabular impingement syndrome have altered gait mechanics in the sagittal plane compared to normal controls

Dr James Wylie¹, Dr Jennifer Marland¹, Dr Hugh West¹, Dr Caitlin Miller¹, Dr Tristin Turner¹, Dr William McDermott¹

¹The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

Introduction

Femoroacetabular impingement syndrome (FAIS) is a functional condition that combines abnormal anatomy with abnormal functional motions of the hip and pelvis. While much is known about the anatomic abnormalities predisposing to FAIS, the functional motions that lead these anatomic abnormalities to become symptomatic are less well understood. We hypothesized that when comparing FAIS patients to normal controls, we would find abnormalities in gait mechanics between the groups.

Methods

A retrospective analysis of patients who underwent a broad lower extremity functional assessment using a 10-camera 3D motion capture system, instrumented force treadmill and in-ground force plates. Current data reported are of gait analysis while walking at 3.5 miles per hour on an instrumented force treadmill. Group 1 consisted of patients with FAIS in the preoperative period before surgery that had failed conservative measures for their FAIS. Groups 2 consisted of normal health controls without hip pain. Differences between group were compared with student t-tests.

Results

Group 1 consisted of 103 patients (43 males, 60 female) with an average age of 32.0 years. Group 2 consisted of 69 patients (32 males, 37 female) with an average age of 19.1 years. Patients with FAIS were found to have greater peak posterior pelvic tilt (p=0.0002) with greater overall pelvic ROM (p=0.0398), greater peak hip flexion (p=0.046), lower peak hip extension (p=0.0004) during the stance phase of the gait cycle compared to the healthy controls.

Conclusions

Patients with symptomatic FAIS have altered gait mechanics in the sagittal plane compared to normal controls. This is consistent with prior evidence suggesting that sagittal plane hip kinematics and strength is associated with symptomatic FAIS.
EP17.73 Arthroscopic excision of intra-articular osteoid osteoma of the hip: A case series

Dr Yan Xu
The Third Hospital of Peking University, Beijing, China

Purpose
Intra-articular osteoid osteoma (IAOO) of the hip is a relatively rare disease. Previous treatments included open surgical hip surgery, percutaneous radiofrequency ablation (RFA) etc. As the developing of arthroscopy technique, there are multiple case reports of osteoid osteoma (OO) in the hip, we present the largest case series of hip osteoid osteoma treated with hip arthroscopy and discuss the outcomes after treatment with hip arthroscopy.

Methods
We retrospectively identified patients diagnosed with IAOO of the hip with confirmatory computed tomography, magnetic resonance imaging or biopsy diagnoses of OO. Twenty-three patients underwent excision with hip arthroscopy. Of the 23 patients, 9 were underwent revision surgery with hip arthroscopy. We analysed lesion location, main presenting symptoms, symptom duration and improvements in modified Harris Hip Score (mHHS), and international Hip Outcomes Tool (iHot12) scores. For the revision cases, we analysed the misdiagnosis and the characteristic of progression of OO after first surgery.

Results
The most common presenting symptom was groin pain which can be relieved by NSAIDs, limited ROM. The aggravation of joint degeneration can be found in the revision cases. Significant improvements can be found in modified Harris Hip Score (mHHS), and international Hip Outcomes Tool (iHot12) scores in all cases.

Conclusion
Based on our experience, arthroscopy can be an effective, safety and less invasive treatment option for excision of intra-articular OO.
EP17.74 Arthroscopic treatment of internal snapping hip: Approach and results

Doctor Gang Chen¹, Master Hsueh Yang²
¹The West China College of Medicine, Sichuan University, Chengdu, China, ²The West China College of Medicine, Sichuan University, Chengdu, China

Biography
Doctor of Medicine(M.D.) ; Lecturer Associate chief physician Secretary of sports medicine committee of Sichuan medical association Secretary of arthroscopy group, orthopaedic committee of Sichuan medical association
Graduated from west China medical university. Engaged in sports medicine clinical and teaching work for a long time.

Background
Snapping hip, or coxa saltans is a palpable or auditory snapping with movement of the hip joint. As we know, there are three different types of snapping hip syndromes. External snapping hip syndrome is caused by friction between the iliotibial tract and greater trochanter of femur. Internal snapping hip syndrome is caused by friction between the iliopsoas tendon and iliopubic protuberance or the iliopsoas tendon and caput femoris. Intra-articular snapping hip is caused by intra-articular lesions, such as loose body, labral tear, ligamentum teres tear and so on. But how to deal with the internal snapping hip is in dispute.

Purpose
The aim was to find a proper approach for various internal snapping hip.

Methods
From January 20015 to December 2017, 15 internal snapping hip cases were included, the basic information was recorded. All cases were performed arthroscopic release in three different levels, including joint line, trans-capsular and lesser trochanter. All cases were followed for 12-36 months and evaluated with Harris score and Charnley score.

Results
There was no severe complication. All cases got good and excellent results at the end of follow-up. The range of motion was normal, and snapping was disappeared.

Conclusion
Arthroscopic release was an effective approach for internal snapping hip, but the methods are depending on the conditions. For a severe case, we strongly suggest multi-point release.

Key words
Internal snapping hip; release; arthroscope
EP17.75 Classification and prognosis of hip pigmented villonodular synovitis

Doctor Gang Chen¹, Master Yang Hsueh²
¹West China Hospital, Sichuan University, Chengdu, China, ²West China Hospital, Sichuan University, Chengdu, China

Biography
Doctor of Medicine(M.D.); Lecturer Associate chief physician Secretary of sports medicine committee of Sichuan medical association Secretary of arthroscopy group, orthopaedic committee of Sichuan medical association
Graduated from west China medical university. Engaged in sports medicine clinical and teaching work for a long time.

Background
The incidence of hip pigmented villonodular synovitis (PVNS) is second only to that of knee joint. The patients were often diagnosed in later stage with severe joint damage. The effect of surgical treatment to PVNS varies greatly with high rate of recurrence. By now, there is no proper classification with clinical value.

Purpose
To summarize the classification and prognosis of hip PVNS.

Method
Retrospective analysis was performed on 28 cases of hip PVNS in our department from January 2013 to December 2017. The images and intraoperative findings were recorded. According to the main sites of involvement, they were classified into three types, central, peripheral and mixed. According to the types, the synovium was rejected by multichannel arthroscopy. Some patients received radiotherapy after surgery. Routine follow-up was conducted, complications, symptom improvement, functional recovery and recurrence were recorded

Result
There were 4 cases of central type, 7 cases of peripheral type and 17 cases of mixed type in all 28 patients. All patients were followed up for 12-48 months. One patient had pudendal nerve palsy, one patient had lateral femoral cutaneous nerve palsy, and no other perioperative complications occurred. All patient symptoms had improved to varying degrees. The difference of VAS score and HSS score before and after operation was significant(P < 0.05).In the end of follow-up,6 patients had MRI confirmed recurrence, all of which belonged to mixed type, and the recurrence time was concentrated between 1-2 years.

Conclusion
Classification of hip PVNS is helpful to improve the accuracy of diagnosis and treatment. The 3 types may represent different stages or status of illness. The recurrence rate of mixed PVNS was significantly higher than the other two types.

Keyword
Hip joint; arthroscopy; pigmented villonodular synovitis; prognosis.
What can the simplified Chinese version of International Hip Outcome Tool (iHOT-12) revealed in young patient undergo hip arthroscopy?

Dr QingFeng Yin1, Dr Chunbao Li2
1The Second Hospital of Shandong University, Jinan, China, 2The PLA general hospital, Beijing, China

Biography
Young and pioneer hip arthroscopist in China

Background
iHOT12 is a simplified and valid patient self-report questionnaire designed for young patients with hip problems, the original English version could not be used for the non-English speaking patient. There is no standard simplified Chinese version of iHOT-12 for patients with a hip problem in the Chinese speaking region.

Purpose
This study is designed to translate and establish the simplified Chinese version of this questionnaire to assess the outcome of hip arthroscopy.

Method
We followed the Guillemin guidelines which including translation, back-translation, prefinal version, pre-test, and editing of the final version. The pre-final version was applied to 30 young patients with hip disorders and underwent hip arthroscopy.

Results
Some medical words with difficulties in understanding were replaced with simpler ones. The mean age of the patient was 39.4±6.7 years, the average BMI was 23.1±4.3. The average follow-up was 8.4 months. The preoperative total score was 11.6±21.4 on average, and the postoperative total score comes to 82.8±9.8. The sum of scores from the first 7 questions which could indicate the function of the hip was prompted from 48.1±13.9 preoperatively to 94.3±3.7 postoperatively. Meanwhile, the sum of scores from the last 5 questions which show the social and psychological condition of patient prompted from 63.5±8.6 preoperatively to 88.5±6.7 postoperatively.

Conclusion
The simplified Chinese version of the International Hip Outcome Tool (iHOT-12) could be well understood and accepted by Chinese patients. The follow-up with this self-report questionnaire indicated that hip arthroscopy makes a more obvious promotion of hip function rather than that of the social and psychological condition for young patients with a hip problem.
EP17.77 Mid-term patient reported outcomes of hip arthroplasty following prior hip arthroscopy: A matched case-control study with minimum 5-year follow-up

Dr Philip Rosinsky¹, Jeffrey Chen¹, Dr Jacob Shapira¹, Dr David Maldonado¹, Dr Ajay Lall¹, Dr Benjamin Domb¹

¹American Hip Institute, Chicago, United States

Background
Prior studies have examined minimum 2-year patient reported outcomes (PRO) of hip arthroplasty in patients who had undergone prior ipsilateral hip arthroscopy (PA) with conflicting results. We report on minimum 5-year patient reported outcomes and complications from a single institution.

Methods
Thirty patients (32 hips), who had undergone arthroplasty following prior arthroscopy, were matched to 93 control patients (96 hips) (MC). Patient reported outcomes, postoperative complications, and reoperation rates were compared at minimum 5-year follow up. Outcomes at two years were compared to evaluate for a time-dependent trend. Lastly, a subgroup comparison of outcomes based on anterior or posterior approaches was performed, both within the PA group and between the PA and MC groups.

Results
At minimum 5-year follow up for the PA and MC, no significant differences were found with respect to HHS (90.75 ± 11.19 vs 87.68 ± 15.67; p=0.23), FJS (82.03 ± 17.37 vs 78.95 ± 25.60; p=0.45), or patient satisfaction (8.78 ± 2.01 vs 8.70 ± 2.55; p=0.74). No significant differences were found regarding rates of revision arthroplasty (RR = 3.0, CI-95% = 0.44 – 20.4) or postoperative complications (RR = 2.0, CI-95% = 0.35–11.43). Comparisons across time points showed that the PA group exhibited significantly lower outcome scores at 2-years but reached comparable scores at 5 years. No significant differences in PROs were found based on arthroplasty approach.

Conclusion
This study is the first to report on 5-year outcomes of hip arthroplasty following prior ipsilateral hip arthroscopy. Results of this study show that while at two years the patients with a prior arthroscopy have inferior outcomes compared to a control group, by five years there are no significant differences in PROs. While not significant, a concern for higher rates of revisions may exist in patients with a prior arthroscopy.
EP19.1 Defining the MCID, PASS and SCB for arthroscopic hip preservation surgery at minimum five-year follow-up

Dr Benedict Nwachukwu¹, Dr Edward Beck¹, Mr. Kyle Kunze¹, Dr Jorge Chahla¹, Mr. Jonathan Rasio¹, Dr Shane Nho¹

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

Background
Minimal clinically important difference (MCID), substantial clinical benefit (SCB) and patient acceptable symptomatic state (PASS) are important variables in the orthopaedic outcome’s literature. In hip preservation surgery it is unknown what represents meaningful patient reported outcome improvement in the medium to long-term. The purpose of this study was to define MCID, PASS and SCB at five years post hip arthroscopy for femoroacetabular impingement syndrome (FAIS). Secondarily, we evaluated the time dependency of MCID, PASS and SCB.

Methods
Patients undergoing hip arthroscopy for FAIS between January 2012 and March 2014 were included. MCID, PASS, and SCB were calculated for each outcome score at 1-, 2-, and 5- years. MCID was calculated using a distribution-based method while PASS and SCB were calculated using an anchor method. Outcomes included the hip outcome score—activities of daily living (HOS-ADL), sports-subscale (HOS-SS), modified Harris hip score (mHHS), and international hip outcome tool–12 (iHOT-12).

Results
Two hundred and eighty-three patients were included with an average age of 34.2+11.9 years. The one year, two year and five-year MCID scores were as follows respectively: HOS-ADL (8.8, 9.7, 10.2); HOS-SS (13.9, 14.3, 15.2); mHHS (6.9, 9.2, 11.4) and iHOT-12 (15.1, 13.9, 15.1). PASS scores were as follows: HOS-ADL (89.7, 88.2, 99.2); HOS-SS (72.2, 76.4, 80.9); mHHS (84.8, 83.3, 83.6) and iHOT-12 (69.1, 72.2, 74.3). SCB scores were as follows: HOS-ADL (89.7, 91.9, 94.6); HOS-SS (78.1, 77.9, 85.8); mHHS (86.9, 85.8, 94.4) and iHOT-12 (72.6, 76.8, 87.5). More patients achieved MCID, SCB and PASS at two-year follow-up than at one-year follow-up. However, 79.3% of the patients achieved MCID at 5 years.

Conclusion
The greatest proportion of patients achieve clinically significant outcome improvement at two-year follow-up post arthroscopic treatment of FAIS. Improvements are maintained at five-year follow-up although there is a slight decrease in the proportion of patients achieving clinical significance.
EP19.2 High preoperative expectations are associated with achieving clinically significant outcome improvement after hip arthroscopy for femoroacetabular impingement syndrome

Dr Jorge Chahla¹, Dr Edward Beck¹, Dr Benedict Nwachukwu², Mr. Thomas Alter¹, Dr Joshua Harris², Mr. Jonathan Rasio¹, Dr Shane Nho¹

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States, ²Department of Orthopaedic Surgery, Houston Methodist, Houston, United States

Purpose
To determine expectations of patients undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS) and the relationship between preoperative patient expectation, postoperative satisfaction and overall patient reported outcome.

Methods
Patients who underwent hip arthroscopy for FAIS completed the validated Hip Preservation Surgery Expectations Survey (21 questions; 0-100 range), as well as multiple patient reported outcomes (PROs) prior to surgery. High expectation was defined as an expectation score greater than one standard deviation above the mean. Patients with osteoarthritis, dysplasia, and those having undergone previous hip surgery were excluded. At one year postoperatively, patient satisfaction and PROs were assessed. Univariable and multivariate analyses were performed.

Results
One-hundred and fifty-three subjects (mean age 34.4+12.6 years, female: 114(71.3%), BMI: 25.9+5.3 kg/m2) participated. The mean expectation score was 84.5+12.3. Significant correlations were observed between high expectation scores (>96.7) and achieving the minimal clinical important difference (MCID) for the modified Harris Hip Score (mHHS) (r=0.339; p=0.043) and Patient Acceptable Symptomatic State (PASS) for Hip Outcome score–Activities of Daily Living (HOS-ADL) (r=0.207; p=0.032). There were no significant correlations between high expectation scores and preoperative or postoperative PROs or patient satisfaction. Regression analysis demonstrated that patients with high expectations were 7.3 times more likely to achieve PASS HOS-ADL compared to those who were in the normal expectations group.

Conclusions
Patients with high preoperative expectations are more likely to achieve postoperative clinically significant outcome improvement. However, preoperative expectations are not associated with postoperative satisfaction. Our study findings suggest therefore that high patient expectations have a positive clinical predictive value. Patients with normal expectations for surgery may benefit from preoperative counselling and decision-making aids to attenuate the risk for diminished clinical outcome.
EP19.4 Patient kinesiophobia and pain catastrophization affect patient recovery and return to activity after hip arthroscopy for femoroacetabular impingement syndrome

Dr Edward Beck Beck¹, Mr. Ian Clapp¹, Dr Benedict Nwachukwu¹, Mr. Jonathan Rasio¹, Dr Shane Nho¹
¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago,

Background
The rate of recovery and overall outcome after orthopaedic procedures varies among patients and are highly influenced by psychological factors such as kinesiophobia and pain perception.

Purpose
To 1) identify whether patient kinesiophobia and pain catastrophizing scores are correlated with patient reported outcomes (PROs) after undergoing hip arthroscopy for FAIS, and 2) determine whether preoperative kinesiophobia and pain catastrophizing scores are predictive of achieving minimal clinically important difference (MCID).

Methods
Patients undergoing primary hip arthroscopy for treatment of FAIS between 12/2016 and 03/2017 were prospectively enrolled. Patients received the Tampa Scale of Kinesiophobiia-11 (TSK-11) and Pain Catastrophizing Scale (PCS) questionnaires preoperatively, 6-months, and 1-year postoperatively. They also received the hip-specific PRO questionnaires preoperatively and 1 year postoperatively. The threshold for achieving minimal clinically important difference (MCID) was determined for each of the standard hip form and analysed for correlation with PCS and TSK-11. ROC curve analysis was performed to determine whether preoperative scores were predictive of achieving MCID.

Results
A total of 85 patients (64 females; age, 33.7±12.4 years; BMI, 24.4±3.9) were prospectively enrolled in the study. At one-year follow-up, there was a significant reduction in TSK-11 scores (26.22 ± 5.99 to 18.70 ± 6.49; p<0.001) and PCS scores (17.81 ± 10.13 to 4.77 ± 7.57; p<0.001) when compared to preoperative scores. There was a negative correlation between1-year TSK-11, PCS, and all 1-year PRO scores (p<0.05 for all). 87.3% of patients achieved any MCID at 1-year postoperatively, with 1-year PCS scores averages in the MCID achieving group being significantly lower than those in the group not achieving MCID (3.2±4.4 vs. 10.8±15.2; p=0.006). ROC curve analysis was not statistically significant (p>0.05) and unable to demonstrate preoperative TSK-11 and PCS scores predictive of achieving MCID.

Conclusion
Patient kinesiophobia and pain catastrophizing at 1-year postoperatively are inversely correlated with 1-year hip-specific PROs following hip arthroscopy for the treatment of FAIS, and patients with less pain catastrophizing at 1-year postoperatively are more likely to achieve MCID. However, preoperative kinesiophobia and pain catastrophizing score were not predictive of patients achieving meaningful clinical outcomes.
Background
Hip arthroscopy has become an important tool for surgical treatment of intra-articular hip pathology. Predictive models for clinically significant outcomes in all-comers undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS) are unknown.

Purpose
To build a predictive model of preoperative variables for achieving Minimal Clinically Important Differences (MCID) at 2-years after undergoing hip arthroscopy for FAIS.

Methods
Data was analysed for patients who underwent hip arthroscopy for FAIS by a high-volume, fellowship-trained surgeon between 01/2012-07/2016. The MCID cut offs for HOS-ADL, HOS-SS, and mHHS were 9.8, 14.4, and 9.14, respectively. Predictive models for achieving MCID with respect to each were built using the LASSO (least absolute shrinkage and selection operator) algorithm for feature selection followed by Logistic Regression on the selected features. Study data were analysed using Patient IQ, a cloud-based research and analytics platform for healthcare.

Results
Of 1,103 patients who met inclusion criteria, 898 (81.4%) had a minimum of 2-year reported outcomes and were entered into the modelling algorithm. A total of 73.9%, 73.5%, and 79.9% met the HOS-ADL, HOS-SS, and mHHS threshold scores for achieving MCID. Predictors of not achieving the HOS-ADL MCID included anxiety/depression, symptom duration for > 2 years before surgery, age 30-45 years, obesity, high preoperative HOS-ADL score, and preoperative hip injection (all p<0.05). Predictors of not achieving the HOS-SS MCID included anxiety/depression, preoperative symptom duration for > 2 years, high preoperative HOS-SS score, and preoperative hip injection, while running at least at the recreational level was a predictor of achieving MCID HOS-SS (all p<0.05). Predictors of not achieving the mHHS MCID included history of anxiety or depression, high preoperative mHHS score, and hip injections, while being female was predictive of achieving MCID (all p<0.05).

Conclusions
This study identified predictive variables for achieving clinically significant outcome after hip arthroscopy for FAIS. Patient factors including anxiety/depression, symptom duration >2 years, preoperative intra articular injection and high preoperative outcome scores are most consistently predictive of inability to achieve clinically significant outcome. These findings have important implications for shared decision-making algorithms and managing preoperative expectations following hip arthroscopy for FAI.
EP19.6 Preoperative performance of PROMIS in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome

Dr Benedict Nwachukwu¹, Dr Edward Beck¹, Mr. Reagan Chapman¹, Dr Kelechi Okoroha¹, Mr. Jonathan Rasio¹, Dr Shane Nho¹

¹Chicago, Chicago, United States

Purpose
To investigate the psychometric performance of Patient-Report Outcome Measurement Information System (PROMIS) compared to legacy patient reported outcome measures (PROMs) in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS).

Methods
Data from consecutive patients who underwent primary hip arthroscopy between January 2018 and December 2018 with routine capsular closure for the treatment of FAIS were analysed. Baseline data, including preoperative PROMs and demographics were recorded. PROMs included PROMIS Physical Function (PROMIS PF), Hip Outcome Score (HOS), modified Harris Hip Score (mHHS), the international hip outcome tool 12 questions (i-HOT 12) and veterans Rand 12 item health survey (VR-12). A multivariate linear regression analysis was used to identify preoperative predictors of having higher preoperative PROMIS scores.

Results
197 patients with an average age and BMI of 32.8+12.6 years and 25.7+5.6 kg/m2 respectively were included in the final analysis. There were no ceiling or floor effects for the PROMIS PF score observed in the study group. PROMIS PF scores demonstrated excellent correlation with HOS-ADL (r=0.801; p<0.001), very good correlation with mHHS (r=0.721; p<0.001), and iHOT-12 (r=0.722; p<0.001) and good correlation with HOS-SS (r=0.675; p<0.001). PROMIS PF also demonstrated very good correlation with VR-12 Mental (r=0.721; p<0.001), good correlation with VR-12 Physical (r=0.618; p<0.001) and poor correlation with a visual analogue scale for pain (r=-0.365; p<0.001). Physically active patients were more likely to have a higher preoperative PROMIS score (β=3.216; p=0.004). Lower PROMIS scores were found in patients with higher BMI (β=-0.236; p=0.005), and females (β=-2.608; p=0.014).

Conclusion
In preoperative patients with FAIS, PROMIS PF demonstrated excellent to good correlation with legacy hip specific instruments. No ceiling or floor effects were identified. PROMIS PF demonstrated the weakest correlation with the HOS Sport Specific Subscale. Regular physical activity, BMI, and gender are predictors of pre-operative PROMIS scores in our patient population.
EP19.7 Does failure to meet threshold scores for mHHS and iHOT-12 correlate to reoperations following hip arthroscopy?

**Dr Philip Rosinsky**, Jeffrey Chen, Dr David Maldonado, Dr Jacob Shapira, Dr Ajay Lall, Dr Benjamin Domb

1American Hip Institute, Chicago, United States

Biography
Dr Philip Rosinsky is an orthopaedic surgeon at the American Hip Institute who specializes in joint replacement and hip arthroscopy.

Background
The minimal clinical important difference (MCID), substantial clinical benefit (SCB), and the patient acceptable symptom state (PASS), have been determined for common PROMS in patients undergoing hip arthroscopy. However, attaining these thresholds has not been assessed in its relation to surgical outcomes such as future hip reoperations.

Purpose
To determine: (a) if failing to achieve a patient reported outcome (PRO) threshold at 1-year could predict reoperations at minimum 2-year follow up and (b) to find the relative risk (RR) of reoperation in patients who do not achieve certain PRO thresholds.

Methods
Inclusion criteria for this study were patients who underwent primary hip arthroscopy between July 2014 and December 2016. Included patients had recorded pre-operative and post-operative modified Harris Hip Score (mHHS) and international Hip Outcome Tool – 12 item (iHOT-12) scores at 1-year follow-up, as well as documented reoperation surgery status at minimum 2 years. Patients were categorized based on their ability to achieve thresholds of minimal clinical important difference (MCID), substantial clinical benefit (SCB), and patient acceptable symptom state (PASS) for mHHS and iHOT-12. The sensitivity, specificity, accuracy, and relative risk of these thresholds as a predictor for reoperation was calculated.

Results
Of the 593 hips that met eligibility, 548 hips (92.4%) had complete follow-up. For mHHS, 418 (76.3%), 268 (48.9%), and 406 (74.1%) hips met MCID, SCB, and PASS, respectively. For iHOT-12, 432 (78.8%), 340 (62.0%), and 368 (67.2%) hips met the respective thresholds. The highest sensitivity, specificity, and accuracy were identified as the iHOT-12 PASS (0.64), iHOT-12 MCID (0.81), and iHOT-12 MCID (0.78), respectively. Modified Harris Hip Score PASS (RR = 4.11) was identified as having the highest RR, whereas SCB generally produced lower sensitivity, specificity, and accuracy.

Conclusion
In a novel approach of PRO threshold score utilization, this study identified patients at increased risk of reoperations following primary hip arthroscopy, notably those who do not achieve MCID or PASS for either mHHS or iHOT-12. The most accurate predictor of reoperation (0.78) was not achieving MCID of iHOT-12, while the highest RR for reoperation was not achieving PASS for mHHS (4.11).
EP19.8 Factors associated with pain catastrophizing in hip arthroscopy

Dr Guillaume Dumont1, Dr Travis Menge2, Mrs Nicole Battle1, Mr Zachary Thier1
1University Of South Carolina School of Medicine, Columbia, United States, 2Spectrum Health Medical Group, Grand Rapids, USA

Introduction
Hip arthroscopy for symptomatic femoroacetabular impingement (FAI) has been shown to yield good mid-to long-term outcomes. Pain catastrophizing has been described as an exaggerated negative mental state in response to an actual or anticipated painful experience, and this may significantly impact patient reported outcome (PRO) scores. The purpose of this study was to determine which factors, if any, are associated with increased scores on the Pain Catastrophizing Scale (PCS).

Methods
Patients who underwent primary hip arthroscopy for symptomatic labral tears and/or FAI by a single surgeon from May 2018 to March 2019 were retrospectively analysed. Patients were included if they completed a standard preoperative PRO questionnaire, including the PCS. Patient specific variables including age, gender, BMI, tobacco use, preoperative opioid use, number of allergies, and mental health diagnoses were recorded. Multiple linear regression was performed to assess for a relationship between these factors and the PCS score.

RESULTS: 84 patients met inclusion criteria and were included in this study. The mean preoperative PCS score was 16 (range 0 - 50). Multiple linear regression demonstrated a statistically significant positive association between the PCS score and both SF-12 PCS (p=0.011) and SF-12 MCS (p<0.001). Age, gender, BMI, tobacco use, preoperative opioid use, number of allergies, and mental health diagnoses were not significantly associated with the PCS score (p>0.05). This overall model accounted for 23% of the variability in the IHOT-12 (R2=0.23, p<0.001).

Conclusion
Preoperative hip arthroscopy patients with better general physical and mental health, as measured by the SF-12, have lower PCS scores. Age, gender, BMI, tobacco use, preoperative opioid use, number of allergies, and mental health diagnoses were not significantly associated with pain catastrophizing scores. These findings may be helpful when interpreting PCS scores and counselling patients prior to arthroscopic hip surgery.
The impact of general physical and mental health, bmi, and pain catastrophizing on a non-arthritic hip specific outcome measure (IHOT-33)

**Dr Guillaume Dumont**¹, Dr Travis Menge², Mrs Nicole Battle¹, Mr Zachary Thier¹

¹University Of South Carolina School of Medicine, Columbia, United States, ²Spectrum Health Medical Group, Grand Rapids, USA

**Biography**

Guillaume Dumont is a faculty member at the University of South Carolina School of Medicine. His clinical and research focuses include hip arthroscopy and femoroacetabular impingement. He is a native of Montreal, Canada. He earned his undergraduate degree in biochemistry at the University of Tennessee, where he played football, before attending medical school at Emory University in Atlanta. He then completed his orthopaedic surgery residency at the University of Texas Southwestern Medical Centre in Dallas. He then completed a fellowship in sports medicine & shoulder surgery at Harvard Medical School / Massachusetts General Hospital in Boston prior to hip arthroscopy training at the Nashville Orthopaedics and Sports Medicine Centre.

**Introduction**

The International Hip Outcome Tool 33 (IHOT-33) has been developed and validated as a patient-reported outcome measure for patients with non-arthritic hip pain, such as labral tears or femoroacetabular impingement (FAI). Various factors may influence a patient’s score on the IHOT-33, including patient specific factors, general physical and mental health, and an individual’s perception of pain. The purpose of this study was to determine which factors, if any, were associated with preoperative values on the IHOT-33 in patients undergoing hip arthroscopy.

**Methods**

Patients who underwent primary hip arthroscopy for symptomatic labral tears and/or FAI by a single surgeon from May 2018 to March 2019 were retrospectively analysed. Patients were included if they completed a preoperative IHOT-33 survey and did not have prior history of surgery on the affected hip. Patient-specific factors including age, gender, BMI, tobacco use, allergies, and preoperative narcotic use were recorded. The presence of a mental health diagnosis or use of a prescription medication for a mental health disorder was also recorded. Linear regression was performed to assess for a relationship between these factors and the IHOT-33 score.

**Results**

84 patients met inclusion criteria and were included in this study. The mean preoperative IHOT-33 score was 34.3 (range 3.4 - 73.9). Multiple linear regression demonstrated a statistically significant association between the following factors and the IHOT-33 score: BMI (p=0.007), SF12-PCS (p<0.001), SF12-MCS (p=0.001), and Pain Catastrophizing scale (p=0.028). This overall model accounted for 62% of variability in the IHOT-12 (R²=0.62, p<0.001).

**Conclusion**

A number of identifiable patient-specific factors can significantly affect patient scores on the preoperative IHOT-33 survey. Higher scores on the SF-12 MCS, SF-12 PCS, and Pain Catastrophizing Scale were each associated with greater IHOT-33 scores. On the other hand, a higher BMI was associated with lower IHOT-33 scores. These findings may be helpful when interpreting IHOT-33 scores and counselling patients prior to arthroscopic hip surgery.
Clinically relevant threshold values for success following hip arthroscopy using the Patient Reported Outcomes Measurement Information System (PROMIS) questionnaire. Determining the Minimum Clinically Important Difference (MCID) and Patient Acceptable Symptomatic State (PASS)

Dr Benjamin Kuhns, David Lawton, John Reuter, Dr Judith Baumhauer, Brian Giordano

University Of Rochester Medical Centre Department of Orthopaedics & Rehabilitation, Rochester, United States

Background
Threshold values for patient reported outcome measures such as the minimum clinically important difference (MCID) and Patient Acceptable Symptomatic State (PASS) are important for relating postoperative scores to meaningful functional improvement. The purpose of this study was to determine the PASS and MCID following hip arthroscopy for femoroacetabular impingement (FAI) using the Patient Reported Outcomes Measurement Information System (PROMIS) metric.

Methods
A consecutive series of patients undergoing primary hip arthroscopy for FAI were administered preoperative and minimum 1-year postoperative PROMIS surveys focusing on physical function (PF) and pain interference (PI) domains. Postoperatively, external anchor questions included “How would you rate your current level of function (Likert scale with responses including excellent, good, average, fair, poor)” and “Taking into account all the activities you have during your daily life, your level of pain, and also your functional impairment, do you consider that your current state is satisfactory (Yes/No)” for the MCID and PASS respectively. Patients achieving the MCID responded to having good or excellent function. Receiver Operator Curves (ROC) were constructed to determine the threshold values for the MCID and PASS based on optimized sensitivity and specificity profiles.

Results
There were 104 patients (37% male, age 34.1±12.9; BMI 26.0±4.5). There were significant improvements in physical function and pain interference domains (p<0.0001). The MCIDs were 5.3 (AUC:0.88) and 2.0 (AUC:0.74) for the PF and PI domains respectively. The PASS thresholds were 51.8 (AUC:0.92) and 51.9 (AUC:0.90) for the PF and PI respectively. The MCID and PASS thresholds were independent of baseline scores across domains. The likelihood of attaining PASS or MCID was not predicated on preoperative outcome scores or gender. A post-hoc analysis found younger (p=0.01) and more active (p=0.0001) patients were more likely to attain PASS postoperatively.

Conclusions
The PROMIS survey is an efficient metric to evaluate preoperative disability and postoperative function following hip arthroscopy for FAI. The MCID and PASS will provide surgeons with threshold values to help determine PROMIS scores that are clinically meaningful to patients.
EP19.11 Hip specific patient reported outcomes scores decrease in an age dependent manner

Dr Ehud Rath¹, Dr Zachary Sharfman², Dr Ran Atzmon, Dr Hal Martin, Dr Oleg Dolkart¹, Dr Eyal Amar¹
¹Tel Aviv Sourasky Medical Centre and the Sackler Faculty of Medicine at Tel Aviv University, Tel Aviv, Israel, ²Montefiore Medical Centre, Bronx, USA

Introduction
Patient Reported Outcome Measures (PROMs) are essential clinical instruments used for assessing patient function, indicating surgeries, quantifying surgical outcomes, and for assisting in clinical decision-making. However, PROMs are often designed using patients with pre-existing pathology and do not take into account the natural aging process, making these tools subject to the ceiling and basement effects.

Methods
Healthy volunteers with no previous hip pathology completed three online PROM surveys. The international Hip Outcome Tool (iHOT), the Modified Harris Hip Score (MHHS), and the Hip Outcome Score activities of daily living (HOS-ADL) and sports (HOS-sports) scores were completed in addition to questions regarding demographic information.

Results
Of the 469 responders, 334 denied history of hip pain or hip surgeries. Responders where scored and arranged by 10-year age groups from 20-29, 30-39… and >70. Scores decreased in a statistically significant age dependent manner in these healthy responders for the iHOT, MHHS, HOS-ADL and HOS-sport PROS (ANOVA between group differences; p<0.05). Healthy responders in the 6th, 5th and in some cases the 4th decade of life had outcome scores which were significantly lower than their younger counterparts for each PROM (ANOVA Post Hoc; p<0.05).

Conclusion
Respondents without previous hip pathology reported significantly lower iHOT, MHHS, HOS-ADL and HOS-sport PROS in an age dependent manner. This information should be considered when evaluating preoperative and postoperative PROM scores in older patients, as lower scores may represent age appropriate responses in older individuals.
EP19.12 The validation of Japanese version of the International PROMs “Vail Hip Score”: Reproducibility, validity, and reliability tested with COSMIN checklist

Dr Nobuyuki Watanabe1,2, Dr Satona Murakami3, Prof Soshi Uchida4, PT Satoshi Tateishi5, Dr Hidetsugu Ohara6, Prof. Yasuhiro Yamamoto3, Dr Taiki Kojima8

1Tosei General Hospital, Seto, Japan, 2Department of Orthopaedic Surgery, Graduate School of Medical Sciences, Nagoya City University, Nagoya City, Japan, 3Department of Rehabilitation Medicine, Graduate School of Medical Sciences, Nagoya City University, Nagoya City, Japan, 4Department of Orthopaedic Surgery, Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu City, Japan, 5Department of Rehabilitation Medicine, Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyusyu City, Japan, 6Department of Orthopaedic Surgery, Hirakata City Hospital, Hirakata City, Japan, 7Department of Occupational Therapy Health Science University, Minamitsuru-gun, Japan, 8Department of Anaesthesiology, Cincinnati Children’s Hospital Medical Centre, Cincinnati, USA

Biography

Position: Consultant; Department of Orthopaedics, Tosei General Hospital (4/1/2012~)
Head of department of Rehabilitation, Tosei General Hospital (4/1/2016~)

Medical studies: University: Shinsyu university medical school, Nagano, Japan 4/1/1987~3/20/1993
PhD. (3/25/2002; Nagoya City University medical school; No.542)
Activity as orthopaedic surgeon

Clinics:
Inabe kousei hospital, Mie, Japan (4/1/1993~3/31/1995)
Kasugai Municipal Hospital, Aichi Japan (7/1/2003~3/31/2009)
Nagoya City University hospital, Aichi, Japan (4/1/2009~3/31/2012)
Tosei General Hospital, Aichi, Japan (4/1/2012~present)

Background

This study aimed to develop a Japanese version of the international PROMs “Vail Hip Score (Vail10)” and to establish its reliability, validity, and responsiveness with COSMIN checklist.

Methods

The study was conducted from March 2016 to October 2017 and included 46 patients totalling 47 joints. Disorders included 30 cases of FAI (55%), 13 cases of DDH (28%), and 4 others (8%). We administered an identical set of PROMs (5 measures: Japanese-version iHOT12 (pilot draft), Japanese-version Vail10, Japanese-version Oxford Hip Score, JHEQ, and SF36) twice in these subjects. We determined interclass correlation coefficients for the first and second round [ICC(1,2)], as well as the Cronbach α coefficient for patient responses to each of the 10 items in Vail10. In addition, we determined Spearman rank correlation coefficients of Vail10, OHS, JHEQ, satisfaction VAS, the 8 subscales of SF36, and the 3 QOL summary scores.

Results

ICC for the total score of all 10 items in Vail10 was 0.96. Cronbach α coefficient was 0.96. Bland-Altman plot analysis showed a solid agreement. Regarding the validity, Spearman rank correlation coefficients, only satisfaction VAS, and SF36 subscales of PF and BP had r>0.45 (p<0.01 in both administration rounds). The SDC (1.32) was smaller than the MIC (8.14).
Conclusions
After developing the Japanese version of Vail10, we examined its Reliability, validity, and responsiveness by administering the measure to patients with acetabular labral tear. Correlations were strong and demonstrated the efficacy of the Japanese version of Vail10. To our knowledge, this is the first study to prove the validation of Vail 10.
Dr Malynda Wynn¹, Dr Robert Westermann¹, Dr Alan Shamrock¹, Zain Khazi¹, Dr Michael Willey¹, Dr John Davison¹
¹University Of Iowa Hospitals and Clinics, Iowa City, United States

Background
Hip dysplasia is known to lead to pain, disability, depression, and eventually secondary hip osteoarthritis in young adults. Although previously validated in other orthopaedic procedures, the performance of the Patient-Reported Outcomes Measurement Information System (PROMIS) Physical Function (PF) Computer Adaptive Test (CAT) in patients with hip dysplasia indicated for periacetabular osteotomy (PAO) is unknown. The aim of this investigation was to validate and compare responsiveness of PROMIS PF CAT with currently accepted patient reported outcome (PRO) instruments in young adults with hip dysplasia indicated for PAO.

Methods
Individuals indicated for PAO to treat symptomatic hip dysplasia were consented to complete the PROMIS PF CAT, Hip disability and Osteoarthritis Outcome Score (HOOS), modified Harris Hip Score (mHHS), International Hip Outcome Tool (iHOT), and pain Visual Analog Scale (VAS) questionnaires during their preoperative clinic appointments. The relationship between PRO instruments was compared using Spearman or Pearson correlation coefficients. Correlation between PRO instruments was defined as high (>0.7), high-moderate (0.61-0.69), moderate (0.4-0.6), moderate-weak (0.31-0.39), and weak (≤0.3). Statistical significance was defined as p<0.05.

Results
A total of 41 individuals scheduled to undergo PAO were enrolled in the study. The PROMIS PF CAT had a high correlation with mHHS (r=0.72, p<0.0001). High-moderate correlation strength was demonstrated with iHOT (r=0.62, p<0.0001), mHHS function (r=0.62, p<0.0001), and mHHS_pain (r=0.61, p<0.0001) surveys. Moderate correlation strength was demonstrated for the remaining PRO measures. There were no observed ceiling or floor effects. Average number of questions answered was lowest in the PROMIS Pain (3.93 ± 0.47) and highest in the iHOT (12) survey.

Conclusion
PROMIS PF CAT is an efficient and valid tool for preoperative clinical assessment of pain and disability in hip dysplasia patients undergoing PAO. It correlates well with legacy PRO instruments with no ceiling or floor effects and has a decreased question burden.
Defining meaningful functional improvement on the visual analog scale for satisfaction at 2-years after hip arthroscopy for femoroacetabular impingement syndrome

Dr Edward Beck1, Dr Benedict Nwachukwu2, Dr Nabil Mehta2, Kyleen Jan2, Kelechi Okoroha2, Mr Jonathan Rasio2, Dr Shane Nho2

1Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, United States, 2Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, United States

Biography
Dr Edward Beck is an orthopaedic resident and post-doctorate fellow in the Department of Orthopaedic Surgery at Wake Forest School of Medicine in Winston Salem, NC, USA. His surgical interests include hip arthroscopy and treatment of femoroacetabular impingement. During the past year he was selected as a research fellow for Dr Shane Nho at Rush University, where he published a number of clinical, biomechanical, and transitional science studies. He also collaborated with other hip arthroscopists including Dr Allston Stubbs, Dr Struan Coleman, Dr Olufemi Ayeni, and Dr Josh Harris. He hopes to pursue a career in sports medicine with a focus on hip arthroscopy and hip preservation.

In his time off, Dr Beck enjoys spending time with his fiancé, Kathryn Thayer, who is a dermatological nurse. He is also passionate about basketball, football, and soccer, and cheers for his alma mater, the University of Arizona, where he was a team member of the water polo team.

Background
The Visual Analog Scale (VAS) for Satisfaction is the most commonly utilized measure of patient satisfaction, increasingly reported in orthopaedic sports medicine and hip preservation surgery. Currently, there is limited understanding of what is considered as clinically important improvement on the VAS Satisfaction.

Purpose
To define and identify preoperative predictors of achieving Substantial Clinical Benefit (SCB), Patient Acceptable Symptomatic State (PASS), and Minimal Clinically Important Difference (MCID) for the VAS Satisfaction in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS).

Methods
Data from consecutive patients who underwent primary hip arthroscopy between November 2014 and January 2017 were collected and analysed. Baseline data and patient-reported outcome (PRO) scores were recorded at 2-years postoperatively. MCID, PASS and SCB were calculated to quantify clinical significance of each outcome achievement. A multivariate logistic regression analysis was used to identify preoperative predictors of achieving SCB, PASS, and MCID.

Results
Final analysis included 335 patients with an average age and body mass index (BMI) of 32.8(SD+12.4) years and 25.2(SD+5.3), respectively. MCID, PASS and SCB were identified as 12.3, 80.9 and 89.7, respectively. Rates of achieving clinically significant improvement were 97.1%, 68.1% and 56.9% for MCID, PASS and SCB, respectively. Larger preoperative alpha angle was predictive of achieving SCB (OR:1.076; p =0.046). Lower BMI (OR:0.955; p =0.047) and larger preoperative alpha angle (OR:1.12; p-value=0.025) were predictors for achieving PASS.

Conclusion
This study identifies VAS Satisfaction scores that can define clinically significant outcomes after arthroscopic treatment of FAIS. Specifically, an improvement of 12.3 points is a clinically important improvement in
satisfaction, while an absolute score above 89.7 represents the upper threshold of Satisfaction performance. Almost all patients (97.1%) demonstrated clinically important improvement in satisfaction. Additionally, there are modifiable and non-modifiable predictors of achieving clinically significant levels of post-operative satisfaction on the VAS Satisfaction.
S1.5 - Ottawa classification for symptomatic acetabular dysplasia: assessment of interobserver and intra-observer reliability

Dr Kamal Bali1, Dr Kevin Smit2, Dr Mazen Ibrahim2, Dr Stephane Poitras3, Dr Geoffrey Wilkin1, Dr Etienne Belzile3, Dr Paul Beaule1

1The Ottawa Hospital, Ottawa, Canada, 2Children Hospital of Eastern Ontario, Ottawa, Canada, 3University Hospital of Quebec, Quebec City, Canada

S1 - Dysplasia, Hidalgo, Ground Level, October 17, 2019, 08:00 - 10:00

Biography
Dr Kamal Bali is a final year resident at the University of Ottawa. He has previously completed a fellowship in hip arthroplasty and conservative hip surgery.

Background
To overcome the shortcomings of classifying hip dysplasia based on just LCEA, Ottawa classification for adult acetabular dysplasia (OCAD) was proposed to classify symptomatic hips into three discrete prototypical patterns of hip instability; lateral/global, anterior, or posterior. The purpose of this study was to assess the reliability of OCAD.

Methods
134 consecutive hips that underwent a periacetabular osteotomy were categorized using a validated software (Hip2Norm) into four categories of normal, lateral/global, anterior or posterior. Based on the prevalence of individual dysplasia and using Kappa Size R package version 1.1, seventy-four cases were found to be necessary for reliability analysis: 44 dysplastic and 30 normal hips were randomly selected. Six blinded raters provided with a flowchart based on the OCAD then looked at the x-rays at two separate time points (minimum two weeks apart) to classify the hips using standard PACS measurements. Thereafter, a consensus meeting was held where a modified flow diagram was devised before a third reading by four raters using a separate set of 74 radiographs.

Results
The overall intra-rater reliability amongst the raters for time 1 and time 2 ranged from moderate ($\kappa=0.416$) to almost perfect ($\kappa=0.873$). With respect to inter-rater reliability for time 1 and time 2, there was substantial agreement overall between all surgeons (time 1 $\kappa=0.619$; time 2 $\kappa=0.623$). Agreement for normal rating (time 1 $\kappa=0.759$; time 2 $\kappa=0.785$) and lateral rating category (time 1 $\kappa=0.847$; time 2 $\kappa=0.862$) was substantial to almost perfect. At time 1, both posterior and anterior rating categories had moderate agreement (posterior $\kappa=0.557$; anterior $\kappa=0.438$). At time 2, posterior and anterior rating categories had moderate ($\kappa=0.506$) and fair ($\kappa=0.250$) agreement respectively. At time 3, overall inter-rater reliability for normal and lateral ratings was substantial. Reliability across posterior and anterior ratings showed an increase in absolute value of kappa (posterior $\kappa=0.579$; anterior $\kappa=0.521$).

Conclusion
OCAD provides a reliable way to identify three categories of acetabular dysplasia that are well-aligned with surgical management.
Characterising the acetabular articular cartilage/cotyloid fossa ratio in the young adult hip: Differentiating between Dysplasia and Impingement.

M.D. Pablo Slullitel¹, PhD. Andrew Speirs², M.HK., B.Sc. Johanna Dobransky³, B.A. Cheryl Kreviazuk¹, M.D. Johan Witt³, M.D. George Grammatopoulos¹, M.D. Paul Beaulé¹

¹The Ottawa Hospital, Ottawa, Canada, ²Department of Mechanical and Aerospace Engineering, Carleton University, Ottawa, Canada, ³University College Hospital, London, United Kingdom

Introduction
Delineating between impingement and dysplasia is critical to indicate adequate surgical treatment. Looking at the acetabular cartilage area could prove useful as the acetabulum has 2 distinct parts; the cotyloid fossa (CF), which is composed of fatty tissue (i.e. no articular cartilage), and the articular surface, lined with cartilage (AC). We aimed to validate whether the AC/CF ratio can be determined from an anteroposterior (AP) pelvic radiograph and to characterise the AC/CF ratio in dysplasia and femoroacetabular impingement (FAI).

Methods
Three-dimensional segmentation of CT scans was used to determine the surface of both the cotyloid fossa and the articular surface (CT-derived AC/CF ratio) of 52 hips (24 cam-FAIs, and 28 asymptomatic controls), for validation purposes. Using the AP pelvic radiograph, the x-ray-derived AC/CF ratio was determined; the AC angle was calculated from the lateral sourcil to the superior edge of the fovea capitis; whereas the CF angle was attained from the latter line to the pelvic teardrop. We measured the aforementioned parameters in 136 hips that underwent preservation surgery; 28 treated for dysplasia, 24 for pincer-FAI and 84 for cam-FAI. Further subgroup analyses were performed in hips with a lateral centre-edge angle (LCEA) between 20°-25° to differentiate between dysplasia and cam-FAI.

Results
Mean LCEA and neck-shaft angles of the validation cohort were 32.8±3.5 and 136.4°±5.5, respectively. Mean radiographic- and CT-derived AC/CF ratios were 0.68±0.04 and 0.72±0.04, respectively. The Spearman’s rho revealed a significant correlation between X-ray and CT-derived ratio values (rho=0.649, p<0.001). The mean radiographic AC/CF ratio was lower in the dysplasia’s (0.55±0.047), compared to the pincer (0.68±0.063) and cam groups (0.67±0.061; p=<0.001). A significant association was found between LCEA and X-ray-derived AC/CF ratio (rho=0.64, p<0.001). When analysing the LCEA frame of 20°-25°, dysplasia presented lower AC/CF ratios than cam-FAIs (p=0.004), despite the similar LCEA.

Conclusion
A strong correlation was found between x-ray- and CT-derived AC/CF ratios, with the latter values being 4% higher. Compared to the FAI-cohort, the dysplastic hips showed overall lower ratios. Although this finding was significantly correlated with LCEA, in cases with similar LCEAs, dysplastic acetabula also showed lower cartilage ratios, suggesting a morphological difference.
What is the pelvic tilt in acetabular dysplasia, and does it change following peri-acetabular osteotomy?

**Dr Mark Roussot**1,2, Mr Saif Salih3, Mr George Grammatopoulos4, Mr Johan Witt1

1University College London Hospital, United Kingdom, 2Department of Orthopaedic Surgery, University of Cape Town, South Africa, 3Sheffield Teaching Hospitals, United Kingdom, 4Ottawa Hospital, Canada

**Background**

Acetabular dysplasia is typically characterised by insufficient antero-superior femoral head coverage. It is postulated (yet unproven) that patients with dysplasia compensate by reducing pelvic tilt (anterior pelvic rotation), effectively retroverting their acetabulum to improve antero-superior cover, which could influence the evaluation of radiological parameters and the planned surgical correction. We aimed to 1) define pelvic tilt (PT) in patients with bilateral and unilateral dysplasia, and 2) quantify PT changes following periacetabular osteotomy (PAO).

**Methods**

We reviewed 32 bilateral, staged PAOs for symptomatic dysplasia in 16 patients (14 females). These cases were matched for age and gender with 32 unilaterally dysplastic hips that underwent PAO for a similar degree of acetabular dysplasia as per pre-operative imaging. Patients were followed up for a mean of 3 years. Supine and AP radiographs pre-PAO and at latest follow-up were used to measure centre-edge-angle (CEA) and Tönnis-angle (TA). PT was measured using two validated methods (Sacro-Femoral-Pubic (SFP) angle and Pubic-Symphysis to Sacro-Iliac (PS-SI) Index with excellent correlation (rho=0.8, p<0.001).

**Results**

Post-operatively, the TA and CEA improved from 20°±8 and 11°±9 to 5°±5 and 33°±6 respectively, with similar improvements between the unilateral and bilateral cohorts (p=0.9). PT pre-operatively was similar between unilaterally (8°±5) and bilaterally dysplastic hips (7°±5) (p=0.87). The change in PT was 1°±3; changing by >5° (all increased) in 6 patients (13%; 3 with unilateral PAOs and 3 with bilateral PAOs).

**Conclusion**

This is the first clinical and radiological evidence that patients with bilateral or unilateral dysplasia demonstrate similar pre- and post-operative PT, which remains unchanged in almost 90% of cases. This suggests that the pelvic tilt in patients with acetabular dysplasia is morphological and not compensatory or reversible in the majority of patients.
Midterm outcomes of concurrent hip arthroscopy and periacetabular osteotomy for the treatment of hip dysplasia with associated intra-articular pathology

Dr Adam Edelstein¹, Dr Adam Khan², Karla Crook², Dr Wahid Abu-Amër², Dr Cecilia Pascual-Garrido², Dr Jeffrey Nepple², Dr John Clohisy²

¹Medical College of Wisconsin Department of Orthopaedic Surgery, Milwaukee, United States, ²Washington University Department of Orthopaedic Surgery, Saint Louis, United States

Biography

John C. Clohisy, M.D. is The Daniel C. and Betty B. Viehmann Professor of orthopaedic surgery at Washington University School of Medicine.

Dr Clohisy received his bachelor’s and medical degrees from North western University. He completed his internship, research fellowship, and residency in orthopaedic surgery at Saint Louis University School of Medicine. Dr Clohisy pursued his adult reconstructive surgery fellowship in the Hip and Implant Unit at Massachusetts General Hospital at Harvard Medical School. Dr Clohisy joined Washington University School of Medicine faculty in 1998, achieving full professorship in 2008. He presently serves as Vice Chair, Chief of adult reconstructive surgery and Director of the Adolescent and Young Adult Hip Service. Dr Clohisy’s clinical expertise includes hip joint preservation (arthroscopy, osteotomies, impingement procedures), and hip replacement surgery. His research focuses on the diagnosis and treatment of pre-arthritic and early arthritic hip disorders, and on hip replacement procedures in young patients.

Dr Clohisy has authored more than 300 scientific publications, book chapters, is a frequent invited lecturer, nationally and internationally. He is PI of the ANCHOR Hip Preservation study group, a member of various orthopaedic societies, and has been the recipient of numerous clinical, research and education honours, grants and awards.

Background

The role for hip arthroscopy (HS) in combination with periacetabular osteotomy (PAO) for the treatment of symptomatic acetabular dysplasia remains to be better defined. In this study, we assessed midterm outcomes of concurrent HS and PAO (HS/PAO) for the treatment of symptomatic acetabular dysplasia with associated intra-articular pathology.

Methods

We performed a retrospective review of the outcomes of concurrent HS/PAO cases at a minimum of 4 years postoperatively in a prospectively collected institutional hip preservation database. From November 2005 to December 2012, 83 hips in 79 patients underwent combined HS/PAO for acetabular dysplasia. Twelve hips were lost to follow-up, leaving 71 hips (85.5%) for analysis at mean 6.6-year follow-up (range 4 -11 years). Hips were classified as failures if they underwent conversion to THA or remained symptomatic (mHHS <70 or WOMAC pain sub score > 10). Additionally, revision surgeries were noted. Major complications were recorded and graded by the Clavien-Dindo classification (Grade III or IV). Regression analyses were performed to identify the interaction between patient factors, radiographic measures, and surgical details with outcome.

Results

A total of 17 hips (20.5%) were classified as failures including two hips (2.4%) had undergone THA and an additional 15 hips (18.1%) were deemed symptomatic. Of the 54 hips (76.1%) not classified as failures, the mean mHHS 92.1 ± 8.8, UCLA activity score 7.8 ± 2.1, and WOMAC pain sub score 1.8 ± 2.4. In univariate
analysis, no patient factors, pre- or post-operative radiographic metrics, or intra-operative findings or procedures were associated with failure. There were 5 (7%) major complications (Clavien-Dindo Grade III or IV). A total of 5 patients underwent repeat surgery for recurrent symptoms: 4 hip arthroscopies (4.8%), 1 open psoas release with ramus osteoplasty) during the follow-up period with resolution of symptoms following repeat surgery.

Conclusion
This study demonstrates that concurrent hip arthroscopy and periacetabular osteotomy is associated with good clinical outcomes and an acceptable complication profile at midterm follow-up.
The cleft sign of the pubis is associated with soccer activity and anterior acetabular over coverage: A cohort study

Dr Keisuke Nakayama¹, Dr Hajime Utsunomiya¹, Dr Fumitaka Hirano¹, Dr Shinichiro Takada¹, Dr Akihisa Hatakeyama¹, Dr Takamasa Toyoshima¹, Dr Akinori Sakai¹, Dr Soshi Uchida¹

¹Wakamatsu Hospital of the University of Occupational and Environmental Health, Kitakyushu, Japan

S2 - Inguinal and Adductor - Related Groin Pain, Castilla, Ground Level, October 17, 2019, 08:00 - 10:00

Biography
I am an orthopaedic surgeon who combines up-and-coming passion and strength. My professional career (10 years), I had been working as an orthopaedic surgeon. After basic training of orthopaedics including trauma, joint replacement, and spine surgery, I have specialized in sports medicine from 2017. I would like to announce at ISHA.

Background
The cleft sign of the pubis is associated with hip and groin pain in athletes; however, the relationship between FAI and cleft sign still remains elusive.

Purpose
To clarify whether the presence of the cleft sign is associated with FAI and sports activities.

Hypothesis
The cleft sign is more frequently observed in soccer players with FAI-related bony morphology.

Methods
From 2015 to 2018, 631 hips that underwent hip arthroscopic surgery were enrolled. Hips with osteoarthritis (Tönnis grade > 1, 50 patients, 51 hips) were excluded, and 580 hips of 506 patients were investigated. All patients (100%) were examined by 3-tesla magnetic resonance imaging preoperatively, and superior cleft sign, inferior cleft sign, and bone marrow edema of ipsilateral side of the pubis were screened. Lateral centre edge (LCE) angle, Sharp angle, Tönnis angle, vertical centre anterior (VCA) angle, and alpha angle were measured using plain radiographs. The relationship between the presence of the cleft sign or bone marrow edema and patient characteristics including sports activity and radiographic measurements was analysed by Student t-test, chi-square test, or Fisher’s exact test.

Results
580 hips (292 males 288 females, mean age 35.8±15.7 years, mean LCEA28.4±8.7° [<18°: 12.7%, 18°-25°: 21.6%, 25°<: 64.5%]) were included. Superior cleft sign, inferior cleft sign, and bone marrow edema of the pubis were seen in 18 hips (3.1%), 13 hips (2.2%), and 36 hips (6.2%), respectively. Superior cleft sign was not seen in the patients with LCEA less than 18° (0%). Patients with positive superior cleft sign had significantly higher VCA angle (positive v negative, 37.1±8.7° vs 30.2±12.5°, p = 0.03). The rate of soccer players among positive superior, inferior cleft signs and bone marrow edema were 56%, 54%, and 53%, respectively (p < 0.001). Among soccer players, superior, inferior cleft signs, and bone marrow edema were more frequently seen (16.4%, 11.5%, 31.1%, respectively) compared to the other athletes/non-athletes (1.5%, 1.2%, 3.3%, p < 0.001, respectively).

Conclusion
The cleft sign can be associated with soccer activity and acetabular anterior over coverage.
S2.8 - Radiographic prevalence of symphysis pubis abnormalities and clinical outcomes in patients with femoroacetabular impingement syndrome

Dr Vignesh Krishnamoorthy1, Dr Edward Beck1, Mr. Kyle Kunze1, Dr Jourdan Cancienne1, Mr. Jonathan Rasio1, Dr Olufemi Ayeni1, Dr Shane Nho1

1Chicago, Chicago, United States

S2 - Inguinal and Adductor - Related Groin Pain, Castilla, Ground Level, October 17, 2019, 08:00 - 10:00

Introduction
Femoroacetabular impingement syndrome (FAIS) may lead to compensatory increased motion at the symphysis pubis (SP), which can subsequently lead to osteitis pubis. The purpose of this study is to quantify the prevalence of SP abnormalities in FAIS patients using imaging modalities and to compare outcomes based on the presence of SP abnormalities.

Methods
Radiographs and MRI scans of 1,009 consecutive patients who underwent primary hip arthroscopy for FAIS from January 2012 to January 2016 were identified. Exclusion criteria were patients undergoing revision, bilateral surgery, dysplasia, and less than two-year follow-up. On radiographs, SP joints were reviewed for joint surface erosions, subchondral sclerosis and cysts and ankylosis. MRI scans were reviewed for marrow edema in the subarticular pubic bone, subchondral sclerosis and cysts, joint surface erosions and ankylosis. Outcomes included the hip outcome score–activities of daily living (HOS-ADL), sports-subscale (HOS-SS), modified Harris hip score (mHHS), international hip outcome tool–12 (IHOAT-12), and visual analogue scales (VAS) for pain and satisfaction.

Results
830 patients were included; 23 (2.3%) demonstrated SP abnormalities. 726 (72%) MRI scans were reviewed of which 15 (1.5%) showed bone marrow edema, subchondral sclerosis, erosions, or ankylosis. After matching, patients without SP abnormalities had significantly greater HOS-ADL (95.7 vs. 83.0;p=0.008), HOS-SS (91.6 vs. 61.9;p=0.003), IHOAT-12 (89.5 vs. 74.6;p=0.046), Satisfaction (91.3 vs. 58.8;p=0.004) scores, and less post-operative pain (6.3 vs.23.5;p<0.001). There were no significant differences in the mHHS (92.5 vs. 82.2;p=0.08). Patients without SP abnormalities had higher odds of achieving the MCID for the HOS-ADL (OR = 4.5, 95% CI: 1.3-14.1;p=0.010), the HOS-SS (OR=7.2, 95% CI 1.8-18.5;p=0.006), and the mHHS (OR = 14.5, 95% CI: 1.8-24.7;p=0.013).

Conclusion
There is a low prevalence (1.5-2.3%) of SP joint abnormalities seen on imaging in FAIS patients. These patients may demonstrate significantly inferior clinical outcomes and persistent postoperative pain after FAIS treatment.
S3.5 - Decreased femoral version is an independent cause of anterior intra- and extraarticular sub spine FAI- 3D CT impingement simulation study

Dr. Till Lerch1, Florian Schmaranzer1, Simon Steppacher1, Guoyan Zheng1, Moritz Tannast1, Klaus Siebenrock1

1Dept. of orthopaedic surgery, Inselspital Bern, University of Bern, Bern, Switzerland

S3 - Femoral Torsion, Doblon, Ground Level, October 17, 2019, 08:00 - 10:00

Range of motion and location of hip impingement in hips with symptomatic FAI combined with decreased femoral version (FV) is unknown and further understanding of this morphology is needed to optimize surgical treatment. Therefore, we evaluated symptomatic hips with decreased FV, using CT-based virtual 3D range of motion (ROM) and impingement simulation and questioned:

1) What is the osseous range of motion?
2) Where are the osseous femoral and acetabular impingement zones located?
3) Is impingement extra- or intra-articular?

Methods
We performed an IRB-approved, retrospective comparative analysis of a total of 84 hips in 68 patients. Of them, 37 hips in 24 symptomatic FAI patients had decreased FV. These hips were compared to 21 hips of 18 symptomatic patients with anterior FAI with normal FV (10-25°) and 26 asymptomatic hips with no FAI morphology and normal FV. All FAI patients had a positive anterior impingement test and pelvic CT scans to measure FV. Decreased FV was defined as FV<5°. The 37 hips with decreased FV presented both with and without cam and pincer FAI. All 84 hips were evaluated using CT-based 3D models and a validated 3D ROM and impingement simulation.

Results
1) Hips with FAI combined with decreased FV have a significantly (p<0.001) lower mean flexion (114±8° vs 125±13°) and internal rotation (IR) at 90° of flexion (18±6° vs 32±9°, p<0.001) compared to the asymptomatic control group.
2) The maximal acetabular impingement zone for hips with decreased FV was located at the 2 o’clock position.
3) In hips with decreased FV, most of the impingement locations were located intra-articular but 32% had combined intra- and extra-articular FAI in 90° of flexion and 30° IR. With 10° and 20° of adduction, extra-articular sub spine FAI was detected in 68% and in 84%.

Conclusion
Hips with FAI and decreased FV have less flexion and internal rotation in 90° of flexion compared to the asymptomatic control group. The majority of hip impingement due to low FV is intraarticular, but one third had combined intra- and extraarticular sub spine FAI. Anterior hip impingement can be caused by decreased FV even without cam or pincer morphologies.
S3.6 - Femoral retroversion does not portend inferior mid-term outcomes after hip arthroscopy: A pair-matched controlled cohort analysis

Dr Ajay Lall¹, Muriel Battaglia², Dr David Maldonado¹, Dr Itay Perets³, Joseph Laseter⁴, Dr Benjamin Domb¹
1American Hip Institute, Chicago, United States, ²The University of Chicago Pritzker School of Medicine, Chicago, United States, ³Hadassah Hebrew University Hospital, Jerusalem, Israel, ⁴Case Western Reserve University School of Medicine, Cleveland, United States

Biography
Dr Ajay C. Lall is a dual fellowship trained orthopaedic surgeon specializing in sports medicine and hip arthroscopy in the Chicago area. His background includes mentorship by world renowned sports medicine physician, Dr James Andrews, at the American Sports Medicine Institute, Birmingham, AL. He has also completed formal hip preservation training under master hip arthroscopist, Dr Benjamin G. Domb, at the American Hip Institute, Chicago, IL. He is an avid clinical researcher with numerous presentations and publications at international academic meetings and within top peer-reviewed journals. Dr Lall has treated collegiate, professional, and elite level athletes, including players for the NCAA, NFL, NBA, MLP, PGA, and WWE. Dr Lall treats patients from across the country who travel to Chicago for their surgery, and he takes pride in caring for every patient like a professional athlete.

Background
While femoral retroversion has been suggested as a negative prognosticator for hip arthroscopy, recent studies have not shown an adverse effect on short-term patient-reported outcomes.

Purpose
To report mid-term five-year outcomes of arthroscopic treatment of hip abnormalities in patients with femoral retroversion compared to a control group of patients with normal femoral anteversion.

Methods
Data was prospectively collected and retrospectively reviewed for all patients who underwent hip arthroscopy between May 2008 and March 2013. Institutional Review Board approval was obtained prior to data collection. Patients were included in analysis if they underwent hip arthroscopy during this period and had femoral version ≤0° calculated using magnetic resonance imaging. Exclusion criteria included prior ipsilateral hip conditions/surgeries or Tönnis grade>1. These patients were pair-matched with patients having femoral anteversion between 10-20° based on gender, body mass index ±10 kg/m², and age ±10 years. Outcomes were collected at three months and one year postoperatively and annually thereafter, including modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS), Hip Outcome Score–Sports Specific Subscale, Visual Analog Scale (VAS) for pain, International Hip Outcome Tool (iHOT-12), Veterans RAND health survey (VR-12), Short Form health survey (SF-12).

Results
A total of 59 patients were identified as our experimental group out of 69 eligible for inclusion (86%). These patients demonstrated significant improvement from their preoperative state in all PRO and VAS scores (P<.001). No differences were noted between retroverted and control patients in any of the outcome measures collected, in pain or satisfaction ratings, or in the frequency of or duration to secondary surgeries (P>0.05).

Conclusion
Patients with femoral retroversion demonstrated favourable outcomes at minimum five-year follow-up after undergoing arthroscopic hip surgery. These outcomes were not inferior to those of patients with
normal femoral version. While femoral retroversion should not be considered a contraindication to hip arthroscopy, it should be carefully considered as a factor in patient selection and surgical planning.

Level of evidence
III, Cohort Study
S3.7 - The bipolar hip: Combined acetabular and femoral pathomorphology determine hip motion
Dr Jessica Shin¹, Ms. Temitope Adeyemi², Dr Taylor Hobson¹, Dr Christopher Peters¹, Dr Travis Maak¹
¹University Of Utah, Salt Lake City, United States

Biography
Dr Travis Maak’s practice is focused on sports medicine and arthroscopic treatment of the hip and knee. He is the Head Orthopaedic Team Physician for the Utah Jazz and Associate Professor in the Department of Orthopaedics at the University of Utah. Dr Maak is originally from Salt Lake City and a graduate from Stanford University. He completed his medical school at Yale School of Medicine and surgical internship at New York Presbyterian Hospital – Weill Cornell Medical College. His orthopaedic surgery residency training occurred at the Hospital for Special Surgery in New York City, where he continued his training with a fellowship in sports medicine. During his fellowship, Dr Maak served as an Assistant NFL Team Physician for the New York Football Giants.

Dr Maak specializes in arthroscopic hip and knee surgery and has a specific interest in the treatment of athletic hip and knee injuries. These injuries include hip and knee arthroscopy and preservation surgery, femoroacetabular impingement (FAI), cartilage restoration, and ligament reconstruction including ACL and multiligament knee reconstruction.

Purpose
Prior studies have suggested femoral version may outweigh the effect of cam impingement on hip internal rotation; however, the effect of acetabular morphology was omitted. This study investigates the individual and combined contributions of acetabular and femoral morphology on hip range of motion (ROM) in patients with femoroacetabular impingement syndrome (FAIS).

Methods
A retrospective chart review and radiographic analysis was performed of patients presenting with hip pain. Femoral head/neck angle, femoral version, size and clock-face location of the maximum femoral alpha angle, mid-coronal centre edge angle (CEA), mid-sagittal CEA, acetabular version, and the McKibbin index were measured on CT scan. Multivariable linear regression analysis was performed to determine which measurements correlated with hip ROM.

Results
200 hips were included in the analysis. Mean age was 31.9 ±10 years, 145 (72%) patients were female, and mean BMI was 25.2 ± 5. In the multivariable logistic regression analysis, mid-sagittal CEA was the only measurement correlating with flexion, femoral head/neck angle and McKibbin index were the only significant variables correlating with external rotation, and McKibbin index and maximum femoral alpha angle were the only variables correlating with internal rotation (all q’s > 0.05 after adjusting for false discovery rate).

Conclusion
Multivariate analysis demonstrated that combined acetabular and femoral version significantly correlated with internal and external rotation while femoral version in isolation did not. Increased cam deformity remained a significant contributor to reduced internal rotation but did not affect hip flexion, in contrast to prior studies. These data suggest that hip ROM is affected in a bipolar fashion and careful evaluation of both femoral and acetabular pathomorphology should be conducted prior to corrective osteoplasty or osteotomy.
S3.8 - Femoral versus acetabular osteotomy for treating combined version deformities leading to femoroacetabular impingement

Mr Paul Haggis1, Mr Saif Salih2, Mr Tom Pollard1, Mr Johan Witt2, Mr George Grammatopoulos2, Mr Tony Andrade1
1Royal Berkshire Hospital, Reading, United Kingdom, 2University College London Hospital, London, United Kingdom
S3 - Femoral Torsion, Doblon, Ground Level, October 17, 2019, 08:00 - 10:00

Biography
I am a dual Fellowship trained hip surgeon. After finishing orthopaedic training, I undertook a year-long Fellowship in hip arthroscopy under Tony Andrade and Tom Pollard at the Royal Berkshire Hospital in Reading, performing over 100 hip arthroscopies. I am currently a Fellow in Hip Arthroplasty at the Royal Bournemouth Hospital with Professor Robert Middleton, where I am on course to perform over 200 hip arthroplasties this year, including periprosthetic hip fracture and revision hip surgery.

Introduction
Combined femoral (<10°) and acetabular retroversion (<10°) is a rare cause of femoroacetabular impingement (FAI) and present in 4% of young adult hip patients. Anteverting proximal femoral osteotomy (APFO) and Anteverting peri-acetabular osteotomy (APA0) are surgical options for this cohort.

Aims
(1) To determine outcomes in this cohort (hip preservation, complications and patient-reported outcome scores (PROMS)), (2) determine whether a difference in outcome exists between patients that underwent APFO and APA0, and (3) compare to a FAI cohort with normal femoral and acetabular version undergoing arthroscopic FAI treatment (HA).

Patients and Methods
This is a retrospective case series from two tertiary referral Young Adult Hip Units. All patients that underwent APFO and APA0 between 2014-17 were reviewed (n=13/11). Only patients with combined deformities as measured by Computed Tomography were included (n=12; 6 APFO/ 6 APA0). Patients were matched for age and gender. HA group included 24 hips (1:2 ratio). Hip morphology was same as measured by Lateral-Centre-Edge Angle (average 36.3/33.7), Acetabular Index (7.5/3.7), Femoral Version (0.9/4.3) and Acetabular Version (-6.3/-4.7). Time to bony union, complications (as per Clavien-Dindo), re-operation rates, and PROMS were collected using NAHS, iHOT12, EQ5D, and UCLA Scores.

Results
At a mean follow-up of 2 years, all hips were preserved. In total 3 underwent further surgery; removal of metalwork surgery (2/5) and one hip arthroscopy post-APFO. Time to radiographic union was longer for the APFO (19weeks vs. 10weeks, p=0.053). Good outcomes post-surgery was reported: NAHS: 74±26; iHOT: 60±33; EQ5D: 74±16; UCLA:6±2. No difference in PROMs was seen between APFOs and APAOs (p=0.45 – 0.91), but HA showed better scores for NAHS 85±16 (p=0.04) and iHOT12 73.1±22 (p=0.02).

Conclusion
Good outcomes can be achieved for this rare cohort of combined deformity by addressing either side of the joint. However, the inferior PROMs compared to other FAI causes addressed with HA needs further study. We recommend that the assessment of symptomatic FAI includes rotational profiling as standard.
S4.5 - Arthroscopic partial release of the gluteus maximus tendon for external snapping hip syndrome. Functional outcome and strength evaluation at mid-term follow-up

Dr Filippo Randelli, Dr Mauro Magnani, Dr Fabrizio Pace, Drss Sara Favilla, Drss Daniela Maglione, Dr Nicolò Cosmelli, Dr Alberto Fioruzzi

Irccs Policlinico San Donato, San Donato Milanese, Italy

Biography
Dr Alberto Fioruzzi studied Medicine and Surgery at University of Pavia and complete with study with a final votation of 110 cum laude in 2012. He has done his residency in Orthopaedics and traumatology at University of Pavia and completed it with a thesis on gluteus maximus transfer with a votation of 50 cum laude in July 2018. He is now working in IRCCS Policlinico San Donato in Milan in the Department directed by Dr Filippo Randelli.

Purpose
Snapping hip syndrome is a common clinical condition that affects more than 10% of the general population. In literature, several surgical techniques have been proposed, and this study aims to present the medium-term results of the partial release of the gluteus maximus tendon, namely Polesello technique.

Materials and methods
In this retrospective study, 13 patients with external snapping hip syndrome who underwent an arthroscopic partial gluteus maximus tenotomy were analysed. The patients were assessed with the following clinical and functional scores: Visual Analogue Scale (VAS), modified Harris Hip Score (mHHS), Non-Arthritic Hip Score (NAHS). The strength of the gluteus maximus muscle and the circumference of the lower limb operated was also evaluated, comparing them to the contralateral. A t-test was used to assess the differences between the preoperative and postoperative time.

Results
We included four males and nine females with a mean age of 30 ± 15.8 years (range 18-76 years). The mean follow-up was 18 ± 17.7 months (range 9-38 months). All our primary results have statistical significance: the VAS decreased from 6.8 to 0.7 (p <0.001), the mHHS increased from 48.2 to 88.0 (p <0.001), the NASH increased from 48.9 to 90.0 (p <0.001 ). We did not find statistically significant differences regarding muscle strength, despite a decrease in the circumference of the lower limb operated.

Discussion
For the first time, in addition to the functional scores, the strength of the operated limb was also evaluated, comparing it to the healthy contralateral limb. This evaluation has allowed us to demonstrate how, despite the new approach to the disease, the strength of the limb is preserved.

Conclusions
The results obtained indicate that this surgical approach for the resolution of a painful external snapping hip represents a valid therapeutic option in cases that do not respond to conservative therapy.
S4.6 - Leucocyte-rich Platelet-rich Plasma (LR-PRP) treatment of gluteal tendinopathy: A double blind randomised controlled trial with 2 year follow up.

Asst Prof Jane Fitzpatrick1, Professor Max Bulsara2, Professor Ming Hao Zheng3, Professor John O'Donnell4

1University Of Melbourne, Melbourne, Australia, 2University of Notre Dame, Fremantle, Australia, 3University of Western Australia, Crawley, Australia, 4Swinburne University, Melbourne, Australia

S4 - Lateral Hip Pain, Auditorium (Plenary), Ground Level, October 17, 2019, 08:00 - 10:00

Biography
Associate Professor Jane Fitzpatrick is a Sport and Exercise Medicine Physician in private practice and at the Graeme Clark Institute for Biomedical Engineering, University of Melbourne. She is a Fellow of the Australasian College of Sports and Exercise Medicine. She was a founding member of the International Olympic Committee – Triathlon Medical Commission and the team doctor for the Australian Triathlon Team for 10 years. Jane is currently the team physician for the Australian Cross-Country ski Team and the Medical Director for the Australian Biathlon Team. Jane was recently part of the leadership group for the Asia Pacific Economic Committee (APEC) project, the Australian Consensus Framework for Ethical Collaboration in the Healthcare Sector. This project is the largest of its kind in the world and brought together over 60 signatories from all sectors of healthcare including consumer organizations, hospitals, medical colleges, universities, pharmaceutical corporations and biotech industry groups. Jane and her colleagues, won the prestigious APEC Business Ethics Lighthouse Award in 2018 which recognises the significant international leadership displayed by Australia in mentoring, supporting and inspiring health leaders across the APEC membership to develop and commit to ethical practice in healthcare. She is currently researching in tendinopathy and osteoarthritis.

Background
A previous trial showed patients with chronic gluteal tendinopathy achieved greater improvement at 12 weeks treated with a single LR-PRP injection than a single corticosteroid injection.

Purpose
2-year follow-up study examined the long-term difference in the Modified Harris Hip Score (MHHS) following LR-PRP injection in chronic gluteal tendinopathy.

Study Design
Randomised Double-blind Controlled Clinical Trial; open labelled crossover; Level of evidence 1, recruitment 29 May 2013 to May 2015, follow-up June 2017. ANZCTR Registry: ACTRN12613000677707

Methods
80 patients randomised 1:1 to either LR-PRP or corticosteroid (CSI) injected intra-tendinously under ultrasound guidance. Mean age of 60, 9:1 ratio of females, a mean BMI of 29 and mean length of symptoms > 15 months. Open labelled extension allowed crossover treatment after three months. The primary outcome measure was the modified Harris Hip Score (MHHS).

Results
MHHS improved significantly at 12 weeks in the PRP group 74.05 (SD 13.92) compared to CSI group 67.13 (SD 16.04) p=0.048. At 24 weeks the LR-PRP group 77.60 (SD 11.88) had improved further compared to the CSI group 65.72 (SD 15.28) p=0.0003. 27 subjects failed the CSI treatment at 16-24 weeks with an exit score of 59.22 (SD 11.54) and had treatment with LR-PRP improving to 75.55 (SD 16.05) at 12 weeks, 77.69 (SD 15.30) at 24 weeks and 77.53 (SD 14.54) at 104 weeks. The LR-PRP group retained 38/39 subjects to 52 weeks and continued to improve from baseline 53.77 (SD 12.08) to 82.59 (SD 9.71) at 104 weeks.
Conclusion
Patients with chronic gluteal tendinopathy, length of symptoms >15 months, a single intra-tendinous LR-PRP injection performed under ultrasound guidance, results in a greater improvement in pain and function than a corticosteroid injection. This is sustained at 2 years whereas CSI is maximal at 6 weeks and returns to baseline by 2 years.
S4.7 - Abductor cuff tears repair: twelve years’ experience with a minimal invasive technique and midterm results

Md Manuel Ribas Fernandez1, Md Carlomagno Cardenas Nylander1, Md Vittorio Bellotti1, Md Emanuele Astarita1, Md Gabriel Chacón1, Md Luis Ramírez1

1University Hospital Dexeus, Barcelona, Spain

S4 - Lateral Hip Pain, Auditorium (Plenary), Ground Level, October 17, 2019, 08:00 - 10:00

Introduction

Great Trochanter Pain Syndrome (GTPS) has gained more worldwide acceptance. Several authors have reported 48 to 60 percent of gluteal tears in patients diagnosed on GTPS. The aim was to evaluate midterm results of the mini open procedure for the treatment of the gluteus medius and minimus tears.

Material and method

From 2007 to 2015 (mean follow up: 7.2 years, R: 1 – 9) 135 patients were treated: 81 with partial hip cuff lesions (Thomas II, Milwaukee I-II) and 54 total avulsions (Thomas III, Milwaukee III-IV), 104 women and 31 men, mean age 53 (24-78). Patients operated with hip replacement were ruled out. Clinical-functional outcomes were assessed by means of Ossendorf, Pattrick-Fabere, Lequesne and Trendelenburg tests, WOMAC-NHMS scores preop and at latest follow-u. MRI was taken preop, at 6 months and later in poor evaluated cases. Complications were recorded. The data were statistically handled using SPSS 13, Chicago, IL.

Results

124 out of 135 patients (92.4%, p =0.007) improved significantly functional outcomes at latest follow-up in scores, US and finally MRI exam. This improvement was moderately more significant between patients Thomas II when compared to Thomas III (p=0,016): 79 out of 81 hips Thomas II (97,5%, p<0,001), 47 out of 54 Thomas III (84,5%, p=0,032). 4 Patients Thomas II needed secondary surgery because of pain persistence after 1st year (4,9%). WOMAC score improved from 57.2 (36 - 68) to 88.8 (46 -98) and NAHS from 47.8 (31 - 57) to 77.3 (37 - 94). No neurovascular complications were registered, 17 cases (11.7%) had seroma that required ultrasound guided aspiration, 1 leading to infection, which required debridement.

Conclusion

Isolated gluteal tears cannot be underestimated. Risk of tear extension, or even fat deterioration can be anticipated. Surgical treatment of rotator-abductor cuff is effective in terms of clinical-functional improvement but results of reattachment of partial tears are (Thomas II) slightly superior than extensive tears (Thomas III). Thus, we recommend early diagnosis of gluteal tears and proper surgical treatment in patients with GTPS.
S4.8 - Endoscopic abductor tendon repair with two-year follow up: Influence of tear type and tendon involvement

MD JW Thomas Byrd1, MSN, RN Kay Jones
1Nashville Hip Institute, Nashville, United States, 2Nashville Sports Medicine Foundation, Nashville, United States
S4 - Lateral Hip Pain, Auditorium (Plenary), Ground Level, October 17, 2019, 08:00 - 10:00

Biography
Dr Byrd is the co-founder of the Nashville Hip Institute and Past President of both ISHA and the Arthroscopy Association of North America (AANA). He is team physician for the Tennessee Titans, has served as physician for the U.S. Olympic team and is a consultant orthopaedic surgeon for numerous professional sports franchises from the NFL, NHL, NBA, WNBA, MLB and MLS as well as players from the PGA, LPGA and ATP. He is a Clinical Professor, Vanderbilt University, Department of Orthopaedic Surgery and Rehabilitation and serves on the Advisory Board for the Titleist Performance Institute (TPI).

Dr Byrd developed the technique of hip arthroscopy that is most popularly used around the world. He pioneered many of the specific surgical procedures for hip arthroscopy and invented numerous instruments that have revolutionized aspects of orthopaedic surgery. He has authored three textbooks on hip arthroscopy, edited numerous other texts and journals and has published over 100 scientific papers, technical and review articles, and book chapters. He has been one of the leaders for defining and developing the role of less invasive arthroscopic techniques in and around the hip.

Objectives
This study aims to answer the question of how patients do with abductor tendon repair in terms of patient reported outcomes, discerning specific subgroups including partial versus full-thickness tears and single versus two-tendon lesions.

Methods
Sixty-six consecutive hips in 64 patients (2 bilateral) undergoing endoscopic abductor tendon repair with a hollow core bioabsorbable suture anchor and achieved two-year follow up were prospectively assessed with modified Harris Hip Score (mHHS) and iHOT scores.

Results
The average age was 57 years (range 22-83 years) with 59 females and 5 males. Post-operative follow up averaged 28 months (range 24-60). There were 32 full-thickness and 34 partial-thickness tears; 40 gluteus medius tears, 24 medius and minimus tears (only 2 were isolated minimus tears). Full thickness tears: average age was 59 (range 33-83), with 29 females/3 males, and average mHHS improvement 43 points (preop 42; postop 85) and iHOT 48 points (preop 24; postop 71). Partial-thickness tears: average age was 55 (range 22-78), with 32 females/2 males; and average improvement mHHS 36 points (preop 55; postop 91) and iHOT 47 points (preop 36; postop 83). The improvement for both groups was statistically significant, but the difference between the groups was not statistically significant. Gluteus medius only: average age was 55 (range 22-78), with 38 females/2 males; and average improvement mHHS 38 points (preop 50; postop 89) and iHOT 47 points (preop 31; postop 78). Combined gluteus medius and minimus tears: average age was 60 (range 39-83), with 21 females/3 males; and average improvement mHHS 41 points (preop 47; postop 88) and iHOT 53 points (preop 29; postop 77). Similarly, both groups demonstrated statistically significant improvement, but the difference between the two groups was not statically significant.

Conclusion
Endoscopic abductor tendon repairs represent a heterogeneous population in terms of partial-thickness vs. full-thickness lesions and single or double-tendon involvement. Statistically significant improvement was observed across all categories of tendon pathology. Excellent improvement can often be expected (mHHS
39 points and iHOT 48 points), even among this older population (average age 57), with low preoperative baseline scores (mHHS 49 and iHOT 30).
S5.5 - Borderline acetabular dysplasia: Evaluating preoperative low-dose computed tomography characteristics as a predictor of symptomatic instability

Dr Elizabeth Graesser¹, Maria Schwabe¹, Dr Cecilia Pascual-Garrido¹, Dr John Clohisy¹, Dr Jeffrey Nepple¹

¹Washington University Department of Orthopaedic Surgery, Saint Louis, United States

S5 - Hip Instability, Castilla, Ground Level, October 17, 2019, 16:30 - 18:30

Introduction
Borderline acetabular dysplasia is classically defined as a lateral centre edge angle (LCEA) of 20-25 degrees. The optimal treatment strategy in this patient group remains controversial, with some patients having primarily hip instability-based symptoms, while others have primarily impingement-based symptoms (non-instability). The purpose of the current study was to define the 3D characteristics on low-dose CT that differentiate patients with instability symptoms from those without instability in the setting of borderline acetabular dysplasia.

Methods
Seventy consecutive hips with borderline acetabular dysplasia undergoing surgical treatment were included in the current study. All patients underwent low-dose pelvic CT with femoral version assessment for preoperative planning. CT measurements included alpha angle and radial acetabular coverage (RAC) at standardized clockface positions (9:00-posterior to 3:00-anterior), central and cranial acetabular version. RAC was assessed in three sectors (anterior, superior, and posterior) and defined (relative to published normative data) as normal (-1 SD, +1 SD), under coverage (<-1 SD), or over coverage (>+1 SD). Statistical analysis was performed to compare the CT characteristics of the symptomatic instability and non-instability groups.

Results
Of the 70 hips, 62.9% had the diagnosis of symptomatic instability, while 37.1% had no instability symptoms. Hips with instability (compared to non-instability) had significantly lower alpha angle (maximal difference at 1:00 - 47.0° vs. 59.4°), increased femoral version (22.3° vs. 15.3°), and decreased radial acetabular coverage (maximal difference at 1:00 – 59.9% vs. 62.2%) (all p<0.001). Multivariate analysis identified femoral version (OR 1.1, p=0.02), alpha angle at 1:00 (OR 0.91, p=0.02), and RAC at 1:00 (OR 0.46, p=0.003) as independent predictors of the presence of instability. The model combining these three factors had excellent predictive probability with a c-statistic 0.92.
Discussion
We found significant differences in the 3D hip morphology of the symptomatic instability and non-instability subgroups within the borderline dysplasia cohort. In the setting of borderline dysplasia, three-dimensional deformity characterization with low-dose CT allowed for differentiation of patients diagnosed with underlying instability vs. non-instability. Femoral version, alpha angle at 1:00, and radial acetabular coverage at 1:00 were identified as independent predictors of diagnosis in borderline acetabular dysplasia.
The pull test: A dynamic test to confirm hip micro instability

Doctor Kostas Economopoulos3, Doctor Christopher Kweon2, Doctor Albert Gee2, Dr Anikar Chhabra3

1Department of Orthopaedics, University of Arizona College of Medicine-Phoenix, Phoenix, United States, 2Department of Orthopaedics, University of Washington, Seattle, United States, 3Department of Orthopaedics, Mayo Clinic Arizona, Phoenix, United States

S5 - Hip Instability, Castilla, Ground Level, October 17, 2019, 16:30 - 18:30

Biography

Dr Economopoulos specializes in sports medicine and hip arthroscopy in Phoenix, Arizona. He is in private practice at the Orthopaedic Clinic Association in Phoenix. In addition, he is Clinical Assistant Professor of Orthopaedics at the University of Arizona College of Medicine-Phoenix.

Background

Hip micro instability can lead to hip pain and labral tears. Diagnosis of the disorder is difficult with current diagnostic testing available. The purpose of this study was to describe the Pull Test which is a new dynamic test used to identify patients with hip micro instability. We define a distraction distance of the femoral head using the Pull Test which represents patients with hip micro instability.

Methods

100 consecutive patients undergoing central compartment hip arthroscopy were included in the study. Patients were separated into a hip micro instability group (HMI) and non-hip micro instability group (NHI) based on the results of the abduction-extension-external rotation test (AB-HEER), hip extension-external rotation exam (HEER) and the prone instability test. The Pull Test is performed with the patient in a hip distraction device prior to surgery with the hip in 30 degrees of abduction, external rotation and the foot in 30 degrees of external rotation. The examiner places gross axial traction on the leg until a firm end point is reached. The distraction distance between the femoral head and acetabulum is the pull length.

Results

32 patients made up the HMI group while 68 patients were in the NHI group. The average pull length for the NHI group was 0.91±.19cm and 1.76±.42cm for the HMI group. Subtracting the standard deviation from the HMI group average, a cut off for hip micro instability was defined as 1.34cm. Using this value, the Pull Test was found to have a sensitivity of .94 and specificity of .96. The positive predictive value for the Pull Test was .91 and the negative predictive value .97.

Conclusions

We describe a new dynamic hip test that can accurately identify patients with hip micro instability. A pull length of 1.34cm using the Pull Test is considered positive for the presence of hip micro instability.
The femoro-epiphyseal acetabular roof (FEAR) index is a predictor of worse outcome of hip arthroscopy in female patients at two to four-year follow-up.

Dr Jennifer Marland, Mrs Brandy Horton, Dr Hugh West, Dr James Wylie

The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

S5 - Hip Instability, Castilla, Ground Level, October 17, 2019, 16:30 - 18:30

Biography

Dr Marland is a DPT that works in the hip preservation clinic at The Orthopaedic Specialty Hospital at Intermountain Healthcare in Murray, UT. She specializes in the clinical and radiographic evaluation and treatment of patients with non-arthritic hip and pelvic pain.

Methods

This was a retrospective review of females undergoing hip arthroscopy with a diagnosis of FAI treated with femoral osteoplasty with or without labral repair. iHOT-12 was collected preoperatively and at 2 to 4-year follow-up. Radiographs were reviewed and the FEAR index was measures in all patients. Patients with borderline acetabular dysplasia (LCEA≤25) were grouped as medially or laterally oriented FEAR index. Correlations were tested using the Pearson correlation coefficient, differences in means were tested using a student’s t-test or an analysis of variance with a post-hoc tukey’s test.

Results

There were 175 Female patients with a mean age of 33 years. Mean follow up was 34.6 months. Mean preoperative iHOT12 was 30.4. Mean postoperative iHOT12 was 74.8. Mean FEAR index was -7.1 (Range -30 to 15) degrees. The FEAR index correlated with both the iHOT12 at follow up(-0.171, p=0.024) and the improvement in the iHOT12(-0.192, p=0.011). There were 31 patients with a laterally oriented FEAR index. These patients had worse iHOT12 at follow-up(64.9 points versus 77.0 points, p=0.037) and less improvement in iHOT12(34.3 points versus 46.6 points, p=0.015). There were 110 patients with LCEA>25, 42 patients with LCEA≤25 with a medially oriented FEAR index and 23 patients with an LCEA≤25 with a laterally oriented FEAR index. Patients with LCEA≤25 and a laterally oriented FEAR index had worse iHOT12 at follow-up(60.7 points versus 78.9 points, p=0.005) and less improvement in iHOT12 from surgery(30.0 points versus 49.4 points, p=0.002) compared to those with an LCEA>25.

Conclusion

A FEAR index suggesting more hip instability is a predictor of worse outcome after hip arthroscopy in female patients.
S5.8 - Arthroscopic iliofemoral ligament augmentation to treat microinstability: between the capsular plicature and the PAO in borderline dysplasia.

MD Nicolas Fiz, MD Ane Miren Bilbao, MD Jorge Guadilla, MD Juan Azofra, MD Jaime Oraa, MD Beatriz Aizpurua, MD Leonor Lopez, MD Mikel Sanchez

1Arthroscopic Surgery Unit (uca), Vitoria-Gasteiz, Spain

S5 - Hip Instability, Castilla, Ground Level, October 17, 2019, 16:30 - 18:30

Introduction
Primary instability due to borderline DDH is a common cause of hip pain. A combination of ligament laxity and a low bone coverage occurs, leading to a situation difficult to resolve. Some non-aggressive techniques like capsular plicature have been described to solve this pathology, but the results are limited. In 2017 we present an arthroscopic technique to reconstruct the iliofemoral ligament after iatrogenic capsulectomies. As a new indication for this technique, we propose an arthroscopic reinforcement of the iliofemoral ligament as a solution prior to a PAO in borderline DDH.

Material and method
10 patients with a diagnose of borderline DDH and hip pain have been treated with this technique. The diagnoses have done with radiological study to determine centre-edge angle (CEA) and acetabular index (AI); we consider borderline DDH with a CEA between 20 to 25º and an AI close to 10º. We also did an arthro-MRI to confirm an increased capsular volume. Furthermore, we explored the capsular laxity under general anaesthesia and fluoroscopy. We performed an arthroscopic anatomical reconstruction of the iliofemoral ligament, using a peroneal tendon as graft. We pinned up the graft limiting the extension and the external rotation, reproducing the normal ROM and reducing the hypermobility. We use the iHOT-33 and HOS scales to analyse the results. The follow up was of two years in all the cases.

Results
We found a significant improvement of the symptoms in 9 of 10 patients. Not major side effects were founded.

Conclusion
The arthroscopic reinforcement of the iliofemoral ligament seems to be an effective and safe technique to treat the pain associated to borderline DDH.

Biography
Dr Nicolás Fiz studied Medicine at the University of Navarre, graduating in 2002. He trained in the speciality of Traumatology and Orthopaedic Surgery at Santiago Hospital in Vitoria-Gasteiz and during his residence there he worked part-time on research and on location work for Doctor Mikel Sánchez's Arthroscopic Surgery Unit. From 2008 on he worked as an assistant in the Traumatology Service in the Santiago Apóstol Hospital, Vitoria-Gasteiz, and joined Doctor Mikel Sánchez's team as a medical assistant. Later, in 2010, he took on a full-time role at the Arthroscopic Surgery Unit (UCA) and the Biological Therapy Unit (UTB). He plays an active part in developing PRP Technology for the different diseases affecting the musculoskeletal system. Likewise, he works with the UCA team on innovation concerning different surgical techniques and has co-authored a number of publications. He works together with the Biotechnology Institute (BTI) research team on animal experimentation work. In 2009 he created the Hip Unit within the Arthroscopic Surgery Unit.
S6.5 - Anatomical description of a sciatic ancillary branch to the gluteus maximus muscle

MD Andrés Campos-Méndez2, MD Salvador Campos-Dorado1, MD Juan Gómez-Hoyos1, MS Anthony Khoury1, PT Ricardo Schröder1, PhD Ian James Palmer1, DO Hal David Martin1

1Baylor Scott & White Hip Preservation Centre, Dallas, United States of America, 2Instituto Nacional De Rehabilitacion, Mexico City, Mexico

S6 - Posterior Hip Pain, Auditorium (Plenary), Ground Level, October 17, 2019, 16:30 - 18:30

Biography:
Orthopaedics chief resident at Instituto Nacional de Rehabilitación in Mexico City focused on training and professional development inside the hip preservation and posterior hip areas.

The objective of this cadaveric specimen study was to examine the presence of an ancillary branch from the Sciatic Nerve (SAB) to the Gluteus Maximus Muscle independent of the Inferior Gluteal Nerve. Thirteen hips from seven human cadaveric pelvises were analysed, exposing the deep gluteal space to look for the presence or absence of the sciatic ancillary branch. When the branch was present four measurements were performed: Sciatic Nerve (SN) diameter at the greater sciatic foramen, the SAB diameter at the origins of the SN, length from the greater sciatic foramen to the point of origin of SAB on the SN, and SAB length from SN to the initial point of contact to the gluteus maximus reported as standard deviation. Five of the thirteen hips (38%) showed the presence of SAB. The mean diameter of SN was 13.6 ± 3.69 mm. The mean diameter of the SAB originated of SN was 2.45 ± 1.2 mm, the length from the greater sciatic foramen to the point of origin of SAB on the SN was 15.8 ± 11.7 mm, SAB length from SN to the initial point of contact in the gluteus maximus was 15.7 ± 10.4 mm. The SAB observed in 38% of the analysed human cadaveric hips confirms the anatomical SN variants providing a better understanding of the deep gluteal space in patients with deep gluteal syndrome. SN variants in the buttock can cause entrapment with neurologic pain. Understanding these variants helps us to explain possible causes of pain experienced by patients in the gluteal region who could be candidates to endoscopic diagnostic and surgical release.
S6.6 - Paradoxical function of Psoas muscle: The hidden root of pain in pelvis?

Dr Aleksandar Vojvodic1, Dr Sava Stajic2, PhD Slobodan Kapor3, PhD Jelena Mihailovic4, Dr Luis Perez Carro5

1Clinical Hospital Centre "Zemun", Belgrade, Serbia, 2Clinical Hospital Centre "Dragisa Misovic", Belgrade, Serbia, 3School of Medicine, University of Belgrade, Belgrade, Serbia, 4Yale School of Medicine, Yale University, New Haven, United States of America, 5Clinical Hospital Centre "Mompia", Santander, Spain

S6 - Posterior Hip Pain, Auditorium (Plenary), Ground Level, October 17, 2019, 16:30 - 18:30

Biography

Dr Aleksandar Vojvodic is a full-time employee orthopaedic surgeon at Clinical Hospital Centre "Zemun", Department for Orthopaedic surgery and Traumatology. He has more than 15 years of experience of treating patients of all ages and skill levels with activity related musculoskeletal injuries. During his career he completed training for full endoscopic surgery of the lumbar spine at St. Anna Hospital, Herne, Germany, as hip arthroscopy under mentorship of Dr. Luis Perez Carro. Dr. Vojvodic clinical practice focuses of alloarthroplastic of hip, shoulder and knee, arthroscopy of knee, shoulder and hip. In close relationship with physical therapist's Dr Vojvodic developed Kinesio-tape test, as a diagnostic tool. He is member of SOTA, STA and member of Serbian Medical Association. Dr Vojvodic had numerous presentations at national and regional conferences. He is graduate at School of Medicine, University of Belgrade. During studies he received intensive training in orthopaedic surgery and traumatology at most prestige Clinical Hospital Centres in Serbia: Orthopaedic Hospital "Banjica" and "Military Medical Academy" Hospital.

Introduction

Relationship between muscular facilitation and neural tension as cause of pain, in the upper extremity is well known(1), but only few studies(2) examine a potentially similar interaction in anterior and posterior hip. The purpose of this study was to determine potential effect and underlying mechanism, between tightness of femoral nerve and psoas muscle on sciatic nerve and piriformis muscle using Ultrasound Elastography, as measure of tissue tightness.

Material and Methods

Shear Wave US Elastography was performed on a group of 25 healthy patients (12 female and 13 male). Measurements of nerve/muscle connection, m.psoas/n.femoralis and m.piriformis/n.sciaticus, tightness were performed on lateral decubitus position in knee extension and knee flexion, at two time points 0 and 3 min for knee flexion and 0 min only for knee extension, due to physiological position.

Results

At t=0 min, in knee extension, n.femoralis/m.psoas are relaxed (4 and 14kPa, respectively) compared to n.sciaticus/m.piriformis (54 and 28kPa, respectively). At this point inverse tightness correlation was observed with statistically significant difference (p<0.001). At t=0 min in knee flexion, n.femoralis/m.psoas are tight (12 and 30kPa, respectively) compared to n.sciaticus/m.piriformis (5 and 12kPa, respectively, p<0.001) with preserved invers correlation. At t=3min tightness of n.sciaticus/m.piriformis starts to increase (22 and 28kPa), while n.femoralis/m.psoas tightness also continues to increase (20 and 40kPa). Obtained high values may be a result of m.psoas spasm due to increased stimulation of the n.femoralis, which through lumbar spine nerve roots affect n.schiaticus and consequently leads to the spasm of m.piriformis.

Conclusions

The findings of this study suggest that increasing n.femoralis/m.psoas tension we may indeed affect gluteal region in healthy patient population through n.sciaticus/m.piriformis. Consideration of potential bidirectionality of neural tension and muscle dysfunction should be included in future studies, as same as patient group with pathology in that region.
References


S6.7 - Surgical outcomes of a novel surgical technique- arthroscopic proximal hamstring repair

MD, MS Amanda N. Fletcher¹, MD Brian C. Lau¹, MD Gregory Pereira¹, MMCi Carolyn Hutyra¹, MD, MBA Richard C. Mather III¹

¹Duke University Medical Centre, Department of Orthopaedic Surgery, Durham, US

S6 - Posterior Hip Pain, Auditorium (Plenary), Ground Level, October 17, 2019, 16:30 - 18:30

Biography
Richard C. “Chad” Mather III MD, MBA is an assistant professor and vice chairman of practice innovation in the Department of Orthopaedic Surgery at Duke University School of Medicine. He is also a faculty member at the Duke Clinical Research Institute and former President of the North Carolina Orthopaedic Association. Dr Mather is a health services researcher and decision scientist with a focus on economic analysis, health policy, health preference measurement and personalized decision-making. In addition to health service research applications, he conducts translational research on biomarkers and hip instability. Dr Mather received his medical doctorate from Duke, where he also completed residency training in orthopaedic surgery. He completed a sports medicine fellowship at Rush University Medical Centre. His clinical practice focuses on hip arthroscopy including both FAI and extra-articular hip endoscopy.

Introduction
Proximal hamstring tears are common injuries that demonstrate better patient reported outcomes, greater return to pre-injury activity, and greater strength with surgical intervention compared to nonoperative treatment. Historically, the gold standard has been open surgical repair, which has a complication rate of 23% and a return to sport of 80%. Arthroscopic techniques are less invasive, often less painful, and improve return to sport. Here we report outcomes of arthroscopic proximal hamstring repair, which we hypothesized would be superior to published open repair outcomes.

Methods
A retrospective analysis was performed on patients who underwent arthroscopic proximal hamstring repair for ruptures involving ≥ 2 tendons from 2014-2017 by a single senior sports medicine trained orthopaedic surgeon. Demographic, operative, and clinical data, including preoperative and postoperative range of motion and strength, complications, and subjective patient outcomes were collected. Student’s T-tests and Chi Squared analyses were conducted, and a probability of ≤0.05 was considered significant.

Results
27 patients were included with a minimum two-year follow-up. The average patient age was 53 years-old (range 19-77) with 18 (67%) female patients. 20 (75%) patients had an isolated endoscopic hamstring repair alone while 7 underwent additional procedures. 13 (48%) patients reported an acute injury while the remainder experienced insidious onset of symptoms. 7 patients participated in an organized sport, and all returned to play postoperatively. Complications (7%) included two re-ruptures, one traumatic late postoperative at 17 months and one atraumatic early postoperative at two months. Both required revision surgery with an open repair. 19 (70%) patients reported complete resolution of pain at last follow-up. 23 (85%) patients returned to their baseline activity level. No statistically significant differences were found between preoperative and postoperative strength and range of motion (p>0.05).

Conclusions
Arthroscopic hamstring repair demonstrates excellent outcomes with 100% return to play, 70% complete resolution of pain, 85% return to baseline activity levels, and only a 7% complication rate warranting consideration over open surgical repair.
S6.8 - Prevalence and preoperative risk factors for postoperative deep gluteal syndrome after hip arthroscopic labral preservation surgery

Dr Soshi Uchida1, Dr Kazuha Kizaki1, Dr Fumitaka Hirano1, Dr Hal Martin2, Prof Akinori Sakai1

1Wakamatsu hospital of University of Occupational and Environmental Health, Kitakyushu, Japan, 2Hip Preservation Centre, Baylor University Medical Centre, Dallas, United States of America

S6 - Posterior Hip Pain, Auditorium (Plenary), Ground Level, October 17, 2019, 16:30 - 18:30

Biography:

P rofessional background 2012 Clinical Professor Department of Orthopaedic Surgery and Sports Medicine Wakamatsu Hospital for the University of Occupational and Environmental Health, Kitakyushu, Japan 2011- 2012 Associate Professor Department of Orthopaedic Surgery and Sports Medicine Wakamatsu Hospital for the University of Occupational and Environmental Health, Kitakyushu, Japan 2006-2010; Assistant Professor Department of Orthopaedic Surgery, School of Medicine, University of Occupational and Environmental Health, Kitakyushu, Japan 2004- 2006; Occupational Physician Nissan Motor Co. 2002-2004; Postdoctoral fellow Under supervision of Prof Dr Jane E Aubin laboratory, Department of Medical Genetics and Microbiology, Faculty of Medicine, University of Toronto Apr/2000-2002; Chief of Orthopaedic ward Assistant Professor, Department of Orthopaedic Surgery, School of Medicine, University of Occupational and Environmental Health, Kitakyushu, Japan Japanese Orthopaedic Association Japanese Regenerative Medicine AANA (Arthroscopy Association of North America) Associate Master Instructor of Master Course Hip Arthroscopy (2013 and 2015, 2016, 2017, 2018) American Academy of Orthopaedic Surgery (AAOS) International Affiliate Member ISAKOS member ISAKOS Hip, Groin & Thigh Committee for the 2015-2019 term JOSKAS (Japanese Orthopaedic Sports Medicine Knee and Arthroscopy Society ) member Member of Guideline, Japanese Hip Society: member of council International Society of Hip Arthroscopy: Board committee member

Background

Deep gluteal syndrome (DGS) is an uncommon source of buttock and groin pain resulting from the entrapment of the sciatic nerve in the deep gluteal space. The prevalence and risk factors of postoperative DGS following primary hip arthroscopic surgery are currently unknown. This study investigated the prevalence and risk factors of postoperative DGS following primary hip arthroscopic surgery.

Methods

This retrospective study reviewed 1133 patients (1167 hips) who underwent arthroscopic surgeries between 2010 and 2018 by a single surgeon at a single centre in Japan. DGS was defined using the sitting piriformis stretch test, active hamstring test, and evidence of hypertrophic sciatic nerve on magnetic resonance imaging (MRI). Eleven of 1167 (1%) hips were diagnosed with DGS postoperatively. The DGS cohort (11 hips) was compared to non-DGS hips (1156 hips). Patient age, body mass index (BMI), general joint laxity (Beighton score >6), number of surgeries, radiographic parameters including lateral centre edge angle (LCEA), Sharp angle, vertical centre anterior (VCA), Tonnis angle, and alpha angle were compared. Logistic regression analysis was conducted to identify potential predictors for postoperative DGS diagnosis.

Results

Females (male: female; 0:11 in DGS versus 568:588 in non-DGS groups, p<0.01), the number of hip surgeries (1.82±0.87 in DGS versus 1.13±0.36 in non-DGS groups, p<0.01), and general laxity (p<0.01) were significantly higher in the non-DGS group, while the mean BMI was significantly lower in the DGS group (19.9±1.9 versus 22.7±3.6, p=0.02). Radiographic parameters were not significantly different between groups. Logistic regression analysis revealed that female sex (odds ratio [OR]=21.7), number of surgeries (OR=10.33), and general laxity (OR=40.9) were potential predictors of postoperative DGS.
Conclusion

Predictors for postoperative DGS following hip arthroscopic surgeries were female sex, general joint laxity, and number of surgeries of the hip. Although hip arthroscopic surgeries could provide favourable clinical outcomes, caution is suggested for those with the aforementioned risk factors for predicting postoperative DGS.
S7.5 - Hip mobility, translations, and micro instability before and after cam FAI surgery

Dr Geoffrey Ng1, Dr Hadi El Daou2, Mr Marcus Bankes3, Prof Ferdinando Rodriguez y Baena2, Dr Jonathan Jeffers2
1Department of Surgery & Cancer, Imperial College London, London, United Kingdom, 2Department of Mechanical Engineering, Imperial College London, London, United Kingdom, 3Department of Orthopaedics, Guy’s and St Thomas’ NHS Foundation Trust, London, United Kingdom

Biography

Geoffrey specializes in various areas of interdisciplinary in vivo, in vitro, and in silico musculoskeletal research, working closely with the MSk Lab and The Biomechanics Group at Imperial College London. His primary research focuses on musculoskeletal biomechanics and joint preservation methods, aspiring to outline a path for joint restoration, injury prevention, and healthy aging. Geoffrey continues to examine joint preservation techniques for the young adult hip, to better understand the effects of morphology, capsular ligaments, micro instability, implants, and surgery on joint function and mechanics.

Introduction

Although surgical management of cam femoroacetabular impingement (FAI) aims to preserve the hip and restore joint function, it is unclear how the capsulotomy, cam deformity, and capsular repair influence functional mobility. The purpose was to examine the surgical effects towards hip range of motion, centre of rotation, and micro instability.

Methods

Twelve cadaveric cam hips (n = 12) were skeletonized to the capsule and mounted onto a robotic testing platform. The robot positioned each hip in multiple positions (Extension, Neutral 0°, Flexion 30°, Flexion 90°); and performed internal-external rotations to 5 Nm of torque. Each hip then underwent a series of surgical stages (intact, capsulotomy, cam resection, capsular repair) and was retested after each stage. Changes in hip range of motion, centre of rotation, and micro instability (i.e., difference between centres of rotation normalized by femoral head radius) were measured after each stage.

Results

At Extension and Neutral°, the hip rotated concentrically with marginal translations after each surgical stage. At Flexion 30°, the hip centre shifted inferolaterally during external rotation after capsulotomy (p = 0.03); while at Flexion 90°, the hip shifted laterally during external rotation after cam resection (p = 0.04). Consequently, micro instability increased after capsulotomy in Flexion 30° (MI = +0.05; p = 0.003); and after cam resection in Flexion 90° (MI = +0.08; p = 0.007) by +31% relative to the intact hip. Capsular repair slightly restrained the rotational centre and decreased micro instability at Flexion 30° and 90°.

Discussion

Micro instability occurred at higher amplitudes of flexion, with cam resection providing more intracapsular volume and lateralizing the hip during external rotation. Cam resection may increase hip micro instability by 31% in deep flexion and external rotation relative to the intact hip. To limit micro instability, activities that involve larger amplitudes of hip flexion and external rotation should be avoided after surgery.
The importance of minimizing capsulotomy to maintain hip stability: A cadaveric study

Dr Hajime Utsunomiya1, Mr Alex Brady1, Mr Samuel Rosenberg1, Mr Joseph Krob1, Mr Bryson Kemler1, Mr Grant Dornan1, Dr Marc Philippon1

1Steadman Philippon Research Institute, Vail, United States

S7 - The Capsule, Hidalgo, Ground Level, October 17, 2019, 16:30 - 18:30

Biography

In my first period of professional career, I had been working as an orthopaedic surgeon including my PhD school years. After basic training of orthopaedics including trauma, joint replacement, and spine surgery, I have specialized in sports medicine from 2009. In 2013, I earned PhD degree in Medical Science. As an MD PhD researcher, I have worked on dozens of sports medicine-related clinical studies and researches for translational medicine. As an international research fellow at Steadman Philippon Research Institute between 2016 and 2019, I had been working on hip arthroscopy-related biomechanical studies and clinical outcome studies. From April 2019, I started to practice at Wakamatsu hospital of University of Occupational and Environmental Health, Kitakyushu, Japan.

Background

Capsular pathology has been clinically identified as a potential contributor to hip micro instability. However, its effects on hip biomechanics have not been quantitatively defined. The purpose of this study was to measure hip kinematics during range of motion and impingement tests in gradually increasing capsular pathology models using a 6-degrees of freedom robotic system.

Methods

Four male and four female full-femur cadaveric hip specimens were tested. A 6-degrees-of-freedom robotic system was used to assess range of motion (ROM) and femoral head translation (FHT) throughout eight tests: flexion, extension, internal rotation, external rotation, abduction, adduction, abduction at 45°of flexion, and anterior impingement. The following states were tested: 1) Native, 2) Sham arthroscopy, 3) Capsular laxity model obtained by stretching the iliofemoral ligament (IFL) for one hour under an extension torque of 25Nm for females, 35Nm for males, 4) 3-cm inter-portal capsulotomy with IFL partially transacted, and 5) 5-cm capsulotomy with IFL completely transacted. Random-intercepts linear mixed-effects models were used to compare consecutive states.

Results

Three significant (P<0.05) increases in both FHT and ROM were found between consecutive states. Capsular laxity: extension (0.1-mm FHT, 4.62° ROM); 5-cm capsulotomy state: external rotation (2.2-mm FHT, 14.68° ROM), adduction (3.2-mm FHT, 10.49° ROM). Seven other significant differences in ROM were observed. Capsular laxity: anterior impingement (1.18°), abduction (1.69°), internal rotation (2.02°); 3-cm capsulotomy: anterior impingement (1.07°), internal rotation (1.85°), flexion (1.27°); 5-cm capsulotomy: extension (2.54°).

Conclusion

The main finding of this study was that the 5-cm capsulotomy created major instability compared to the 3-cm capsulotomy. Furthermore, significant differences were observed following the stretching of the IFL, and these smaller changes in FHT and ROM may be attributed to micro instability. These results demonstrate the importance of capsular management in the clinical setting.
S7.7 - Must we crash through the wall to enter a hip joint or can we gently use a door instead? Capsular closure versus capsular preservation in hip arthroscopy

Dr Ali Bajwa1,2, Mr Richard Villar1,2
1Princess Grace Hospital, London, United Kingdom, 2Villar Bajwa Practice, Cambridge, United Kingdom

S7 - The Capsule, Hidalgo, Ground Level, October 17, 2019, 16:30 - 18:30

Biography
Ali Bajwa is a Discus thrower and an expedition racer who specialises in Hip arthroscopy. He is a partner at the Villar Bajwa Practice. An alumnus of Darwin college, Cambridge university and Harvard, he maintains a keen research interest especially in biologics.

Introduction
Hip arthroscopy requires access and good visualisation. Various portals have been identified to enter the hip joint. Hip capsule contributes to hip joint mechanical stability and proprioception. Hence logic dictates to preserve it. Recent trend has shifted towards capsular closure. We explore the capsular preservation during hip arthroscopy.

Aims
To compare capsular-preservation (preservation-group) during hip arthroscopy using 3-portal technique with capsular-closure (repair-group). Null hypothesis was that capsular repair would provide improved function.

Methods
Study design was that of a prospective cohort study of 120 patients undergoing hip arthroscopy for FAI. Capsular preservation-group (n=60) and capsular-repair (n=60) both used a standardised 3-portal technique including postero-lateral(PL), antero-lateral(AL) and super-lateral(SL) portals. Capsulotomy portals were neither joined nor T-capsulotomy undertaken. Iliofemoral ligament and zona-orbicularis were preserved. Capsular repair, when performed, was with interrupted sutures. Patients with previous surgery and dysplasia were excluded. Data were collected pre/per/post-operatively at 6,12,26 weeks and annually thereafter. Demographics, functional scores including modified Harris Hip Score(mHHS), VAS for satisfaction(0-10), Non-Arthritic Hip Score(NAHS), peri-operative analgesia requirement and adverse events were recorded. Mean follow-up was 20months (range 12, 26). Descriptive statistics, t-test for parametric and chi-squared test for non-parametric variables were employed with alpha set at 5% and beta at 80%.

Results
Capsular preservation and repair groups were matched in mean age (37 (18,54) vs 39(18,59) and gender (males 60% vs 58%) respectively. Pre-operative mean scores improved in the capsular-preservation group (mHHS from 65 to 85 (p<0.01), VAS from 5 (median 6) to 9 (median 9), NAHS from 63 to 84 (p<0.01) and in capsular-repair (mHHS from 66 to 84(p<0.01), VAS from median 6 to 9, NAHS from mean 62 to 81(p<0.01). No significant difference was detected between the groups (p>0.05). Peri-operative analgesia requirement was higher in capsular-closure group and operative time was mean 9 minutes longer.

Conclusion
Judicious and planned capsulotomy (capsular-preservation) gives equally good functional outcome compared to capsular-repair. Peri-operative analgesia requirement increased for repair-group perhaps owing to rich neural supply of the capsule.
Outcomes of open capsular plication of the hip at a mean of six years postoperatively: Do results deteriorate with time?

Dr Jeffrey Nepple1, Dr Wahid Abu-Amer1, Emmanuel Engermann1, Dr Cecilia Pascual-Garrido1, Dr Perry Schoenecker1, Dr John Clohisy1
1Washington University Department of Orthopaedic Surgery, Saint Louis, United States

Introduction

While short-term outcomes of capsular plication of the hip are encouraging, mid- to long-term outcomes are unknown. Results of capsular tightening procedures in other joints seem to deteriorate with time in the setting of soft tissue laxity. Therefore, our objectives were to examine the patient-reported outcomes (PROs) of hips receiving capsular plication at a minimum 4-year follow-up.

Methods

In this retrospective cohort study, we included all skeletally mature hips with significant hip laxity receiving capsular plication between 2008 and 2013. Those with associated acetabular dysplasia, increased femoral anteversion, or previous periacetabular osteotomy (PAO) were excluded. Data collected included demographics, radiographic parameters, UCLA activity score, and modified Harris Hip Score (mHHS), preoperatively and at minimum 4-year follow-up. Paired 2-tailed t-tests were used to analyse changes over time of PROs.

Results

The study cohort included 21 hips with minimum 4-year follow-up (mean 6.4 years). Mean age was 26 years old, with 21 female hips (100%) and 9 (43%) having received previous hip surgery. Mean LCEA was 26.2°, with 14/21 (52%) having LCEA>25° and 5/21 (19%) having LCEA 20°-25°. Mean AI was 4.0° (±5.2°). Mean UCLA worsened from 6.75 preoperatively to 6.4 postoperatively (decreased 0.4, p<0.001). Mean mHHS improved from 54.7 preoperatively to 77.3 postoperatively (increased 22.61, p<0.001). Of the 21 hips, 17 (81%) achieved MCID or PASS on mHHS. Only 1 hip (5%) went on to PAO (27 months post-op), and 2 hips (10%) had to undergo repeated arthroscopy (110 months and 53 months post-op).

Discussion

Patients receiving capsular plication in absence of acetabular dysplasia or increased femoral anteversion demonstrate significantly decreased pain and increased overall hip function at mean 6.4 years after surgery. This supports capsular plication as a viable treatment option for patients demonstrating symptoms of hip laxity in absence of bony hip deformity.
Novel Three-dimensional Measurements for Assessing Hip Morphology

MS Daniel F. Duecker, MD James W. Genuario, MD MBA Richard C. Mather, MD PhD Struan H. Coleman, MD MS Shane J. Nho, PhD Floor M. Lambers

1Stryker Sports Medicine, Freiburg, Germany, 2University of Colorado School of Medicine, Denver, USA, 3Duke Health, Durham, USA, 4Hospital for Special Surgery, New York, USA, 5Rush University Medical Center, Chicago, USA

S8 - Planning, navigation and robotics, Doblon, Ground Level, October 17, 2019, 16:30 - 18:30

Biography
Floor Lambers is a researcher in the field of orthopaedic biomechanics and imaging. She received academic training from Eindhoven University of Technology (MS), ETH Zurich (PhD), and Cornell University (post doc) and is a (co-)author of 25 journal articles and 53 conference proceedings. Her industrial career is focused on patient-specific solutions and more recently was targeted at pre-operative planning for hip arthroscopy.

Objectives
Hip acetabular morphology is commonly described with centre-edge angle (CEA) and Tönnis angle (AI) as measured on two-dimensional radiographs. However, three-dimensional measurements may more accurately characterize the acetabular morphology, and therefore, provide more objective information regarding the hip joint. The present study aims to define and evaluate novel three-dimensional measurements that support the evaluation of hip acetabular geometry.

Methods
Forty-five anonymized computed tomography data were segmented using semi-automated algorithms and aligned to a standard orientation. Data were divided into three groups: low volume (n=15; CEA < 20° or AI > 10°), normal (n=15; CEA 20-40 and AI 0-10), and high-volume (n=15, CEA > 40° or AI < 0°). The acetabular morphology was characterized using the three-dimensional surfaces, surface directions and volumes. For example, the ratio between the three-dimensional surface area of the acetabular cup and the acetabular opening plane was evaluated. Novel three-dimensional measurements were compared between groups.

Results
The orientation of the acetabular opening (3D Sharp's angle) was significantly different between the low-volume (51° ± 3°), normal (47° ± 3°), and high-volume groups (43° ± 3°, p<0.001). The acetabular roof obliquity ranged between 11.3°-14.4° for the normal group which was significantly different from the low-volume group (15.8°-20.3°, p= 0.004) and the high-volume group (0.3°-5.9°, p< 0.001). The ratio of the acetabular cup surface to the acetabular opening size was smaller for the low-volume group (95%CI: 1.62-1.68) and greater for the high-volume group (95%CI: 1.8-1.88) than for the normal group (95%CI: 1.7-1.77, p<0.001). The average contact area ratio was identical between groups (0.68).

Conclusion
As our ability to characterize complex three-dimensional pathoanatomy improves with more sophisticated analyses as presented in this study, surgeons will be able to identify hips with features suggestive of impingement, dysplasia or dysplasia variants. In addition, surgeons may be able to detect more subtle patterns of hip pathomorphology that were not previously known. Also, more sophisticated analyses improve accuracy and repeatability compared to common two-dimensional diagnostic methods.
S8.5 Frequency of posterior femoroacetabular impact in patients with suspected anterior femoroacetabular impingement evaluated with a 3-dimensional dynamic study

Dr Bernardo Aguilera-Bohórquez¹, Dr Ruddy Coaquira¹², Ms Erika Cantor¹
¹Centro Médico Imbanaco De Cali S.a, Cali, Colombia, ²Universidad Javeriana de Cali, Cali, Colombia

Introduction
Anterior femoroacetabular impingement (AFAI) is considered as one of the main causes of hip pain in young adults. It is caused by an irregular contact on the intra-articular area between the acetabulum and femoral neck, which usually affects the anterior-superior zone of the joint. However, it is possible that an irregular contact between these structures occurs on the posterior-superior zone.

Objective
(1) To estimate the frequency of posterior femoroacetabular impact (PFAI) in patients with suspected symptomatic AFAI and (2) To compare range of motion (ROM), acetabular anteversion, femoral anteversion, central-edge angle and alpha angle in cases with and without PFAI.

Methods
We performed a retrospective observational study of patients with suspected of symptomatic AFAI evaluated by computed tomography (CT) from February 2015 to December 2017. PFAI was identified through a 3-dimensional (3D) dynamic study with Clinical Graphics software (Move ForwardTM, Zimmer Biomet, Inc. Miami, USA). Acetabular anteversion, femoral anteversion, lateral central-edge (LCE) angle, alpha angle and ROM were collected. A comparison between 28 cases identified with AFAI and 19 cases with PFAI was done.

Results
The study included 181 hips in 131 patients with a mean age of 38.7 ± 14.1 years; 61.1% were women. PFAI was found in 18.8% of hips [95% confidence interval: 13.8%-25.1%]. An LCE angle at 11:00 of 42.1°± 5.6 was observed on the hips with PFAI in comparison with 33.5°±5.7°of AFAI group. Values of LCE angle at 11:00 greater or equal to 38.6° increases the probability of PFAI (Sensitivity: 84.2%; Specificity: 82.1%).

Conclusion
The impact between the acetabulum and femoral neck on the posterior-superior zone is a frequent finding in patients with symptomatic AFAI through a 3D dynamic study. An LCE angle equal to or greater than 38.6° at 11:00 could be considered as an imaging criterion for suspected AFAI.
S8.6 - Utility of 3D printed models in the treatment of femoroacetabular impingement: A matched cohort study

Dr Ivan Wong1, Dr A P Tejaswi Ravipati2
1 Dalhousie University, Halifax, Canada, 2 Nova Scotia Health Authority, Halifax, Canada

S8 - Planning, navigation and robotics, Doblon, Ground Level, October 17, 2019, 16:30 - 18:30

Biography
Dr Ivan Wong is an Orthopaedic Surgeon at the Queen Elizabeth II Health Sciences Centre in Halifax, NS. He specializes in Sports Medicine treating patients using minimally invasive reconstructive techniques in the shoulder, hip, and knee. After completing medical school at Dalhousie University, he continued with his orthopaedic residency at McMaster University before completing his Sports Medicine, Arthroscopy and Reconstructive Surgery Fellowship with Dr Stephen Snyder at the Southern California Orthopaedic Institute (SCOI). Dr Wong completed his Masters of Academic Medicine at the University of Southern California. He is currently an Associate Professor in Orthopaedic Surgery, the School of Health and Human Performance, and the School of Physiotherapy, at Dalhousie University. He also co-directs a joint Preservation, Sports Medicine and Arthroscopy fellowship program in Halifax, NS. Dr Wong is a founding member and the current president of the Arthroscopy Association of Canada (AAC).

Objective
The purpose of this study was to determine the 1) radiographic and 2) clinical effects of preoperative use of 3D printed models has on femoroacetabular impingement (FAI) surgery

Materials and Methods
Two-hundred and seven patients that underwent FAI surgeries by the same surgeon (IW) were retrospectively analysed. The two groups were matched with those who had pre-operative 3D-printed hip models (n=105) and those with conventional planning using X-rays, computed tomography, and/or MRI (n=102). Radiographic parameters such as alpha angle (45 Dunn view and AP pelvis), centre edge angle (CEA) (AP pelvis), and head-neck offset ratio (HNO) were obtained on pre- and post-operative radiographs. Clinical outcomes were assessed by analysing International Hip Outcome Tool (iHOT) and Hip Outcome Score (HOS) scores pre- and post-operatively.

Results
Two-hundred and seven patients (3D printed group 105, conventional group 102) with a mean age at surgery of 37.5 +/- 12.3 years were evaluated. Mean follow-up time was 28 months. For all of the radiological variables (CEA, alpha angle, and HNO), there was a significant improvement in both groups (p<0.05). The 3D printed group demonstrated significantly better outcomes with regards to cam resection including alpha angle (both AP and Dunn views) and HNO ratio (p<0.05). In particular, the most posterior and lateral aspect of the cam deformity as measured by the alpha angle in AP view was significantly better in the 3D-printed group. Also, the 3D-printed group showed a significantly higher percentage of patients with better resection of bone to a normal alpha angle (<55) and normal LCEA than did the conventional group (p<0.001 and p=0.052, respectively). Statistically significant improvements were seen within both groups on the HOS and iHOT-33 (p=0.001), but there were no statistically significant differences in patient-reported outcomes between groups.

Conclusion
This is the first study to show that utilizing 3D printed models for cam and pincer resection resulted in better radiological outcomes as compared to conventional surgical planning. Additionally, the utilization of 3D prints allowed for better resection and resulted in more patients within the normal radiological value for cam and pincer impingement as measured by alpha angle and CEA, respectively.
S8.7 - Validation of computer navigated arthroscopic osteoplasty of the femoral head - experimental case control study on CT based printed models

Assist. prof. Klemen Strazar¹, Uroš Meglic¹

¹University Medical Centre Ljubljana, Ljubljana, Slovenia

S8 - Planning, navigation and robotics, Doblon, Ground Level, October 17, 2019, 16:30 - 18:30

Biography

Assist. Prof. Klemen Stražar, M.D., Ph
Place and Date of Birth: Ljubljana, 14/03/1971

Medical education:
1989-97 Medical Faculty, University of Ljubljana, Slovenia - graduation 24/11/1997
1999-2015 Postgraduate Studies of Biomedicine, University of Ljubljana, Slovenia

• Masters of Science degree (21/5/2001) “Comparison of loosening of isoelastic noncemented and metal cemented femoral stems using histological and radiographic analyses”

2000-04 Residency in Orthopaedic surgery – licensed by Medical chamber of Slovenia 31/6/2004

Employment:
1999-04 Department of Orthopaedic Surgery, UMC Ljubljana - Resident and young scientist
2004-2017 Department of Orthopaedic Surgery, UMC Ljubljana Consultant orthopaedic surgeon – Division for arthroscopy and sports injuries
2017 onward Member of Chair of Orthopaedics, Medical Faculty, University of Ljubljana

Academic activities
2004-17 Assistant undergraduate orthopaedic students (Medical faculty, University of Ljubljana)
2018 onward Assistant professor for orthopaedic surgery (Medical faculty, University of Ljubljana)
2015 Visiting Ph.D. and consultant at Department for Orthopaedic Surgery Aarhus University, Denmark

Publications
• Invited lecturer, moderator, or committee member in over 50 national/international conferences
• 137 publications (20 in SCI/SCIE journals)

Background

Computer navigation of arthroscopic instruments has been considered as a potential solution to improve accuracy of CAM resection, but its positive contribution has not been well tested yet.

Methods

CT scans of 16 hips with isolated CAM deformity were used to print models of proximal femur. Four identical pieces were obtained per hip. Kinematic plan was transferred to the surgical navigation system.

Total of 64 arthroscopic osteoplasties were performed by two surgeons: 1 experienced, 1 unexperienced. Each surgeon performed 1 navigated arthroscopic osteoplasty and 1 free-hand arthroscopic osteoplasty on a printed model of the same hip. The obtained shape of the femoral head was scanned and compared to the desired shape acquired by planning. Accuracy of osteoplasty obtained with navigation system was compared to the one obtained without navigation. The impact of surgical experience on the results was tested.

Results

Using navigation, an average of 10 % (experienced surgeon) and 13 % (unexperienced surgeon) of bone volume was under-resected. The accuracy was significantly better compared to results obtained without navigation with average of 35 % (experienced surgeon) and 38 % (unexperienced surgeon) of bone volume being under-resected. Furthermore, and even more important, the average maximum depth of persisted
CAM after navigated osteoplasty was significantly lower than after non-navigated osteoplasty (experienced surgeon: 1.06 mm and 3.13 mm, respectively; unexperienced surgeon: 1.06 mm and 3.20 mm, respectively). Regarding under-resection there was no difference in result between surgeons. There was a tendency to over-resect the femoral head either navigation was used or not, with even some better performance shown by unexperienced surgeon. It was roughly estimated that navigated osteoplasty was performed with accuracy being twice better compared to non-navigated osteoplasty.

Conclusion
According to the results, navigation improves accuracy of arthroscopic resection of CAM deformity significantly. Navigation has been proven to improve performance of arthroscopic osteoplasty reducing the risk of persisted CAM. Some technical advances of the navigation system may be considered to further improve accuracy of arthroscopic osteoplasty, in particular to prevent over-resection. It seems that experience of a surgeon may not have any significant influence on the accuracy of arthroscopic osteoplasty.
S8.8 - Dynamic calculation and volumetric measurement in planning and assessing surgical resection in femoroacetabular hip impingement

Ph Dr Alberto Frances-Borrego¹, PhDr Yaiza Lopiz², Ph Alvaro Arriaza-Cantos³, Dr Julio Otero Otero⁴, PhDr Antonio Ruiz Ollero⁵, Radiology Technician Catalina Nieto Gongora⁶, Ph Dr Ana Crespo Rodriguez⁷

¹HOSPITAL CLINICO SAN CARLOS, MADRID, SPAIN, ²HOSPITAL CLINICO SAN CARLOS, Madrid, SPAIN, ³HOSPITAL CLINICO SAN CARLOS, Madrid, SPAIN, ⁴HOSPITAL CLINICO SAN CARLOS, Madrid, SPAIN, ⁵HOSPITAL CLINICO SAN CARLOS, Madrid, SPAIN, ⁶HOSPITAL CLINICO SAN CARLOS, Madrid, SPAIN, ⁷HOSPITAL CLINICO SAN CARLOS, Madrid, SPAIN

S8 - Planning, navigation and robotics, Doblon, Ground Level, October 17, 2019, 16:30 - 18:30

Biography

Traumatology and Orthopaedic Surgeon (Hospital Clínico San Carlos De Madrid)
.Unidad De Cadera. Cirugía Reconstructiva De Cadera Del Adulto
.Associate Professor of Medicine (Facultad de Medicina. Universidad Complutense de Madrid)

Introduction

Unaddressed or residual femoroacetabular impingement (FAI) appears to be a leading cause for arthroscopic hip revision. Accurate understanding of hip deformities is the goal, although radiological images (X-rays, Arthro-MRI and TAC with 3D-reconstructions) used are not maybe enough to show the dynamic impingement. FAI is a dynamic problem not completely addressed with these static images in which theoretically calculates resections without understanding how it impinges throughout the range of motion. We propose a standardized method for dynamic planning and assessment for FAI surgery.

Material and methods

10 patients were included with FAI diagnosis who underwent pre and post-surgical high-resolution CT of the pelvis with same specific parameters, especially the field of vision (FOV). Estimation of osseous volume either on the acetabulum and the femur that should be remove was perform with a Philips® post-processing tool. Presurgical CT evaluation include a simulation of dynamic range of motion of the hip by the software Meshmixer®. Post-surgical quantification of the osseous volume resected was performed with software Synapse® 3D Fuji®. Volumetric impinging 3D volumes were compared pre and post-surgically.

Results

We were able to reproduce normal hip range of motion and dynamically calculate when hip deformities impinge, and which was the volume of bone that should had being resected for free-FAI range of motion pre and post-surgically. We dynamically calculate when the hip impinges, and which is the exact volume of bony resection to be done not to impinge.

Discussion

Our aim was to establish a new approach for understanding FAI, with dynamic calculation and a volumetric measurement used in an easy, not expensive and reproducible way in our patients. This quantitative method will allow us to know in advance which is the amount of bony resection needed in any single patient with FAI in a customized way, taking into account which is the individual range of motion needed for any of our patients related to their sports and daily activities. We considered this a novel, easy and reproducible method for preoperative planning and postoperative assessment. We have developed a standardized method for dynamic planning and assessment of FAI surgery.
S9.5 - Ischiofemoral impingement in adolescents: From clinical presentation to return to sports

Dr Javier Besomi1,2, MD Alan Garin1, MD Cristhian Herrera3, PT Pedro Salgado1, MD Selim Abara1,5, MD Luis E. Moya1, MD Carlos Tobar4, MD Joaquin Lara3

1Clinica Alemana De Santiago, Santiago, Chile, 2Hospital Clinico San Borja Arriaran, Santiago, Chile, 3Clinica Las Condes, Santiago, Chile, 4Clinica Avansalud, Santiago, Chile, 5Hospital Dipreca, Santiago, Chile

S9 - Children and Adolescent Hips, Castilla, Ground Level, October 18, 2019, 08:00 - 10:00

Biography
35 years-old pediatric orthopaedic surgeon and hip preservation surgeon at Clinica Alemana de Santiago and Hospital San Borja Arriaran in Santiago, Chile.

Background
Ischiofemoral impingement is an often-unrecognized cause of hip pain in adolescents. It is caused by abnormal contact between the proximal femur and the ischium. The aim of our work is to describe clinical presentation, imaging findings and functional outcomes of ischiofemoral impingement in adolescents.

Methods
A retrospective study was performed, clinical files (age, sex, type and duration of symptoms and hip physical examination) were reviewed. Imaging findings were evaluated in pelvis radiographs (presence of coxa profunda, acetabular protrusio, Wiberg angle, femoral neck shaft angle and acetabular retroversion) and in MRI (quadratus femoris edema, measurement of ischiofemoral and quadratus femoris space). Lower extremity functional scale (LEFS) were used to measured response to a physiotherapy protocol. Relapse and time to sports return was recorded.

Results
33 hips, in 30 patients (91% female), with 12.8 years-old on average (9-16) were obtained. Main symptom was hip pain with latency to consultant of 6 months on average (1 day to 24 months). All patients practiced school sports, the most frequent was gymnastics. The most frequent provocative test was ischial palpation pain. Main Wiberg angle was 32º (21-48), femoral neck shaft angle 140º (125-161) , and coxa profunda was present in 40%. MRI showed quadratus femoris edema I all cases, two with muscle atrophy. Ischiofemoral space was 17 mm on average (8-27) and quadratus femoris space 10 mm on average (4-21). Our physiotherapy protocol was followed for all patients with a median of 18 sessions (10-30). LEFS improved from 56.4% (30-93) to 92% (80-100) (p=0,02). Time to turn asymptomatic was 7.9 months on average (3-24). With 12 months follow up, 2 hips had recurrence of symptoms. Time to sports return was 5 months on average (3-9).

Conclusions
Ischiofemoral impingement is cause of hip pain in active female adolescents. X-rays are unspecific and MRI shows typically quadratus femoris edema. Conservative treatment with physiotherapy is an effective method that allows sports return in few months. This is largest case-series of IFI in adolescents with clinical and imagenogical assessment and the first report with results of treatment including time to return to sports.
**S9.6 - Ten-year outcomes in adolescents following hip arthroscopy for FAI and labral repair**

*Dr Travis Menge*, Ms Karen Briggs1, Dr Ioanna Bolia1, Dr Marc Philippon1

1*Steadman Philippon Research Institute, Vail, United States*, 2*Spectrum Health Medical Group Ortho and Sports Med, Grand Rapids, United States*

S9 - Children and Adolescent Hips, Castilla, Ground Level, October 18, 2019, 08:00 - 10:00

**Introduction**

Studies have demonstrated hip arthroscopy to be an effective treatment for femoroacetabular impingement (FAI) with associated labral tears in young patients. The purpose of this study was to report 10-year outcomes and revision rate following hip arthroscopy for FAI and labral repair in adolescents’ patients.

**Methods**

Prospectively collected data on patients aged 13 to 17 followed for a minimum of 10 years after hip arthroscopy for FAI with labral repair performed by a single surgeon were retrospectively analysed. Patients were excluded if they had previous surgery on the hip and if they presented with a lateral centre edge angle <20. The primary patient-reported outcome measure was the Hip Outcome Score (HOS) Activities of Daily Living (ADL) subscale. In addition, HOS Sport score, modified Harris hip score, SF12, and patient satisfaction with outcome (1 to 10, 10=very satisfied) were collected. Failures were defined as need for revision arthroscopy or symptomatic failure (HOS-ADL <50 or patient satisfaction<5).

**Results**

Average age of the cohort was 16±1.3 with 15 males and 35 females. 7 out of 50 (14%) required revision hip arthroscopy for adhesions or reinjury; however, there were no symptomatic failures. There was no association between failure and gender(p=0.97), age or BMI. At an average follow-up of 11±1 year, mean HOS-ADL was 92.5±9.2, SF12 PCS=52±8.2, mHHS=86±12, HOS-Sport=83±18 and median patient satisfaction with outcome was 10[95%CI 7.8-9.1]. There was no association between outcomes scores and gender or BMI. Age correlated with mHHS (rho=-0.365;p=0.031). HOS-ADL was correlated with SF12-PCS(rho=0.596;p<0.01), mHHS(rho=0.801;p<0.01), HOS-sport(rho=0.858;p<0.01)and patient satisfaction(rho=0.553;p=0.001).

**Conclusion**

Hip arthroscopy for FAI with labral repair resulted in excellent patient-reported outcomes and satisfaction at a minimum of 10 years in patients who did not require revision. Most revisions were due to adhesions; however, these were not associated with any patient demographics.
S9.7 - FAI Surgery in the adolescent patient population: Mild deformities and lack of sports participation are associated with an increased risk of treatment failure
Dr Jeffrey Nepple¹, Dr Yi-Meng Yen², Dr Ira Zaltz³, Dr David Podeszwa⁴, Dr Ernest Sink⁵, Dr Young-Jo Kim², Dr Daniel Sucato⁴, ANCHOR Group, Dr John Clohisy¹

¹Washington University Department of Orthopaedic Surgery, Saint Louis, United States, ²Harvard Medical School Department of Orthopaedic Surgery at Boston Children’s Hospital, Boston, United States, ³William Beaumont Hospital Department of Orthopaedic Surgery, Royal Oak, United States, ⁴Texas Scottish Rite Hospital, Dallas, United States, ⁵Hospital for Special Surgery Department of Orthopaedic Surgery, New York, United States

Purpose
The purpose of this study was to determine the clinical outcomes of FAI surgery in adolescent patients and to identify predictors of treatment failure.

Methods
A cohort of 126 adolescent patients (<18 years) undergoing surgery for symptomatic FAI were prospectively assessed among a larger multicentre cohort. The adolescent subgroup included 74 (58.7%) males and 52 (41.3%) females, mean age of 16.1 years (range 11.3-18.0), and mean follow-up of 3.7 years. Mild cam FAI was defined as alpha angle < 55°. Clinical outcomes were the mHHS, HOOS (5 domains), and UCLA activity score. Failure defined as revision surgery or clinical failure (failure to reach MCID (minimally clinically important difference) or PASS (patient acceptable symptoms state) for mHHS. Statistical analysis identified factors significantly associated with failure.

Results
There was clinically important improvement in all PROs (mHHS, HOOS) for the overall cohort and 81% of patients met criteria for successful outcome. Failure rate (revision surgery or clinical failure) of the overall cohort was 19%, including revision surgery in 8.7%. Females were significantly more likely than males to be classified as a failure (25.7% vs. 9.1%, p=0.017, OR 2.6), in part because of lower preoperative mHHS (59.1 vs. 67.0, p<0.001). Mild cam FAI (alpha <55°) was present in 31.5% of cases including 39.1% of females and 14.5% of males. Maximal alpha angle was significantly inversely associated with the failure rate (37.5% for alpha<55°, 19.2% for alpha 55-63°, and 6.8% for alpha>63°, p<0.005). Non-athletes were at a significantly greater risk of failure compared to athletes (26.5% vs. 10.3%, p=0.043, OR 2.3). Multivariable logistic regression identified mild cam FAI and lack of participation in sports as predictive of failure (p=0.005 and p=0.04). Gender was no longer significantly associated with failure after controlling for other variables.

Conclusion
Adolescent patients, independent of gender, undergoing surgical treatment of FAI demonstrate significant improvement at early follow-up. Mild cam FAI deformities and lack of sports participation are independently associated with higher rates of treatment failure.

Significance
This study identified factors associated with higher rates of clinical failure. These factors should be considered in surgical decision-making and patient counselling.
S9.8 - Hip arthroscopy in slipped capital femoral epiphysis: Articular damage and time to scope

Dr Javier Besomi1,2, MD Valeria Escobar3, MD Juanjose Valderrama4, MD Selim Abara1,5, MD Luis E. Moya1, MD Jaime Lopez1, MD Claudio Mella1, MD Carlos Tobar6, MD Joaquin Lara7

1Clinica Alemana De Santiago, Santiago, Chile, 2Hospital Clinico San Borja Arriaran, Santiago, Chile, 3Universidad de Chile, Santiago, Chile, 4Hospital Clinico Mutual de Seguridad, Santiago, Chile, 5Hospital DIPRECA, Santiago, Chile, 6Clinica Avansalud, Santiago, Chile, 7Clinica Las Condes, Santiago, Chile

S9 - Children and Adolescent Hips, Castilla, Ground Level, October 18, 2019, 08:00 - 10:00

Biography
35 years old Pediatric Orthopaedic Surgeon and Hip Preservation Surgeon at Clinica Alemana de Santiago and Hospital San Borja Arriaran in Santiago de Chile.

Objective
To describe chondrolabral damage in patients with slipped capital femoral epiphysis (SCFE) who underwent hip arthroscopy and his correlation with time to arthroscopy and type of SCFE.

Methods
Descriptive prospective study in a cohort of patients with SCFE who underwent hip arthroscopy for femoral osteochondroplasty. Demography data, type of SCFE, time from slip fixation surgery to hip arthroscopy and intra-articular findings on arthroscopy were collected: aspect of synovial tissue and labral and chondral damage using Konan classification. Statistical analysis was performed using STATA 12, Chi2 and linear regression.

Results
17 hips in 14 patients were obtained, 9 male and 5 females, with 13.2 years-old on average (8 – 20). Time from slip fixation to hip arthroscopy was 23.9 months on average (3 weeks to 8 years). 41% of the cases were acute, 88% mild and 82% stable SCFE. 94% of the cases had synovial hyperaemia on hip arthroscopy. Labral fraying was found in 94%, but unstable labrum required treatment in 71%. Acetabular chondral damage in 77% (35% Konan type 3) and femoral chondromalacia in 18%. Time from slip fixation to arthroscopy had a positive correlation with chondral damage (p=0.029). SCFE stability, severity and temporality were no significant (chi2 p=0.446, chi2 p=0.54, chi2 p=0.254 respectively).

Conclusions
94% of the SCFE cases had intra-articular damage. Most frequent lesion was labral fraying followed by acetabular chondral lesions. The greater time elapsed from SCFE fixation to arthroscopy, greater chondral damage. This is the first study showing a positive correlation between intra-articular damage and time to scope in SCFE.
Biomechanical evaluation of the hip joint motion in water polo players

Doctor Leandro Ejnisman¹ ², Dr Kimberly Hall³, Thomas Andriacchi³, Lexie Ross³, Dr Marc Safran³

¹Universidade de Sao Paulo, Sao Paulo, Brazil, ²Stanford University, Redwood City, USA

S10 - The Hip in Sport, Hidalgo, Ground Level, October 18, 2019, 08:00 - 10:00

Introduction
The egg-beater motion is a key element in water polo. It is responsible for keeping the athletes above water so that they can use their arms to hold the ball, pass, shoot and defend. There is an apparent large incidence of hip pathology in water polo athletes. Understanding the hip biomechanics during the egg-beater motion may help elucidate risk factors for hip problems in this population and for future study.

Methods
Twenty-two athletes (8 males, 14 females) from a NCAA Division 1 University Team were included. Athletes were filmed at orthogonal views while performing the egg-beater motion using 2 waterproof cameras (GoPro, San Mateo, CA) in synchrony. A model-based image-matching technique was used to determine hip joint angles. This technique uses the Poser animation software (SmithMicroSoftware, Aliso Viejo, CA) to match the athletes to a pre-built humanoid model. Hip joint angles were recorded from the software.

Results
The total arc of motion during the egg-beater cycle was on average: rotation 66.3° + 18.3, abduction-adduction 29.5° + 7.3, flexion-extension 51.5° + 13.2. Average angles for specific motions were external rotation (ER) 21.1°, internal rotation (IR) 45.2°, abduction 53.8° and flexion 78.8°. Female athletes presented significant higher IR angles (49.6° vs 37.5°, p=0.002). A description of hip biomechanics divided the egg-beater cycle in 4 phases: (1) hip moves to maximum flexion, abduction and ER, (2) hip is progressively being extended with adduction and IR (3) the hip is forcefully ER and adducted and (4) hip flexes, abducts and ERs to return to phase 1 position.

Discussion/Conclusion
Water polo athletes demonstrated a large total arc of rotation when performing the egg-beater motion, which may increase their risk of presenting with symptomatic femoroacetabular impingement. Females had more IR than males. The model-based image-matching technique was a feasible method to evaluate underwater hip biomechanics.
Hip screening of a professional ballet company using ultrasound-assisted physical examination: Diagnosing the at-risk hip

Ms Michelle Rodriguez1, Ms Michele Philippon2, Ms. Karen Briggs1, Dr Marc Philippon2

1Manhattan Physio Group, Physical Therapy and Wellness Centre, New York, United States, 2Steadman Philippon Research Institute, Vail, USA

S10 - The Hip in Sport, Hidalgo, Ground Level, October 18, 2019, 08:00 - 10:00

Biography
Michelle Rodriguez, MPT, OCS, CMPT is the founder of Manhattan Physio Group. She has over 19 years of experience as a physical therapist working with elite dancers, athletes, performers, musicians, and actors. Michelle graduated with honours in psychology from Amherst College and received her Master’s degree in physical therapy from Rutgers University & UMDNJ in 1999, where she was honoured with the APTA Minority Scholarship for Academic Excellence Award. She became a certified manual physical therapist (CMPT) through NAIOMT in 2004 and attained board certification by the American Physical Therapy Association as an Orthopaedic Certified Specialist (OCS) in 2009. She completed a comprehensive motor control curriculum, The Movement Solution, in 2013 with Kinetic Control Seminars. Michelle's unique background in orthopaedics and biomechanics began with her career as a professional ballerina. As a physical therapist she has maintained a close relationship with dancers. Michelle lectured for the education department of NYC Ballet on injury prevention, presented papers at the IADMS Annual Conference, presenter and faculty member of the Vail Hip Symposium. Michelle founded Manhattan Physio Group LLC in May 2008 to expand her range of service. At the heart of Manhattan Physio Group’s practice is Michelle’s integrative approach to physical therapy.

Hip pathology is common in athletes and may be the result of an acute injury or an overuse syndrome. Several studies have shown the prevalence of hip injuries depends partially on sport, participants’ age, and level of competition. Previous studies have shown a high prevalence of hip injuries in ballet dancers. The purpose of this study was to determine the prevalence of “hips-at-risk” in ballet dancers before the season and determine the prevalence of abnormal findings and injuries.

Methods
All dancers in the company who agreed to participate underwent a standard hip exam including anterior and posterior impingement, dial test, resistant abduction, Trendelenburg and pelvic tilt. In addition, range of motion was also measured. Sonograms were performed on dancers suspected of labral tears and tendinopathy.

Results
Eighty-two elite dancers from one company were screened prior to the ballet season. The average age of the dances was 28.6 +/- 6.5 years. There were 44 females; 38 males. The dancers started ballet at average of 7 years of age +/-2.3 years. At time of screening, dancers had an average of 21.6yrs +/- 6.5 of dance experience. Femoroacetabular Impingement (FAI) was diagnosed in 78%, with labral tears seen in 18 dancers. 76 dancers had bilateral FAI and 4 patients had bilateral labral tears. 25 dancers identified with hip intra or extra articular pathology. Dancer 25 years of age and under had injuries in 6/25(24%); over 25 years had19/57(33%)

Conclusion
This study showed most dancers had “hips-at-risk” based on the screening exam. Most dancers had signs of FAI and micro-instability. As with other athletes, dancers may place repeated stress on the physics, predisposing them to FAI type bony abnormalities. In addition, dancers do prolonged stretches starting at an early age will may stretch the capsular ligaments in addition to the hip muscles.
S10.6 - Arthroscopic treatment for femuroacetabular impingement in elite athletes- 5-year follow up

Dr Ida Lindman1, Dr Axel Öhlin, Dr Mikael Sansone
1Orthocenter Gothenburg, Gothenburg, Sweden

Biography
Ida Lindman received her medical degree at Gothenburg University in 2016. During her medical studies, she was a visiting student researcher at Harris Orthopaedics Laboratory at Massachusetts General Hospital in Boston. PhD-student at Orthocentre Gothenburg in the team of Jon Karlsson and Mikael Sansone.

Background
Femoroacetabular impingement syndrome (FAIS) is a common reason for hip pain and disability in the athletic population. Hip arthroscopic treatment for FAIS is a well-established treatment for this diagnosis. However, few studies have reported the long-term outcomes after arthroscopic treatment in elite athletes.

Purpose
The aim of this study is to report outcomes five years after arthroscopic treatment for femoroacetabular impingement syndrome in elite athletes.

Methods
Sixty-four elite athletes (52 men, 12 women) with a mean age of 24 ± 6 years underwent arthroscopic treatment for FAIS in 2011 and 2012 and were prospectively followed up five years after surgery with patient-reported-outcomes (PROMS). Inclusion criteria in the study was a Hip Sports Activity Scale (HSAS) level of 7 and 8 prior to symptoms and a participation in the follow-up. Preoperatively and five years post-surgery, all athletes were asked to complete a web-based questionnaire including; the International Hip Outcome Tool (iHOT-12), the Copenhagen Hip and Groin Outcome Score (HAGOS, including 6 sub scores), the Euro Quality of Life 5 dimensions questionnaire (EQ-5D), HSAS and a visual analogue scale (VAS). At last, the patient reported their overall satisfaction with their hip function. To evaluate the cohort, preoperative data was compared with those obtained at the five-year follow-up.

Results
Preoperative scores compared to those at the five year follow-up presented an improvement for the following measured outcomes, iHOT-12 (40 vs 69), HAGOS subscales (52 vs 72, 61 vs 81, 67 vs 84, 40 vs 72, 25 vs 67, 34 vs 68), EQ-5D (0,59 vs 0,83) and VAS (66 vs 76). Of 64 elite athletes, 54 % still remained in competitive sports (HSAS 5-8) five years after surgery. Lower levels of sports activity (HSAS 0-4) were seen in patients with higher age at time of surgery and patients with longer symptom duration. At the follow-up, 90.5 % reported satisfaction with their overall hip function.

Conclusion
Arthroscopic treatment for elite athletes with a diagnosis of FAIS improve hip function and decrease hip pain with good results five years after surgery and allow athletes to return to high-level sports.
S10.7 - Patient-reported outcomes for a return to running rehabilitation program following hip arthroscopy

Dr Alan Reynolds¹, Dr Ryan McGovern², Dr John Christoforetti²
¹Allegheny General Hospital, Pittsburgh, United States, ²Texas Health Sports Medicine, Dallas, United States

S10 - The Hip in Sport, Hidalgo, Ground Level, October 18, 2019, 08:00 - 10:00

Purpose
To present outcomes for patients attempting a return to running following hip arthroscopy, and the rehabilitation protocol used to guide them.

Methods
Data was reviewed retrospectively from a prospectively collected database of patients undergoing hip arthroscopy by a single expert hip arthroscopist. Patients who listed running as a pre-operative activity and had a minimum of 6 months of follow up were included. Returning to running was the primary outcome measure and defined as the successful ability to run at least one mile three times weekly while maintaining patient reported relief of pre-operative hip symptoms.

Rehabilitation protocol
At least 3 months postoperatively, a standardized, 4 week “month to mile” program was begun by all patients. This included 3 days per week of running, 3 days of optional, non-impact cardio and 1 day of total rest. Each running day included completing 1 mile on a track with a combination of running and walking, with a progressively increasing proportion of running.

Results
A total of 76 patients were included, with 64 (84%), returning to running successfully. The average time at successful return was 5.5 months. Patients that successfully returned to running were younger (29 vs 40, p=0.002), and had higher patient reported pre-operative mental health scores (SF-12, 50.6 vs 44.2, p=0.034; and VR-12, 53 vs. 47, p=.043) than those who were unsuccessful. No difference was found between the two groups in terms of sex, BMI, procedure performed, or pre-operative patient reported physical activity or pain scores.

Conclusions
This study demonstrates the effectiveness of a standardized, 4-week return-to-running rehabilitation protocol for patients undergoing hip arthroscopy. Risk factors for failing to return to running included older age and lower pre-operative patient reported mental health scores.
Biography

T. Sean Lynch specializes in the nonoperative and operative treatment of hip and knee disorders in athletes of all levels at Columbia Doctors Orthopaedics. He is an expert in hip surgery and knee ligament reconstruction with minimally invasive and arthroscopic techniques. His particular clinical interests include injuries of the ACL, knee articular cartilage and the meniscus. He also specializes in labral injuries of the hip and uses advanced arthroscopic techniques to treat this ever-increasing problem.

Background

Femoroacetabular impingement (FAI) and labral tears are a common athletic hip condition. To facilitate return to sports, many athletes with symptomatic FAI may undergo hip arthroscopy; however, return to play following surgical intervention can be intimidating for fear of re-injury. An athletes’ psychological readiness to return to sporting activity after hip arthroscopy has not been explored in the literature.

Methods

Athletes who underwent a hip arthroscopy for a labral tear in the setting of FAI were included with a minimum of 2 months after surgery. Participants completed a Readiness Questionnaire (12 questions) that assessed their psychological readiness to return to sporting activities (for each question, 0 corresponded to a hesitance to return, 100 corresponded to complete readiness to return; a total score of 1200 was considered perfect). Analyses were conducted using the two-tailed t-test or Pearson correlations when appropriate.

Results

Nineteen patients (26 hips; 26.3% female) were included. The patients were 23.89 ± 5.96 years old and 7.18 ± 4.35 months out from surgery. Our cohort included competitive athletes (20 hips) and self-guided/recreational athletes (6 hips). The average total score was 741.6 ± 297.8 (307-1184). Athletes felt somewhat confident in returning to their previous level of sport (63.47 ± 28.80) but were nervous about playing their sport (57.47 ± 31.88). Athletes who had already returned felt more relaxed about playing their sport than those who had not (82.00 vs 51.23, p = 0.019). Baseline VR-12 Mental Health scores correlated significantly with the total Readiness scores (R = 0.681, p = 0.007). VR-12 Mental Health scores and modified Harris Hip Scores (mHHS) taken closest to the time of the questionnaire did not correlate significantly with total Readiness scores.

Conclusion

Athletes following hip arthroscopy have some apprehension about returning to sports. Individuals who had returned to sports were more relaxed with regards to their sport. Patients’ preoperative VR12 Mental Health scores could be used by surgeons in preoperative counselling to prepare athletes for how ready they may feel about returning to sports. Physicians should focus on encouraging athletes that their hips can withstand the stresses of competition.
S11.5 - A cadaveric study comparing hip contact pressures between acetabulum labral repair vs total labral reconstruction

Dr Sunikom Suppauksorn¹, Dr Edward Beck², Dr Jourdan Cancienne¹, Dr Jorge Chahla¹, Ms. Laura Krivicich¹, Mr Jonathan Rasio, Dr Shane Nho¹
¹Rush University Medical Centre, Chicago, US, ²Department of Orthopaedic Surgery, Wake Forest Baptist Health, Winston-Salem, US

S11 - Labral Repair, Auditorium (Plenary), Ground Level, October 18, 2019, 08:00 - 10:00

Purpose
To biomechanically compare the contact area, contact pressures, and peak forces of primary labral repair versus labral reconstruction.

Methods
A cadaveric study was performed using 8 frozen hemi-pelvises with cam-type deformities (alpha angle >55°) with an intact labrum. Intraarticular pressure maps were produced for each specimen under the following conditions: 1) intact labrum, 2) labral repair, and 3) labral reconstruction using iliotibial band (ITB) allograft. Specimens were examined at neutral, 20° of extension and 60° of flexion to simulate the complete arc of the natural hip range of motion during normal gait on a level surface and during stair climbing. Each specimen was placed in a custom-designed jig in the MTS electromechanical test system to create pressure and area map measurements. In each condition, contact pressure, contact area, and peak force within a region-of-interest (ROI) were obtained. Repeated measures ANOVA was used to identify differences in biomechanical parameters among the three conditions with post-hoc analysis using pairwise comparison with Bonferroni correction to analyse the differences within each condition. Analysis of contact pressures between labral repair and labral reconstruction were normalized to the pressures measured in the intact labrum.

Results
Repeated measures ANOVA for contact area in neutral, extension, and flexion demonstrated statistically significant differences between study states (p<0.05). Post-hoc analysis for each consistently demonstrated significantly larger contact areas measured in labral repair specimens compared labral reconstruction specimens. In addition, paired-T test analysis demonstrated significantly higher contact areas (33.3+7.9 vs 27.4+6.9; p=0.009) and significantly lower contact pressures (2.5+0.3 vs 2.7+0.4; p=0.038) in labral repair specimens compared to labral reconstruction specimens. Finally, there was no statistically significant difference in peak forces measured between specimens (p<0.05 for all).

Conclusion
Primary labral repair may result in lower intra-articular hip contact pressures and higher contact area compared to primary labral reconstruction.
The effect of cam impingement on complexity of labral tears; A multi-centre descriptive study

Dr Dominic Carreira1, Dr Benjamin Kivlan2, Dr Dean Matsuda3, Dr Shane Nho4, Dr John Salvo5, Dr Geoffrey van Thiel8, Dr Al Stubbs9, Dr Misty Suri10, Dr John Christoforetti6, Dr Andy Wolff5, Dr Steven Garden1

1Peachtree Orthopaedics, Atlanta, United States, 2Duquesne University, Pittsburgh, United States, 3DISC Sports and Spine Centre, Marina del Rey, United States, 4Rush University Medical Centre, Chicago, United States, 5Washington Orthopaedics and Sports Medicine, Washington, United States, 6Allegheny Health Network, Pittsburgh, United States, 7Rothman Institute, , United States, 8Ortho Illinois, Philadelphia, United States, 9Wake Forest Baptist Health, Winston-Salem, United States, 10Ochsner Sports Medicine, Jefferson, United States

S11 - Labral Repair, Auditorium (Plenary), Ground Level, October 18, 2019, 08:00 - 10:00

Purpose

Morphological properties of the femur are known to cause intra-articular hip pathology. The purpose of this study was to report the effect of cam-type impingement as quantified by alpha angle on the complexity of labral tears of patients undergoing hip arthroscopy across at multiple U.S. centres.

Number of Subjects

A total of 1191 patients from 10 select surgical hip centres that had hip arthroscopy for labral pathology between January 1, 2015 – March 1, 2018 were analysed for this study.

Methods

De-identified data was collected from 10 individual high-volume surgeon practices. An anterior-posterior view establishing the alpha angle of the involved hip was recorded for each patient. Patients were grouped by labral tear complexity identified during arthroscopic evaluation. An analysis of variance (ANOVA) tested the effect of radiographic alpha angle of the observed tear complexity during arthroscopy. The magnitude of the differences between the groups of patients based on labral tear complexity were established by a Tukey’s post hoc analysis. Labral tear complexity was graded as follows: Grade 0, no tear; Grade I, the labrum has a stable rim configuration. There is evidence of some fraying of the substance; Grade II, the labrum has rim instability and damage; Grade III, the labrum has a complex multiple plane injury including >50% of the labral substance.

Results

The 1191 patients (429 males; 762 female) averaged 34.05 (SD: 11.3) years of age, 25.2 (SD: 3.6) BMI, a 40.8 (SD:20.4) pre-op pain VAS, and 34.07 (SD: 17.9) pre-op iHOT-12. Analysis of variance confirmed an effect of alpha angle on labral tear complexity, F(3)=14.5, p<0.001. The post hoc analysis showed that alpha angles in
the Grade 0 (57; SD:13) and Grade I tears (55; SD 11) were less ($p<0.001$) than patients with Grade II (61;SD: 10) and those with Grade III (64; SD: 13).

Conclusions
The results of this study show that patients with greater complexity of labral tears generally have greater alpha angle values.

Clinical Relevance
Patients that present with radiographic evidence of cam lesions may expect labral tears that are more complex, the greater the alpha angle.
S11.7 - Primary labral reconstruction in patients with femoroacetabular impingement, irreparable labral tears, and severe acetabular chondral defects decreases the risk and rate of conversion to total hip arthroplasty.

A pair-matched study

Dr David Maldonado¹, Cammille Go¹, Joseph Laseter², Dr Ajay Lall¹, Michael Kopscik³, Dr Benjamin Domb¹

¹American Hip Institute, Chicago, United States, ²Case Western Reserve University School of Medicine, Cleveland, United States, ³Medical University of South Carolina, Charleston, United States

S11 - Labral Repair, Auditorium (Plenary), Ground Level, October 18, 2019, 08:00 - 10:00

Introduction

In the presence of severe acetabular cartilage defects, the benefits of labral reconstruction (RECON) versus labral resection (RESEC) have not been determined.

Methods

Prospectively collected data between August 2008 and July 2016 were retrospectively reviewed. Inclusion criteria were hip arthroscopy, acetabular Outer bridge grade III/IV, irreparable labral tears that underwent RECON or RESEC, and minimum 2-year postoperative measures for the modified Harris Hip Score, Non-Arthritic Hip Score, Hip Outcome Score–Sports Specific Subscale, International Hip Outcome Tool, Patient Satisfaction, and Visual Analogue Scale. Exclusion criteria included Tönnis grade>1, previous hip conditions, or previous ipsilateral hip surgeries. A 1:1 matched-pair analysis was performed based on age ±5 years, sex, body mass index ±5 kg/m², Tönnis grade, acetabular microfracture, femoral Outer bridge grade (0 or I compared with II, III, or IV). Relative Risk (RR) and conversion rate to total hip arthroplasty (THA) were calculated.

Results

34 RECON hips were successfully matched. Both groups demonstrated significant improvements in patient-reported outcomes (PROs). THA conversion was 8.8% and 29.4% for the RECON and RESEC groups, respectively (P=0.03). RECON was over three times less likely to require THA conversion than the RESEC group (RR = 3.33; 95% CI = 1.005-11.05).

Conclusion

In the setting of primary arthroscopic management of FAI, irreparable labral tears, and acetabular chondral lesions of Outer bridge III/IV, patients that underwent RECON and RESEC experienced significant improvement in PROs at minimum 2-year follow-up, and these functional scores were comparable when groups were matched. However, RR and rate to THA conversion were significantly higher in the RESEC group.
S11.8 - Long-term survivorship following labral reconstruction

Ms Karen Briggs¹, Dr James Spratt¹, Dr Marc Philippon²

¹Steadman Philippon Research Institute, Vail, United States

S11 - Labral Repair, Auditorium (Plenary), Ground Level, October 18, 2019, 08:00 - 10:00

Biography
Karen Briggs is the Director of Hip Research at the Steadman Philippon Research Institute. She started with Dr Richard Steadman 26 years ago and now specializes in hip outcome research.

Recent biomechanical studies have demonstrated the importance of the labral suction seal in the hip. Irreparable labral damage is a common finding during hip arthroscopy and threatens the long-term survival of the joint. Labral reconstruction has been used to replace the damaged labrum. The purpose of this study is to determine long term survivorship of labral reconstruction.

Methods
Between 2006 and 2008, 91 hips in 89 patients underwent labral reconstruction. 13 patients were lost to follow-up. Kaplan-Meier analysis was used to assess survivorship with an end point of revision hip arthroscopy or total hip arthroplasty (THA). Hips were evaluated using the modified Harris hip score (mHHS), Hip Outcome Score (HOS), WOMAC and patient satisfaction (1 to 10; 10=very satisfied).

Results
Eleven patients underwent revision hip arthroscopy and 21 converted to THA and were considered non-survivors. Analysis revealed a survival rate of 70% at 5 years postoperatively and 61% at 10 years. Mean survival was 9 years (95%CI: 7.6 to 10). Patients 45 years or younger had statistically significant longer survival compared to patients over 45 years of age (9.9 years vs. 5.5 years; p=0.002). There was no difference in survival between patients with previous hip surgery and those without (p=0.9). For conversion to total hip arthroplasty only, patients with >2mm of joint space had statistically significant longer survival compared to those with 2mm or less (10.2 vs 6.8;p=0.02), as did patients younger that 45 compared to patients over 45 (11.3 vs 5.5;p=0.0005). In patients who did not undergo revision or THA and had minimum 10-year follow-up, the mean SF12 PCS was 51±10, WOMAC was 14 ± 16, mHHS was 82±17, HOS ADL was 87±15, and HOS Sport was 76±27. Median patient satisfaction was 10.

Conclusions
Results demonstrate the durability of arthroscopic labral reconstruction. Young patients with adequate joint space demonstrated excellent survival and high patient satisfaction. Increased risk of total hip arthroplasty included age and joint space, but not previous surgery.
S12.5 - Iatrogenic cartilage injury during hip arthroscopy: A common occurrence that results in superficial cartilage cell death

Dr Robert Westermann1, Dr Jocelyn Compton1, Mr Mike Slattery1, Dr Mitchell Coleman1

1University Of Iowa, Iowa City, United States

S12 - Communicating Risk and Managing Complications, Doblon, Ground Level, October 18, 2019, 08:00 - 10:00

Biography
Dr Westermann (Robby) is an Orthopaedic Surgeon and team physician University of Iowa. He went to medical school at the University of Washington in Seattle, WA and completed his residency in Iowa City. He completed a sports medicine fellowship at the Cleveland Clinic and was subsequently awarded the William Harris Award in Hip Preservation and completed a Traveling Fellowship with the ANCHOR Hip Preservation group spending time in St Louis, Michigan and Twin Cities, MN. He practices sports Medicine at the University of Iowa and treats athletic injuries of the knee, hip and shoulder. He is involved in cellular and biomechanics basic science research and Multi-centre clinical outcomes research through the MOON and ANCHOR groups.

Background
Advanced arthroscopic procedures in the hip are being performed in increasingly constrained anatomic locations. The prevalence of iatrogenic cartilage injuries during hip arthroscopy remains unknown. Furthermore, the cellular effects of arthroscopic tool contact and insult to the articular cartilage remain unknown.

Methods
Technique videos of arthroscopic hip procedures on VuMedi and Arthroscopy Techniques were reviewed, and iatrogenic cartilage injuries were identified then graded by two independent reviewers (minor, intermediate, and major injury). To investigate cellular injury, an arthroscopic trochar was used to create minor iatrogenic injuries to bovine femoral condyle explants at load bearing and non-load bearing sites. Varied masses were used during injury to mimic minor (1.5 N), intermediate (2.5 N) and major injury (9.8 N). The explant was incubated in 0.9% normal saline for 2 hours at 37ºC to simulate a 2-hour procedure. Samples were imaged with an Olympus FV1000 confocal microscope.

Results
94 videos of arthroscopic hip procedures were analysed, and the incidence of iatrogenic cartilage injury was 77.7%. There were 42 (57.5%) minor, 26 (35.6%) intermediate, and 5 (6.8%) major iatrogenic injuries (ICC 0.6). In the explant model, all forces tested resulted in chondrocyte death at the area of impact. The strongest force (9.8 N) caused increased width of cell death compared to smaller forces (1.5 N and 2.5 N, p = 0.01). Chondrocyte death within the injury zone was reproducible and similar between load bearing and non-load bearing as well as amongst the three forces.

Conclusions
Iatrogenic articular cartilage injuries are common in hip arthroscopy occurring in more than 75% of surgeon-published instructional videos. Chondrocyte death occurs with very minor simulated iatrogenic injuries (1.5 N) and increases with intermediate and major simulated injuries. Further studies evaluating the roles these injuries might play in patient outcomes are warranted.
S12.6 - There is a low rate of infections and subsequent 30- and 60-day admission rates in primary hip arthroscopy, revision hip arthroscopy and cases converted to total hip arthroplasty

Dr Wesley Verhoogt¹, Dr Jurek Pietrzak², Sr Kathleen Nortje², Dr Josip Cakic²
¹Gauteng Department of Health, Johannesburg, South Africa, ²University of the Witwatersrand, Johannesburg, South Africa

Biography
Doctor in community service at Edenvale Hospital with passion for academic endeavour, medical innovation and accessibility to healthcare.

Introduction
The incidence of Hip Arthroscopy has increased 25-fold worldwide. Superficial infection complicates 0.3% of cases. However, complication rates may be under-estimated in the literature. The aim of this paper was to determine the incidence of infective complications in primary Hip Arthroscopy, revision Hip Arthroscopy and in cases converted to THA after index Hip Arthroscopy.

Materials and Methods
We conducted a retrospective chart review of all patients who underwent Hip Arthroscopy by a single high-volume surgeon from 2012 to 2018. The incidence of all complications, 30- and 60-day readmission rates was noted. All revision Hip Arthroscopy and conversion THA had aspirate fluid sent for microscopy, culture and sensitivity (MC&S) at surgical portal insertion and exposure capsulotomy respectively. Appropriate pre-operative antibiotics were given in all cases.

Results
There were 880 Hip Arthroscopies performed in 647 patients (248 males and 399 females) at an average age of 35.4 ± 9.7 years. There were 84 (9.61%) revision Hip Arthroscopies performed at an average time after 18.34 ± 6.2 months. There were 25 (2.8%) conversion THAs done at 23.85 ± 8.1 months. The overall complication rate after index Hip Arthroscopy was 2.4% (n=21). Primary Hip Arthroscopy, revision Hip Arthroscopy and conversion THA were complicated by superficial infections in 0,2% (n=2), 1.2% (n=1) and 0% respectively. There was no growth on MC&S from specimens taken at any revision arthroscopy or THA. There were no readmissions or complications in all conversion THA. No deep infections were reported in any case at minimum 1-year follow-up. BMI, age, medical comorbidities or type of surgery did not influence infection rates. All 3 infections were treated successfully with oral antibiotics.

Conclusion
Primary Hip Arthroscopy has a low superficial infection rate. Revision Hip Arthroscopy and conversion THA does not predispose to infective complications or increased 30- or 60-day readmission rates provided prophylactic antibiotics are prescribed and appropriate precautions are followed.
S12.7 - Intraabdominal fluid extravasation after hip arthroscopy: Incidence and risk factors

Dr Bernardo Aguilera-Bohórquez1, Dr Salvador Ramirez1,2, Ms Erika Cantor1, Dr Miguel Sanchez1,2, Dr Miguel Brugiatti1,2, Dr Orlando Cardozo1,2, Dr Mauricio Pachón-Vasquez1

1Centro Médico Imbanaco De Cali S.a, Cali, Colombia, 2Universidad Javeriana de Cali, Cali, Colombia

Biography
Dr Bernardo Aguilera is an orthopaedic surgeon from Universidad del Valle. He has a Fellowship in Reconstructive Orthopaedics from University of Alabama and his work is focused on hip arthroscopy. He is the founder of the hip preservation unit (UPRECA) at Centro Médico Imbanaco located in Cali, Colombia. Dr Aguilera is professor and director of the hip preservation arthroscopic surgery fellowship at Universidad Javeriana and since its creation in 2011, he has trained 14 fellows in hip arthroscopy.

Background
The extravasation of fluid to the intra-abdominal space is recognized as a possible complication of hip arthroscopy. The exposure of anatomical areas to elevated pump pressures and high volumes of irrigation fluids, increases the risk of fluid leakage into anatomical spaces around the hip joint, especially to the abdominal cavity.

Objective
To estimate the incidence and risk factors related to Intra-abdominal fluid extravasation (IAFE) after hip arthroscopy.

Methods
We carried out a prospective study of 106 hip arthroscopies between June 2017 and June 2018. Ultrasound was performed by a trained anaesthesiologist at the end of the surgery to detect IAFE. The hepatorenal (Morison’s pouch), splenorenal, retro aortic, suprapubic (longitudinal and transverse) and pleural spaces were examined. The patients were monitored during three hours after surgery to assess abdominal pain. The data collected included maximum pump pressure, duration and volume of irrigation fluid, total surgical time and traction time.

Results
The incidence of IAFE was 31.1% (33/106) [95% confidence interval (CI): 23.1%; 40.5%] The risk factors identified for IAFE were minor trochanter osteoplasty (Odds Ratio-OR: 14.0 [95% IC: 1.50-131.6]) and sciatic nerve decompression (OR: 4.15 [95% CI: 1.65-10.47]). No statistically significant relationship was found in total surgical time, maximum pump pressure and total pump fluid between the groups. Postoperative abdominal pain was found in 36.4% (12) of the cases with IAFE compared to 2.7% (2) of the group without extravasation (p value <0.001).

Conclusions
IAFE is a frequent event during hip arthroscopy. The sciatic nerve decompression and lesser trochanteric osteoplasty may increase the risk of IAFE. Pain and abdominal distension during the immediate postoperative period are early warning signs for significant IAFE. These results reinforce the need of careful intraoperative and postoperative monitoring by both the surgeon and the anaesthesiologist in order to identify complications related to IAFE.
The effects of hip arthroscopy without a perineal post on venous blood flow, muscle damage, peripheral nerve conduction, and perineal injury: A prospective study

Dr Matthew Kraeutler, Dr K Welton, Dr Tigran Garabekyan, Dr Laura Vogel-Abernathie, Dr Daniel Raible, Mr Jesse Goodrich, Dr Omer Mei-Dan

St. Joseph's University Medical Centre, Paterson, United States, MultiCare Orthopaedics & Sports Medicine, Auburn, United States, Southern California Hip Institute, North Hollywood, United States, University of Colorado School of Medicine, Aurora, United States, Nerve Watch, LLC, Wheat Ridge, United States, University of Colorado Boulder, Boulder, United States

S12 - Communicating Risk and Managing Complications, Doblon, Ground Level, October 18, 2019, 08:00 - 10:00

Background
Prior reports of hip arthroscopy utilizing a perineal post have established risks of groin soft tissue injury, sexual dysfunction, and altered lower extremity neurovascular function. These parameters have not been investigated for hip arthroscopy without the use of a perineal post. The purpose of this study was to evaluate the effects of post-less hip arthroscopy on lower extremity venous blood flow, nerve conduction, muscle tissue damage, and perineal injury.

Methods
Patients between the ages of 18-50 years undergoing an elective unilateral or simultaneous bilateral hip arthroscopy were enrolled. Creatine phosphokinase (CPK)-MM level and D-dimer tests were obtained preoperatively, immediately postoperatively, and 7-12 days postoperatively. Bilateral Doppler ultrasonography of the common femoral (CFV) and popliteal veins were conducted intraoperatively. Somatosensory evoked potentials (SSEPs) and transcranial motor evoked potentials (TcMEPs) were measured intraoperatively for the lower limbs. Perineal injury was assessed at 7-12 days postoperatively.

Results
Thirty-five patients underwent a total of 40 hip arthroscopies. There were no significant differences in venous blood flow between the operative and non-operative legs for either the CFV or popliteal veins. SSEP monitoring of the peroneal nerve showed no significant reduction when traction was applied to the operative leg, 90.8%, compared with final measurement just before it was removed, 72.4% (p = 0.09). For TcMEPs measured in the muscles outside of the traction boots, there were no significant changes in percent of cases with abnormal measurements throughout the procedure. CPK-MM levels preoperatively, immediately postoperatively, and 7-12 days following surgery were on average 112 IU/L, 190 IU/L, and 102 IU/L, respectively (normal < 156 IU/L). There was no significant relationship between abnormal venous flow and altered D-dimer levels. No clinical evidence of nerve or vascular injury was encountered, and no groin soft tissue complications were observed during the study period.

Conclusion
Post-less hip arthroscopy is safe, without a notable reduction of venous blood flow or alteration of nerve function in the operative leg. Muscle tissue damage is subclinical, transient and reduced compared to distraction with a post. No cases of perineal injury were observed during the study period.
S13.5 - Influence of surgery interval between first and second hip in bilateral hip arthroscopy for femoroacetabular impingement

Dr Jesus Mas Martinez1, Dr Javier Sanz-Reig1, Dr David Bustamante Suarez de Puga1, Dr Carmen Verdu Roman1, Dr Manuel Morales Santias1, Dr Enrique Martinez Gimenez1
1Traumatologia Vistahermosa, Alicante, Spain

S13 - FAI Surgery, Auditorium (Plenary), Ground Level, October 18, 2019, 16:30 - 18:30

Background

Between 21% to 26% of patients with femoroacetabular impingement (FAI) have bilateral symptoms. Surgical treatment options include single-stage or 2-stage hip arthroscopy (HA).

Objectives

The purpose of this study was to analyse the influence of the interval time on functional outcomes between first and second HA. We hypothesized that interval time had not influenced these outcomes.

Study designs and methods

Retrospective study of a HA prospective database between January 2011 and December 2016. Inclusion criteria were bilateral FAI, age between 18 and 50 years of age, Tönnis grade 0-1, articular space greater than 2 mm, lateral centre-edge angle between 25º and 40º, minimum 2-year follow-up, no HA revision surgery, or conversion to total hip arthroplasty.

Interval time between stages was grouped in smaller than 6 months or greater than 6 months. Patients were prospectively assessed preoperatively and postoperatively using mHHS, HOS-AVD and HOS-SSS, and IHOT-12. Measurements were made from radiographs, including the joint space, lateral centre-edge angle, alpha angle, Tönnis angle, and Tönnis grade.

Results

There were 41 patients with staged bilateral HA. Mean interval time was 10 months. Interval time between stages was smaller than 6 months in 21 patients, and greater than 6 months in 20 patients.

Preoperative data were similar in both cohorts.

Mean follow-up was 41 months in cohort with interval smaller than 6 months and 36 months in cohort with interval greater than 6 months.

Patient-reported outcomes improve significantly in both cohorts from preoperatively to final follow-up. There were no significant differences from preoperative, final follow-up, and mean changes in outcome scores between the first and second hip in both cohorts. And comparing both cohorts there were no significant differences between the first and second hip. However, there was a positive correlation between interval time with second staged HA and mHHS score, and HOS-AVD score at final follow-up.

Conclusions

In a small sample, patients reported outcomes measures were similar between the first and second hip in bilateral FAI patients. Time interval smaller than 6 months seems not to influence the outcomes in our study.
S13.6 - Long-term patient reported outcomes following isolated acetabuloplasty for femoroacetabular impingement - 5-year average follow-up

Dr Matthew Hartwell1, Dr Ujash Sheth1, BA Patrick Nelson1, BA Allison Morgan1, BA Claire Fernandez1, Dr Vehniah Tjong1, Dr Michael Terry1

1Department of Orthopaedic Surgery, Feinberg School of Medicine, North western University, Chicago, United States

S13 - FAI Surgery, Auditorium (Plenary), Ground Level, October 18, 2019, 16:30 - 18:30

Biography
Undergraduate Education: Hope College, 2012
Medical Education: University of Michigan Medical School, 2017
Orthopaedic Surgery Resident: North western Memorial Hospital, 2017-2022

Background
Femoroacetabular impingement (FAI) frequently results from mixed osseous abnormalities of the acetabulum and femur. The purpose of this study was to evaluate long-term patient reported outcomes following isolated acetabular osteoplasty and labral repair for the treatment of patients with FAI, using both traditional legacy measures and the more recently developed computer adaptive testing (CAT) tool, the Patient Reported Outcomes Measurement Information System (PROMIS).

Methods
A retrospective review of patients undergoing isolated acetabular osteoplasty and labral repair for FAI was performed. Multiple patient reported outcome measures (PROMs) were assessed at a minimum of 2-year follow up. PROMs included the PROMIS for Physical Function (PROMIS-PF) and Pain Intensity (PROMIS-Pain), and the traditional legacy measures including the modified Harris Hip Score (mHHS), Hip Outcome Score (HOS) for ADLs and Sport, International Hip Outcome Tool-12 (iHOT-12), Numeric Pain Rating Scale (NPRS), and Visual Analog Scale (VAS) for pain.

Results
We identified 43 patients with an average age of 40.9 (range, 19-62 years). Clinical follow-up was obtained at a mean follow-up of 66.7 months (range, 27-115 months). The average results and standard deviations for the patient reported outcomes measures were as follows: PROMIS-PF 54.5 ± 2.7, PROMIS-Pain Intensity 38.3 ± 3.5, mHHS 81.6 ± 8.4, HOS-ADL 94.1 ± 6.6, HOS-Sport 76.7 ± 18.5, HOS-Total 92.3 ± 9.4, iHOT-12 79.1 ± 20.3, NPRS 1.8 ± 2.1, and VAS 1.9 ± 2.0.

Conclusion
Compared to previously published long-term outcomes utilizing a femoral osteoplasty with or without an acetabuloplasty, an isolated acetabuloplasty provides comparable legacy measure outcomes. We also present long-term outcomes utilizing the more generalizable PROMIS-CATs that demonstrate good outcomes with respect to pain and physical function. Thus, an isolated acetabular osteoplasty for the treatment of FAI may provide adequate decompression of the underlying bony impingement to provide good long-term outcomes.
S13.7 - 15-year follow up after surgical hip dislocation for patients with cam-type femoroacetabular impingement results in high survivorship

Dr Till Lerch1, Florian Schmaranzer1, Inga Todorski1, Simon Steppacher1, Moritz Tannast1, Klaus Siebenrock1

1Dept. of orthopaedic surgery, Inselspital Bern, University of Bern, Bern, Switzerland

S13 - FAI Surgery, Auditorium (Plenary), Ground Level, October 18, 2019, 16:30 - 18:30

Introduction
Cam-type Femoroacetabular Impingement (FAI) is a cause for osteoarthritis of the hip in young patients with hip pain. Before the year 2000, it was treated with isolated cam resection using open surgical hip dislocation. We were interested in the long-term follow up after this procedure. Therefore, we questioned (1) the cumulative 10-year and 15-year survivorship with the endpoints total hip arthroplasty (THA), subsequent FAI surgery, progression of OA and MdA score <15 points, (2) Predictive factors associated with the endpoints, (3) Clinical results, subsequent FAI surgery and MdA score.

Methods
We retrospectively evaluated 116 hips of 100 patients that underwent isolated cam resection using a surgical hip dislocation between 1997 and 2000. Mean follow up was 17±3 years (range 1–20) and the follow up rate was 94%. Mean preoperative age was 32±10 years (range 15–52). Surgical hip dislocation and isolated cam resection was consecutively performed according to the technique described by Ganz et al. This was performed without evaluation of the acetabular morphology (e.g. pincer morphology). To calculate the cumulative survivorship the method described by Kaplan Meier was applied. Cox regression model was used to calculate predictive factors.

Results
(1) The cumulative 10-year and 15-year survivorship was 79% (71–86%) and 73% (66–81%) with the single endpoint THA. Using all endpoints, the cumulative 10-year and 15-year survivorship was 66% (56–74%) and 59% (50–67%). At follow up, 36 hips (31%) underwent conversion to THA (2) Preoperative hip dysplasia (LCE-angle<22°), over coverage (LCE- angle>34°), female sex and preoperative age>40 years resulted in a lower cumulative survivorship. (3) The preoperative Merle d’Aubigné score significantly improved from 14±2 (10–17) to 17±2 (10–18) at 1-year follow up (p<0.001).

Conclusion
Preoperative hip dysplasia, acetabular over coverage, female sex and preoperative age > 40 years negatively affect the long-term outcome after open treatment for cam FAI. Careful assessment of acetabular morphology is recommended before hip arthroscopy or open surgery for the treatment of cam FAI. These results have implications for the treatment with hip arthroscopy for patients with symptomatic cam- FAI.
S13.8 - Surgical treatment of femoroacetabular impingement: arthroscopy vs surgical hip dislocation – A propensity matched analysis
Dr Jeffrey Nepple1, Dr Ira Zaltz2, Dr Asheesh Bedi3, Dr Paul Beaule4, Dr Michael Millis5, Dr Rafael Sierra6, Dr Ernest Sink7, ANCHOR Group, Dr John Clohisy1
1Washington University Department of Orthopaedic Surgery, Saint Louis, United States, 2William Beaumont Hospital Department of Orthopaedic Surgery, Royal Oak, United States, 3University of Michigan Department of Orthopaedic Surgery, Ann Arbor, United States, 4The Ottawa Hospital Division of Orthopaedic Surgery, University of Ottawa, Ottawa, Canada, 5Harvard Medical School Department of Orthopaedic Surgery at Boston Children’s Hospital, Boston, United States, 6Mayo Clinic Department of Orthopaedic Surgery, Rochester, United States, 7Hospital for Special Surgery Department of Orthopaedic Surgery, New York, United States

Biography
John C. Clohisy, M.D. is The Daniel C. and Betty B. Viehmann Professor of orthopaedic surgery at Washington University School of Medicine.

Dr Clohisy has authored more than 300 scientific publications, book chapters, is a frequent invited lecturer, nationally and internationally. He is PI of the ANCHOR Hip Preservation study group, a member of various orthopaedic societies, and has been the recipient of numerous clinical, research and education honours, grants and awards.

Purpose
Surgical treatment of femoroacetabular impingement (FAI) has continues to evolve. Hip arthroscopy is increasingly utilized for treatment of typical FAI deformities, while open surgical hip dislocation is reserved for complex or severe cases. The purpose of the current study was to compare the outcomes of surgical treatment of FAI between hip arthroscopy and open surgical hip dislocation utilizing a propensity analysis.

Methods
A prospective multicentre cohort undergoing primary surgical treatment of FAI was assessed. Follow up at a minimum of one year was available in 621 hips (81.7%). Propensity scores reflect the likelihood of surgical treatment with arthroscopy versus surgical hip dislocation for a given set of covariates and allow subsequent matching to identify similar patients at baseline to include in the analysis. After propensity matching, a total of 256 patients are included in the current study. The primary outcome was a composite failure defined as total hip arthroplasty (THA), revision surgery, or clinical failure. Clinical failure was defined as improvement in mHHS less than 8 (MCID) and mHHS less than 74 (PASS).

Results
The mean mHHS was similar at baseline between the two groups (60.2 HA vs. 60.7 SD). Both groups demonstrated statistically significant improvements in all PROs. The final mHHS was not statistically different between the two groups (81.2 vs. 80.2, p=0.67). Similarly, the HOOS pain subscale was similar at final follow-up (80.6 vs. 77.7, p=0.32). The rates of THA (0% and 3.1%, p=0.409) and revision surgery (7.8%...
and 10.9%, p=0.34) in the HA and SD groups. Overall rates of failure (revision surgery or clinical failure) were 21.9% for HA and 25.0% for SD (p=0.54).

Conclusion
Patients undergoing surgical treatment of FAI with either hip arthroscopy or surgical hip dislocation demonstrate significant improvements in PRO.

Significance
In a propensity matched analysis, patients undergoing hip arthroscopy or surgical hip dislocation demonstrated similar outcomes in patient reported outcomes and overall rates of failure.
S14.5 - Concomitant Lumbar Spine Pathology in Patients Undergoing Hip Arthroscopy: A Matched Cohort Analysis

Dr Jonathan Haskel¹, Samuel Baron¹, Dr Mikhail Zusmanovich¹, Dr Thomas Youm¹
¹NYU Langone Orthopaedic Hospital, New York, United States

Purpose
To evaluate the outcomes of hip arthroscopy in patients with concomitant lumbar spine disease compared to those without lumbar spine pathology

Methods
A retrospective review of a prospectively collected, single-surgeon database was performed to identify patients who underwent hip arthroscopy with objective evidence of lumbar pathology. Patients were included if they were skeletally mature, had hip pathology that failed non-operative treatment, and had advanced imaging of the lumbar spine (computed tomography or magnetic resonance imaging) confirming lumbar spine disease. Patients were excluded if they had any prior hip surgery or Tönnis grade ≥2. The lumbar pathology cohort was matched by age, gender, and BMI in a 1:3 fashion to a control cohort consisting of patients without lumbar spine disease who underwent hip arthroscopy over the same time period. Baseline preoperative modified Harris Hip Scores (mHHS) and Non-Arthritic Hip Scores (NAHS) were compared to scores at two-year follow up, and rates of revision arthroscopy or total hip arthroplasty were assessed. Statistical analysis was performed with student-T statistical testing.

Results
Thirty-eight (38) patients with spine pathology were matched with 111 control patients. Pre-operative mHHS and NAHS scores were significantly lower in the lumbar spine cohort (P = 0.02 and P = 0.02, respectively), however there were no significant differences in mHHS or NAHS scores between the cohorts at 1 and 2 years postoperatively. There was a 90% increase in mHHS scores in the lumbar spine cohort, compared to a 74.4% increase in the control cohort (P = 0.0475). No significant difference in the rates of revision or total hip arthroplasty conversion was identified between the lumbar spine and control cohorts (23.7% vs. 18.0% respectively, P = 0.44).

Conclusion
Patients with known lumbar spine disease had significantly greater percentage of improvement at 2-year follow-up compared with those with isolated hip pathology, and outcomes were ultimately not significantly different. There was no increased risk of re-operation in patients with concomitant lumbar spine pathology.
Low back pain-related disability, but not pain, is associated with worse patient-reported hip function for patients with non-arthritic hip disease.

**Background**

Low back pain (LBP) is prevalent among patients with non-arthritic hip disease (NAHD). Understanding the relationship between LBP-related disability, LBP severity, and patient-reported hip function may inform when additional spine-focused treatment is warranted. We tested the hypothesis that worse LBP-related disability and LBP severity would be associated with worse hip function in patients with NAHD.

**Methods**

Patients within a hip preservation clinic enrolled in a prospective registry. Registry participants with NAHD were included in this study. Severity of low back pain was recorded using a 0-100 visual analogue scale. The modified Oswestry Disability Index (mOSW) was used to collect patient-reported LBP-related disability for participants with LBP. The 33-item International Hip Outcome Tool (iHOT33) was used to collect patient-reported hip function. Pearson correlations were used to determine relationships between (1) mOSW and (2) severity of LBP with iHOT-33 scores (P≤0.05). Participants were categorized based on 90-day treatment decision (surgery or not); mOSW, LBP severity, and iHOT33 scores were compared across groups using independent sample t-tests (P<0.05).

**Results**

Ninety-two participants were included and 75% of participants reported LBP (n=69). Higher mOSW scores were significantly associated with lower iHOT scores (P<0.001, r=-0.71). Severity of LBP was not strongly associated with iHOT33 scores (P=0.06, r=-0.23). More participants with LBP pursued surgery (55%) than those without LBP (34%, P=0.09). Participants who reported LBP and underwent surgery within 90 days were younger (p=0.005) but did not report different mOSW or iHOT33 scores than non-surgical patients.

**Conclusion**

Patients with NAHD report a high prevalence of LBP. For those with LBP, LBP-related disability, but not pain severity, was related to self-reported hip function. Presence of LBP may be related to the decision of individuals with NAHD to have surgery, but larger samples are required to confirm this relationship.
S14.7 - The Influence of lumbosacral spine pathology on achieving meaningful clinical improvements in patients undergoing arthroscopic surgery for femoroacetabular impingement syndrome

Mr. Reagan Chapman¹, Dr Edward Beck¹, Dr Anirudh Gowd¹, Dr Benedict Nwachukwu¹, Mr. Jonathan Rasio³, Dr Brian Waterman¹, Dr Shane Nho¹

¹Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, US

Purpose
To determine whether having a history of lumbosacral spine pathology influences achievement of Minimally Clinically Important Differences (MCID) after hip arthroscopy to correct Femoroacetabular Impingement Syndrome (FAIS)

Methods
Patients undergoing hip arthroscopy for FAIS from a single, fellowship-trained orthopaedic surgeon from 01/2012 to 04/2017 with minimum two-year follow-up, were retrospectively reviewed. Patients with a history of lumbosacral spine pathology were matched 1:2 by age, BMI, and gender to patients without pathology. Clinical outcomes Hip Outcome Score- Activities of Daily Living (HOS-ADL), HOS – Sports Subscale (HOS-SS), modified Harris hip score (mHHS), international Hip Outcome Tool (iHOT-12), VAS pain, and VAS satisfaction were compared between the groups using an independent T-test. Threshold scores of every outcome score for achieving MCID was calculated separately for each group and frequencies were compared.

Results
A total of 69 patients with lumbosacral pathology were identified and matched to 138 patients without spine pathology. When compared to the non-spine pathology group, the lumbosacral pathology group had significantly lower HOS-ADL (77.7±22.1 vs 89.2±13.7), HOS-SS (59.8±30.0 vs 80.9±20.9), mHHS (73.1±21.2 vs 83.6±14.7), iHOT-12 (57.5±29.9 vs 75.9±22.6), and VAS satisfaction (71.8±31.8 vs 82.2±25.2) scores, as well as significantly higher VAS pain scores (29.9±27.2 vs 18.2±22.3) (all p<0.001). There were significant differences in proportion achieving threshold scores for HOS-ADL (60.6% to 80.0%; p=0.004), HOS-SS (57.6% to 82.1%; p<0.001), mHHS (66.7% to 81.7%; p=0.025), and iHOT-12 (54.8% to 87.6%; p>0.001) scores for MCID when comparing the lumbosacral and non-lumbosacral pathology group. Furthermore, comparison of the proportion of patients achieving MCID for any outcome score demonstrated significantly higher rate in the non-lumbosacral vs the lumbosacral pathology group (92.9% vs 75.4%; respectively; p>0.001).

Conclusion
Patients with a history of lumbosacral pathology achieve significantly lower mid-term meaningful clinical outcomes after undergoing hip arthroscopy for FAIS when compared to patients without spine pathology. A number of factors may influence this finding including continued referred pain from the spine and continued biomechanical imbalances from lower back pain compensatory movement.
S14.8 - Improvement in Lower Back Pain and Function After Hip Arthroscopy

Dr Yuhang Sun1, BS MBA Kamali Thompson1, MS Christon Darden1, Dr Thomas Youm1

1Nyu Langone Health, New York, USA

S14 - Hip-Spine Syndrome HSPC, Castilla, Ground Level, October 18, 2019, 16:30 - 18:30

Biography
Dr Thomas Youm is a Board-Certified Orthopaedic Surgeon who specializes in the treatment of athletic injuries and performs arthroscopic and reconstructive surgery of the hip, shoulder, elbow and knee. Dr Youm has published over 50 articles and has over 50 presentations at numerous national meetings on the topics of orthopaedic sports medicine. He is a Clinical Assistant Professor at the NYU School of Medicine where he teaches both medical students and orthopaedic residents. Dr Youm has twice won the Teacher of the Year Award which is voted and determined by the graduating class of orthopaedic chief residents. He is one of the main instructors for the sports medicine fellows at NYU Langone Orthopaedic Hospital. He is currently Director of Hip Arthroscopy and, in this role, he runs the clinical research for hip arthroscopy at NYU. He is a member of the Hip Centre and the Sports Medicine department at the NYU Langone Orthopaedic Hospital.

Background
In patients with hip pain, presentation of symptoms can often be confounded by pre-existing spinal conditions. While prior studies have demonstrated improvements in both hip pain and lower back pain in patients undergoing total hip arthroplasties, there is still limited data on the impact of hip arthroscopies. The purpose of the study is to determine if patients with coexisting lumbar back pain experience an improvement in hip and back pain after hip arthroscopy.

Methods
An IRB approved retrospective chart review was performed looking at patients undergoing hip arthroscopy between November 2016 and November 2017. Preoperative and postoperative outcome scores were compared between patients with back pain prior to surgery and patients solely reporting hip pain. The modified Harris Hip Score (MHHS) and Nonarthritic Hip Score (NAHS) were recorded from the preoperative and 1-year follow up visits. The Oswestry disability score and visual analogue scale (VAS) from the study cohort alone. Statistical analysis was performed using paired sample t-tests with p<0.05 considered significant.

Results
A total of 46 patients who underwent hip arthroscopy between November 2016 and November 2017 were enrolled. Twenty-three patients with a mean age of 47.7 ± 15.0 years and BMI of 26.3 ± 5.2 had a history of back pain and 23 patients were age- and sex-matched for the control cohort. The control cohort had lower MMHS and NAHS scores preoperatively. The control cohort also experienced a larger increase in the MMHS (p= 0.014) and NAHS scores (p= 0.006). Following surgery, the study cohort reported a lower score on the Oswestry Disability score indicating improvement from moderate disability to minimal disability (p= 0.05).

Conclusion
Patients with coexisting lower back pain had a significantly smaller increase in hip function after hip arthroscopy. However, patients with lower back pain had a significant improvement in their lower back functional disability score follow hip arthroscopy. Surgical intervention for hip disease can lead to improvements in hip and back pain in patients with co-existing lumbar pathology.
Can a biopolymer scaffold injected arthroscopically restore articular cartilage and delay hip osteoarthritis?

Dr Ivan Wong1,2, Dr Rakesh John2
1Dalhousie University, Halifax, Canada, 2Nova Scotia Health Authority, Halifax, Canada

S15 - Cartilage Injury and Repair, Hidalgo, Ground Level, October 18, 2019, 16:30 - 18:30

Biography
Dr Ivan Wong is an Orthopaedic Surgeon at the Queen Elizabeth II Health Sciences Centre in Halifax, NS. He specializes in Sports Medicine treating patients using minimally invasive reconstructive techniques in the shoulder, hip, and knee. After completing medical school at Dalhousie University, he continued with his orthopaedic residency at McMaster University before completing his Sports Medicine, Arthroscopy and Reconstructive Surgery Fellowship with Dr Stephen Snyder at the Southern California Orthopaedic Institute (SCOI). Dr Wong completed his Masters of Academic Medicine at the University of Southern California. He is currently an Associate Professor in Orthopaedic Surgery, the School of Health and Human Performance, and the School of Physiotherapy, at Dalhousie University. He also co-directs a joint Preservation, Sports Medicine and Arthroscopy fellowship program in Halifax, NS. Dr Wong is a founding member and the current president of the Arthroscopy Association of Canada (AAC).

Purpose
To evaluate short-term clinical and radiological outcomes of patients treated arthroscopically with Car Gel for acetabular chondral defects in conjunction with microfracture (MF) compared to lesions treated with MF alone.

Methods and Materials
Patients who underwent hip arthroscopy and had MF +/- Car Gel between 2012 and 2016 with a minimum clinicoradiological follow-up of 2 years were included. Intraoperative details and postoperative complications were analysed. Patients answered self-reported questionnaires, including the international Hip Outcome Tool (iHOT-33), Hip Outcome Score (HOS) pre-operatively and at 6 months, 1 year, and annually thereafter. Serial plain radiographs were assessed by two blinded observers independently for measurement of joint space and osteoarthritis grading utilizing the Kellgren-Lawrence scale. The number of failures, defined as a conversion to total hip arthroplasty (THA), was identified in both groups and correlated with the cartilage defect size at the time of surgery.

Results
86 patients (53 Cargel, 33 MF) were evaluated with a mean age of 38.3 years at the time of the surgery. The average follow-up was 36 months. There were no statistically significant differences in iHOT-33 scores between the groups (p=0.85). 30% of MF cases progressed to THA while only 5% of Cargel cases did (p=0.0027). The mean defect size in the failure groups was significantly higher in the Cargel group compared to the MF group (8.8 cm2 and 3.5 cm2, respectively; p=0.0002). Mean joint space reduction was 1.41 mm and 0.21 mm in the MF and Cargel groups, respectively, (p < 0.0001) denoting a significant decrease in the rate of progression to hip osteoarthritis in the Car Gel group.

Conclusion
Arthroscopic treatment of chondral acetabular defects with Car Gel demonstrated a significant decrease in progression to hip osteoarthritis and conversion to THA compared to MF alone. Short-term results are promising in this population of patients and this single-step, arthroscopic, cartilage repair technique does not burn any bridges.
S15.5 - Short-term outcomes following hip arthroscopic microfracture augmented with allograft cartilage

T. David Luo1, Michael Koulopoulos1, Amy Trammell1, Alejandro Marquez-Lara1, Ian Al'Khafaji1, Allston Stubbs1
1Wake Forest Baptist Medical Centre, Winston-Salem, USA

Biography
Dr Luo is an orthopaedic resident with interest in cartilage preservation and basic science research. He is also currently a PhD candidate in the molecular medicine program at Wake Forest, with a future goal of bridging the gap between bench science and clinical research.

Introduction
The purpose of this study was to evaluate short-term outcomes in a series of patients who underwent hip arthroscopy with augmented microfracture using a novel biologic scaffold combining minced allograft cartilage and autologous platelet-rich plasma.

Methods
Consecutive patients with symptomatic hip pain and high-grade chondromalacia (Outer bridge IV), who underwent hip microfracture with biologic augmentation were prospectively followed. Intraoperative chondromalacia severity index (CMI), defined as the product of Outer bridge chondromalacia grade (I to IV) and the affected surface area (mm²) were assessed. Preoperative and minimum one-year postoperative patient-reported outcomes Tegner score, modified Harris Hip Score (mHHS), Hip Outcome Score-Activities of Daily Living (HOS-ADL), Hip Outcome Score-Sport-Specific Subscale (HOS-SSS), and Nonarthritic Hip Score (NAHS) were prospectively collected for comparison.

Results
Twenty-five patients (14 females, 11 males) with mean age of 36.8±9.5 years and mean BMI of 29.4±4.6 kg/m² were included. Intraoperatively, all patients demonstrated acetabular chondromalacia with mean CMI of 701.9. Fourteen patients also demonstrated femoral head chondromalacia with mean CMI of 448.1. At mean of 16.0 months, significant improvements were seen in mHHS (62.3 to 87.3), HOS-ADL (63.5 to 92.1), HOS-SSS (42.7 to 88.5), and NAHS (62.6 to 88.1). Two patients converted to total hip arthroplasty at mean 10.4 months after augmented microfracture. One patient had previous femoral osteotomies and screw fixation for treatment of slipped capital femoral epiphysis (SCFE). The other patient had persistent pain and residual acetabular chondral defect on post-arthroscopy MRI.

Discussion and Conclusion
Our study demonstrated significant functional improvements after hip microfracture with biologic augmentation at one-year with 92% short-term survivorship. One of the two patients who failed microfracture treatment had multiple prior hip procedures for SCFE, including previous femoral osteotomy, and exhibited substantial bipolar hip pathology, highlighting the need for further research to optimize patient selection for this novel technique.
S15.6 - Biological reconstruction versus traditional microfracture techniques in hip preservation arthroscopic surgery for FAI

Mr Rishi Chana1, Mr Anshul Sobti

1Princess Margaret Hospital, Windsor, United Kingdom

S15 - Cartilage Injury and Repair, Hidalgo, Ground Level, October 18, 2019, 16:30 - 18:30

Biography
I am a dedicated hip and knee specialist with expertise relating to all adult hip conditions.

My two main areas of focus are in Hip Joint Preservation Surgery and Joint Replacement Surgery of the Hip and Knee.

As a fellowship trained Hip Arthroscopy surgeon, it is always a pleasure to see any patient who is struggling with conservative active therapy.

Hip Joint Preservation (keyhole or arthroscopy) is a philosophy of doing our utmost to keep your natural hip joint in the best health and function, for as long as we can. My goal is to bridge the gap for those patients with early wear and tear hip problems that are not ready for a hip replacement. With a biological reconstruction rather than metal implants, we can help you to achieve your goals whilst still allowing you to keep your natural hip joint. Our multidisciplinary super team will ensure you have the best care and results possible using the latest innovations including regenerative stem cell therapy using your own bone marrow cells augmented with collagen scaffolds to preserve your joint. This is called AMIC / BMAC.

Introduction

In an attempt to bridge the osteo-arthritis gap, this study compared biological reconstruction with traditional microfracture techniques in patients with femoro-acetabular impingement and focal cartilage defects.

Method

A prospective cohort of two groups were investigated as an age, gender and Tonnis grade matched comparison for outcomes between microfracture (the current gold standard) and newer biological reconstruction techniques for joint preservation hip arthroscopy surgery using ROCKSTAR Kit, Joint Operations UK, consisting of Chondro-Gide, Autologous Matrix-Induced Chondrogenesis (AMIC), Giestlich, Switzerland and Bone Marrow Aspirate (Marrow Cellution) combination.

Outcomes investigated were pre-op and post-op average iHOT-12 scores up to 18 months after surgery and a Kaplan-Meier survivorship analysis was also carried out.

Results

Of 111 patients, 46 patients underwent microfracture and 65 biological reconstruction hip arthroscopies as well as cam/pincer osteoplasty and labral repair surgery. The two groups were age, gender and Tonnis matched with no significance between the two groups. Age range was 20-69, average age 45 years for both groups, Tonnis grading was as follows: Grade 0: 26% vs 30%, Grade 1: 52% vs 47% and Grade 2: 22% vs 23% in microfracture and biological reconstruction groups, respectively. The average pre-operative iHOT-12 score differences between microfracture and biological reconstruction were not significant (36.5 vs 39, respectively). Mann-Whitney U test. The average post-operative iHOT-12 score differences between microfracture and biological reconstruction were significant at 1-year minimum follow-up (66 vs 95, respectively, p<.05). Mann-Whitney U test. The microfracture group had a 67.4% survivorship for conversion to hip replacement at 18 months (32.6% failure rate for any reason) and biological reconstruction had 100% survivorship at 18 months post-operatively with no failures for any reason.

Conclusion

This study provides further support to the evidence base for biological reconstructive techniques as superior to microfracture in combination with joint preservation arthroscopic surgery, even in the face of focal cartilage defects and offers both surgeons and patients a potential bridging of the osteo-arthritis gap.
S15.7 - Injectable autologous chondrocyte implantation (ACI) in acetabular cartilage defects – three-year clinical and radiological results

Dr Jörg Schröder¹, Prof. Dr Carsten Perka¹, Dr. David Krüger¹
¹Charité, Berlin, Germany

Biography
Dr Schröder is Oberarzt at in the Hip Department, Musculoskeletal Centre, Charite University Hospital, Berlin. He is an accomplished hip surgeon.

Introduction
To evaluate the clinical outcome after arthroscopic matrix-associated injectable autologous chondrocyte implantation (ACI) in patients with large full-thickness acetabular cartilage defects.

Materials and Methods
ACI was performed in young patients with full-thickness acetabular cartilage defects ≥ 2 cm² in a two-step arthroscopic procedure. The patients were followed closely with clinical examinations and pre- and postoperative scores. The modified Harris Hip Score (mHHS), iHOT33 questionnaire (iHOT33) and the Subjective Hip Value (SHV) were surveyed. Demographic patient data was evaluated for influencing factors for the pre- and postoperative results. For radiological follow-up a 3-Tsl-MRI was carried out and the 2D MOCART (Magnetic resonance observation of cartilage repair tissue) score calculated.

Results
26 cases (4 female, 22 males, mean age 33 years) were included. The average defect size was 4.9 cm². They were followed at 6, 12, 24 and 36 months postoperatively, follow up averaged 35.5 (24-49) months. Patients had improved significantly from 63 to 91 points (p=0.001) in the mHHS, from 44 to 86 % (p < 0.001) in the iHOT33 and from 55 to 88 % (p=0.001) in the SHV. The MOCART-Score in the follow-up MRI averaged 85 (50-100) points. No surgery related complications were noted. Patients age and size of the cartilage defect showed no significant correlation to the pre- or postoperative results.

Discussion
Injectable ACI is a reliable procedure treating full-thickness acetabular cartilage defects leading to promising radiological results three years postoperatively with a significant increase of all clinical scores despite large acetabular cartilage defects in the weight-bearing zone.
S15.8 - 24 months after arthroscopic matrix-associated autologous chondrocyte transplantation of the hip – significant improvement of PROs and MRI using an injectable hydrogel

Dr Stefan Fickert, Dr Katharina Bretschneider, Prof. Dr Siegfried Trattnig, Prof. Dr Stefan Landgraeber, Dr Albrecht Hartmann, Prof. Dr Michael Dienst, Dr Jörg Schröder, Prof. Dr Klaus-Peter Günther

Sporthopaedicum Straubing Regensburg Berlin München, Straubing, Germany, 1University Centre for Orthopaedics & Trauma, University Hospital Carl Gustav Carus, Dresden, Germany, 1MR-Center of Excellence, Department of Radiology and Nuclear Medicine, Medical University of Vienna, , Austria, 4Department of Orthopaedics and Trauma Surgery, University of Duisburg-Essen, , Germany, 5Orthopedic Surgery München, OCM Clinic GmbH, , Germany, 6Center for Musculoskeletal Surgery, Campus Virchow-Klinikum, Charité-Universitätsmedizin Berlin, , Germany

15 - Cartilage Injury and Repair, Hidalgo, Ground Level, October 18, 2019, 16:30 - 18:30

Biography
Stefan Fickert is Associate Professor of Trauma and Orthopaedic Surgery at the Faculty of Medicine at Heidelberg University and is a partner at the Sporthopaedicum in Straubing and Regensburg as well as the St Wolfgang Private Clinic in Bad Griesbach, Bavaria. Stefan earned his medical degree at the University of Würzburg, Charite Berlin and Bern, Switzerland. He undertook his residency and fellowship training in orthopaedic surgery at the universities of Ulm, Dresden and Adelaide, Australia and New York, USA. Prior to his moving to Straubing he served for more than 7 years as Surgeon-in-Chief at the University Clinic Mannheim and as an Associate Professor at the Medical Faculty of the University of Heidelberg.

His clinical interest is the diagnosis and treatment of hip pain in young patients. Arthroscopic management of sports medicine injuries, joint-preserving surgery for early arthritis and open surgical management of non-arthritic disorders in and around the hip are particular passions. He has major interest and extensive experience with cartilage restoration at the hip, especially with autologous chondrocyte transplantation.

Stefan is married with two young girls. In his spare time, he is active in cross-country skiing, road cycling and enjoying time with his family.

Purpose
The treatment of acetabular chondral lesions has the most significant impact on outcome in Femoroacetabular impingement. For large full-thickness cartilage defects arthroscopic matrix-associated autologous chondrocyte transplantation (MACT) using an injectable in situ crosslinking product is an option. Aim of the study was to evaluate clinical and MRI results 24 months after MACT of acetabular cartilage defects in FAI patients.

Methods
21 patients with a focal cartilage defect of the hip (2.97 ± 1.44 cm² (mean ± SD) caused by FAI were included. The treatment of associated pathologies and the harvesting of cartilage was performed in the first operation. After cultivation MACT was conducted arthroscopically. The results were assessed with patient-reported outcome measures (iHOT33, EQ-5D) pre- as well as postoperatively and by MRI using MOCART scoring system 6 and 12 months post-operatively.

Results
The iHOT33 score improved from 52.9 ± 21.1 (mean ± SD) preoperative to 85.8 ± 14.8 (mean ± SD; p=0.0012) 24 months postoperative. The change in the iHOT33 score at 24 months compared with preoperatively was with 33.6 ± 25.3 (MW ± SD); p <0.0001 points very high. Patients showed a significant improvement in quality of life after 24 months as measured by the EQ-5D-5L index (p = 0.0004) and EQ-5D VAS (p = 0.0006). In the 24-month MRI analysis, 11 out of 14 patients showed a complete filling of the defect area and in all 14 patients a complete healing of the graft, the MOCART score improved from 62.5 ± 18.3 after 12 months to 72.9 ± 10.7 (MW ± SD) at 24 months.
Conclusions
Injectable MACT is a promising minimally invasive treatment option for full-thickness cartilage defects of the hip caused by FAI. A significant improvement in function and quality of life despite large cartilage defects had been detected in the study population.
S16.4 - In office screening by a physiotherapist for new hip patients increases efficiency of a hip arthroscopists clinic

Dr Jennifer Marland¹, Dr Hugh West¹, Dr James Wylie¹
¹The Orthopaedic Specialty Hospital, Intermountain Healthcare, Murray, United States

Biography
Dr Marland is a DPT that works in the hip preservation clinic at The Orthopaedic Specialty Hospital at Intermountain Healthcare in Murray, UT. She specializes in the clinical and radiographic evaluation and treatment of patients with non-arthritic hip and pelvic pain.

Background
Pain in the hip area can be from multiple different sources some of which are appropriately treated by the hip arthroscopist. There is limited literature on how to initially screen hip patients to improve clinic efficiency. We hypothesized that patient screening with a specially trained physiotherapist could improve hip arthroscopy clinic efficiency.

Methods
This retrospective study reviewed all patients seen from 9/2015 to 9/2016 after starting a pilot protocol to screen new hip patients with a specialty trained hip physiotherapist. All patients were offered either a new patient visit directly with the surgeon or with the physiotherapist for initial screening. Patients that were screened and were deemed appropriate for referral to the surgeon then saw the surgeon at a subsequent visit. Other patients were treated with appropriate conservative measures based on their diagnosis or referred to other surgeons with appropriate surgical expertise (i.e. spine, hip arthroplasty, open hip preservation, etc.). Diagnoses of patients in each group are reported. Proportion of patients referred to the hip arthroscopist from screening was recorded and conversion rate of patients to surgery was compared between screened and unscreened patients using Pearson’s chi-squared test.

Results
In study period, there were 407 new hip patients in the practice 256 (63%) patients underwent screening with the physiotherapist and 151 (37%) patients did not. Of the 256 patients that were screened by the physiotherapist, 177 (69%) were referred to the hip arthroscopist. Of these 177 patients, 98 (55%) underwent surgical intervention. In contrast, of the 151 patients that did not undergo screening, 49 (31%) underwent surgical intervention. A higher proportion of screened patients seeing the surgeon underwent surgery (55% versus 31%, p<0.001). The most common diagnosis for surgery was femoroacetabular impingement (FAI) (95 patients, 65%). The most common diagnoses for screened patients not being referred to the surgeon were FAI with or without early osteoarthritis in older patients (26, 33%) and abductor tendinopathy (12, 15%).

Conclusion
Initial evaluation of new hip patients with a specialized physiotherapist increases the efficiency of a hip arthroscopy clinic.
Purpose
To retrospectively evaluate the diagnostic validity and reliability of hip intra-articular anaesthetic injections, by alleviating pain originated by the various types of intra-articular hip pathologies, while differing them from extra-articular originated pain.

Materials and Methods
During January 2016 to July 2018, 877 patients undergone hip MRI arthrography (MRA) including injection with Lidocaine, preceded by a physical examination for signs of femuroacetabular impingement (FAI). In total, 813 patients met the inclusion criteria and were retrospectively analysed. Lidocaine test results were assessed according to MRA interpretation. All interpretations were performed by an MSK radiologist. All lidocaine and contrast injections were handled by the same senior orthopaedic surgeon, thus reducing variability of injection technique.

Results
In 776 (95.4%) of the hips MRA at least one intra-articular pathology was detected. Of which, intra-articular lidocaine injection eased pain (positive test result) in 489 of the patients, consisted with 63.0% sensitivity. Due to high rates of false-positive and non-indicative test results, the test specificity is merely 21.6%. Overall, lidocaine test was accurate in 61.1% of patients, compared to MRA. The Kappa coefficient value in our study indicating slight statistical coherence between lidocaine test and MRA test results ($\kappa = 0.21; P = 0.145$). Furthermore, a sturdy evidence for the inaptitude of lidocaine test, is the comparability of distributions of the lidocaine test results between the positive and negative to intra-articular pathologies, diversified by age groups (will be shown in the presentation).

Conclusion
Our findings indicate that the diagnostic value of lidocaine test, in differentiating intra- from extra-articular hip pathologies, is little to none. Given these results, the large sampling pool in our study, and lack of any significant contradicting study, we strongly advise for immediate additional research measuring the diagnostic utility of lidocaine test. Reconsideration of indications and guidelines for practicing lidocaine test may also be fitting.
Biography

Dr Jonathan Bartlett is an Academic Foundation Doctor working the Essex, Bedfordshire, Hertfordshire Deanery. He graduated with a Distinction from the University of Cambridge in 2018.

Introduction

Decreases in trainees’ working hours, coupled with evidence of worse outcomes when hip arthroscopies are performed by inexperienced surgeons, mandate the development of additional means of arthroscopic training. Though virtual reality simulation training has been adopted by other surgical specialities, its slow uptake in arthroscopic training is due to a lack of evidence as to its benefits. These benefits can be demonstrated through learning curves associated with simulator training – with practice reflecting measurable increases in validated performance metrics.

Methods

Twenty-five medical students completed seven simulated arthroscopies of a healthy virtual hip joint in the supine position on a previously validated simulator. Twelve targets had to be visualised within the central compartment; six via the anterior portal, three via the anterolateral portal and three via the posterolateral portal. Eight students proceeded to complete seven probe examinations of a healthy virtual hip joint. Eight targets were probed via the anterolateral portal. Task duration, number of collisions with soft tissue and bone, and distance travelled by arthroscope were measured by the simulator for every session.

Results

A learning curve was demonstrated by the students, with significant improvements in time taken (P<0.01), number of collisions (P<0.01), collision severity (P<0.01), and efficiency of movement (P<0.01). The largest difference between consecutive sessions was seen between sessions 1 and 2, with sessions thereafter showing only minimal rates of improvement. Similar improvements were found in the probe examination with students showing significant improvements in time taken (P<0.01), number of collisions (P<0.01), collision severity (P<0.01) and distance travelled by arthroscope (P<0.01).

Conclusions

The results of this study demonstrate a learning curve for a previously validated hip arthroscopy simulator, confirming improved performance with repeated use. These results support the use of virtual reality as a potential means of developing basic hip arthroscopic skills.
What is the revision rate in the learning curve of arthroscopic hip preservation surgery and why are they performed - Is it a failure of patient selection or surgical technique?

Dr Joshua Harris¹, David Dong¹, Domenica Delgado¹, Thomas Yetter¹, Brayden Gerrie¹, Haley Goble¹, Lindsay Barter¹

¹Houston Methodist Hospital, Houston, United States

S16 - Teamwork and Training, Doblon, Ground Level, October 18, 2019, 16:30 - 18:30

Background
The learning curve of hip arthroscopy is significant, with outcomes dependent on both patient selection and surgical technique. The career case minimum threshold has been recently established to be 519 cases, with a maintenance of 164 cases per year.

Purpose
To determine the reoperation and total hip conversion rates during a single surgeon’s learning curve, with analysis of the reason for reoperation as either patient selection or surgical technique or both.

Methods
A retrospective case series of the first 519 arthroscopic hip preservation cases of a single surgeon’s career was analysed. Patients of any age or diagnosis undergoing primary or revision central, peripheral, peri trochanteric, and/or deep gluteal space compartments were eligible. Surgical indications included FAI (femoroacetabular impingement) Syndrome, labral tear, peri trochanteric, or deep gluteal space diagnoses that had failed three months of nonsurgical treatment. Minimum follow-up was one year. Reoperations were classified as arthroscopic, open non-arthroplasty, or arthroplasty. Reoperations were additionally classified as due to a failure in patient selection and/or surgical technique. Traction time, surgical time, number of anchors placed, intraoperative anchor pull out, magnitude of cam/pincer correction, concomitant procedures (periacetabular osteotomy, pubalgia surgery), and all patient demographics were analysed. Descriptive comparative and regression statistical analyses were performed.

Results
519 arthroscopic hip preservation surgeries were analysed (age 35.3+/-14.1 years; 63% female; 54% right hip; 91% primary; surgical time 99+/-21 minutes; traction time 40.6+/-8.7 minutes; 484 supine with post, 35 supine post less; 458 labral repair; 11 labral reconstruction; 474 cam osteoplasty; 460 complete capsular closure; 10 endoscopic abductor repair; 7 endoscopic hamstring repair; 4 ischiofemoral decompression; 90% follow-up at minimum one year). Revision surgery rates were 1.8% arthroscopy, 2.8% arthroplasty, and 0.4% PAO. Arthroplasty and PAO conversions were due to failure in patient selection (100%). Revision arthroscopies were due to both failure of surgical technique (83%; inadequate cam correction) and patient selection (17%).

Conclusions
A low rate of revision surgery (5%) was observed during an arthroscopic hip surgeon’s short-term learning curve. Arthroplasty and PAO revisions were due to failure in decision-making, while arthroscopic revisions were primarily due to surgical technique.
S16.8 - Pain management trends in hip arthroscopy

**Dr Travis Menge¹, Dr Robert Boykin², Dr Guillaume Dumont³**

¹Michigan State University/Spectrum Health, Grand Rapids, United States, ²EmergeOrtho, Asheville, United States, ³University of South Carolina, Columbia, United States

S16 - Teamwork and Training, Doblon, Ground Level, October 18, 2019, 16:30 - 18:30

**Biography**

Dr Travis Menge, M.D. is an orthopaedic surgeon and sports medicine specialist in Grand Rapids, Michigan. His practice offers innovative techniques for joint preservation, with the goal of keeping people active and in good health. Fellowship-trained at the renowned Steadman Philippon Institute in Vail, Colorado, Dr Menge is sought out for his expertise in hip arthroscopy, as well as minimally invasive surgery of the shoulder and knee. He is an active United States Ski and Snowboard Team Physician and travels internationally with the team. Additionally, he provides care for multiple sports teams across Michigan, including the high school, collegiate, and professional levels. Education, teaching, and mentorship are also a passion for Dr Menge. He is a clinical professor at Michigan State University School of Medicine, and actively involved in teaching medical students and resident surgeons.

**Purpose**

Arthroscopic hip surgery continues to grow at an exponential rate, and as such, optimal pain management in these patients is increasingly important. Reducing post-operative pain can lead to decreased narcotic consumption, increased patient satisfaction, and improved cost-effectiveness of hip arthroscopy. The purpose of this study, therefore, was to evaluate and report current practices in pain management techniques for patients undergoing arthroscopic hip surgery.

**Methods**

Seventy-five arthroscopic hip surgeons from around the world were sent an electronic survey to assess current practices in perioperative pain management. The survey included 30 questions on physician/practice demographics, preoperative medications, peripheral nerve blocks, intra-operative soft tissue injections, durable medical equipment, and postoperative protocols. Statistical analysis and comparisons were made utilizing surgeon experience, age, geographic location, and operative case volume.

**Results**

Fifty-three surgeons (71%) across five continents completed the questionnaire. Surgeons 40 years of age or younger were significantly less likely to give preoperative oral pain medications (p=0.015), but more likely to use perioperative anaesthetic injections (p=0.009), prescribe postoperative gabapentin and/or cyclobenzaprine (p=0.049), and prescribe a greater number of narcotic tablets (p=0.036). Additionally, surgeons in the United States are both more likely to prescribe narcotics following surgery than international surgeons (93.2% vs 37.5%, p=0.001), as well as prescribe more tablets of narcotic pain medication (p<0.0001). Lastly, lower operative case volume was significantly associated with a higher utilization of regional nerve blocks (p=0.186).

**Conclusions**

This study highlights the wide variability in pain management techniques among leading arthroscopic hip surgeons. Importantly, surgeons in the United States were more likely to prescribe narcotics following surgery and prescribe more narcotic tablets compared to international surgeons. Further studies are warranted to evaluate these trends and practice patterns to identify strategies that result in improved pain control following surgery while minimizing use of narcotic pain medication.
S17.1 Predictors of Mid-Term Clinical Outcomes After Hip Arthroscopy: A prospective analysis of 1038 patients with 5-year follow-up

Dr Ajay Lall¹, Sarah Chen¹, Cammille Go¹, Dr Rafael Walker-Santiago¹, Dr David Maldonado¹, Dr Benjamin Domb¹

¹American Hip Institute, Chicago, United States

S17 - Free Papers, Doblon, Ground Level, October 19, 2019, 08:00 - 09:20

Biography:
Dr Ajay C. Lall is a dual fellowship trained orthopaedic surgeon specializing in sports medicine and hip arthroscopy in the Chicago area. His background includes mentorship by world renowned sports medicine physician, Dr James Andrews, at the American Sports Medicine Institute, Birmingham, AL. He has also completed formal hip preservation training under master hip arthroscopist, Dr Benjamin G. Domb, at the American Hip Institute, Chicago, IL. He is an avid clinical researcher with numerous presentations and publications at international academic meetings and within top peer-reviewed journals. Dr Lall has treated collegiate, professional, and elite level athletes, including players for the NCAA, NFL, NBA, MLP, PGA, and WWE. Dr Lall treats patients from across the country who travel to Chicago for their surgery, and he takes pride in caring for every patient like a professional athlete.

Background
Although hip arthroscopy has been shown to have favourable results, there is a paucity of literature describing predictive factors of 5-year clinical outcomes.

Purpose: Identify predictive factors of midterm outcomes after hip arthroscopy in a cohort of 1038 patients, whose outcomes at minimum 2-year follow-up have previously been reported. In addition, to provide a comparison of short-term and midterm predictive factors in outcome measures following hip arthroscopy.

Study Design
Case-control study; Level of evidence, 3.

Methods
Data was prospectively collected and retrospectively reviewed on all patients undergoing hip arthroscopy between February 2008 and June 2012. Patients were included if they had minimum 5-year follow-up on 3 patient reported outcomes: Nonarthritic Hip Score (NAHS), modified Harris Hip Score (mHHS), and Hip Outcome Score-Sport Specific Subscale (HOS-SSS). Patients were excluded if they had any prior ipsilateral hip conditions. Using bivariate and multivariate analyses, we analysed the effect of 36 preoperative and intraoperative variables on NAHS.

Results
A total of 1038 patients met our listed inclusion and exclusion criteria, with a mean follow-up time of 62.0 months (range, 60.0 - 120.0 months). The bivariate analysis identified 11 variables (4 categorical and 7 continuous) that were predictive of 5-year postoperative NAHS. For the multivariate analysis, 7 variables were identified as being significant: preoperative NAHS, body mass index (BMI), age, lateral joint space, alpha angle, revision hip arthroscopy, and acetabular microfracture. These 7 variables were also predictive in the bivariate analysis.

Conclusion
This study reports favourable midterm clinical outcomes in the largest cohort of hip arthroscopies with minimum 5-year follow up in the literature to date. Seven variables were identified as being significant predictors in both the bivariate and multivariate analysis: preoperative NAHS, body mass index (BMI), age, lateral joint space, alpha angle, revision hip arthroscopy, and acetabular microfracture. Of these, preoperative NAHS, BMI, age, and revision hip arthroscopy were predictive of both 2-year and 5-year
postoperative NAHS. These predictive factors may prove useful to clinicians in determining indications for hip arthroscopy and counselling patients on its expected outcomes.
S17.2 Mental health disorders in hip arthroscopy: An evaluation of its prevalence and associated factors

Dr Guillaume Dumont1, Dr Travis Menge2, Mrs Nicole Battle1, Mr Zach Thier1
1University Of South Carolina School of Medicine, Columbia, United States, 2Spectrum Health Medical Group, Grand Rapids, USA

Introduction
Hip arthroscopy for symptomatic femoroacetabular impingement (FAI) has been shown to yield good mid to long-term outcomes. The potential impact of mental health disorders on treatment of musculoskeletal injuries, such as hip pain, is under-reported in the current literature. The purpose of this study was to determine the prevalence of mental health illness among patients who underwent hip arthroscopy for FAI, and identify factors that may be associated with the presence of mental health disorders in this population.

Methods
Patients who underwent primary hip arthroscopy for symptomatic FAI by a single surgeon between November 2014 and March 2019 were retrospectively analysed. Patient specific variables including age, gender, BMI, tobacco use, preoperative opioid use, allergies, and mental health diagnoses were recorded. The prevalence of mental health disorders was assessed. Binary logistic regression was performed to evaluate which factors were associated with the presence of a mental health illness.

Results
325 patients met inclusion criteria and were included in this study. Our cohort included 112 males (34%) and 213 females (66%) with a mean age of 32.7 years (range 15 – 69) and BMI of 26.5 (range 16.7 – 48.8). 111(34%) patients were diagnosed with a mental health illness. Regression analysis showed that increased age (p=0.003), female gender (p=0.006), tobacco use (p=0.007), and preoperative opioid use (p=0.003) were associated with a mental health illness. Conversely, BMI and number of allergies were not significantly associated with a mental health diagnosis (p>0.05).

Conclusion
Mental health disorders are found in approximately one third of patients who underwent hip arthroscopy for treatment of FAI. Increased age, female gender, tobacco use, and preoperative opioid use are factors associated with the presence of mental health illnesses in this patient population. These findings may be helpful when formulating treatment plans and counselling patients with FAI.

Biography
Guillaume Dumont is a faculty member at the University of South Carolina School of Medicine. His clinical and research focuses include hip arthroscopy and femoroacetabular impingement. He is a native of Montreal, Canada. He earned his undergraduate degree in biochemistry at the University of Tennessee, where he played football, before attending medical school at Emory University in Atlanta. He then completed his orthopaedic surgery residency at the University of Texas Southwestern Medical Centre in Dallas. He then completed a fellowship in sports medicine & shoulder surgery at Harvard Medical School / Massachusetts General Hospital in Boston prior to hip arthroscopy training at the Nashville Orthopaedics and Sports Medicine Centre.
S17.3 FABER distance on clinical exam compared to exam under anaesthesia to determine contribution of soft tissue constraint in patients with FAI

Dr Lorenzo Fagotti¹, Dr Ashley Payne³, MPH Karen Briggs¹, Dr Marc Philippon¹,²

¹Steadman Philippon Research Institute, Vail, USA, ²Steadman Clinic, Vail, USA

S17 - Free Papers, Doblon, Ground Level, October 19, 2019, 08:00 - 09:20

Biography

Board of Brazilian Hip Surgeons
Board of Brazilian Orthopaedic Surgeons
International Research Fellow Steadman Philippon Research Institute
Post-graduate at Federal University of Sao Paulo Sports Medicine Program
Orthopaedic Surgeon at Hospital Sírio-Libanês

Background

It has been shown that patients with femoroacetabular impingement (FAI) have decreased hip range of motion (ROM); however, it is unclear if this is due to bony or soft tissue block. The purpose of this study was to determine if reactive soft tissue constraint was present in FAI and contributed to reduced ROM. We hypothesized that FABER (flexion abduction external rotation) distance would be increased (reduced ROM) on clinical exam compared to EUA due to soft tissue constraint (captured hip).

Methods

FABER distance on the operative hip of 707 patients who had a primary hip arthroscopy for FAI was obtained during preoperative evaluation (FABER-Clinic) and under anaesthesia (FABER-EUA) prior to hip arthroscopy. Difference between the two measurements (FABER-DIF) of 3.7 cm was considered significant, based on previous published minimal detectable change. Radiographic and intraoperative data were also collected. This study was IRB approved.

Results

There were 433 (61.2%) males and 264 (38.8%) females with a mean age of 35.6 ± 12, BMI of 24 ± 3.5 Kg/m², LCEA of 34.5° ± 6.3 and AA of 72°± 11. The mean FABER-Clinic was 25.6 ± 6.6 cm and the mean FABER-EUA was 18 ± 6.5 cm (p<0.001). The mean FABER-DIF was 7.3 (95% CI-6.9 to 7.8). In 88% (622/707) cases, the FABER-Clinic was greater than the FABER-EUA. In addition, in 534(76%) cases the FABER-DIF was greater than 3.7 cm. Larger labral tear size significantly correlated with higher FABER-EUA (r=0.125; p=0.001) and FABER-Clinic (r=0.122; p=0.002). In addition, patients with grade III or IV cartilage damage on the femoral head had higher FABER-EUA (p<0.001) and FABER-Clinic (p=0.009).

Conclusion

Soft tissue constraint contributes to the loss of ROM seen on clinical exam in patients with FAI. FABER distance (reduced ROM) correlated with size of labral tear and severity of cartilage damage in the hip.
S17.4 Bernese periacetabular osteotomy. Is the operative fluoroscopy more reliable than the intraoperative radiography to assess an adequate acetabular correction?

Dr Joaquin Lara¹, Dr Alan Garin¹, Dr Cristhian Herrera¹, Dr Selim Abara¹, Dr Hassan Neumann², Dr Diego Villegas³, Dr Javier Besomi², Dr Carlos Tobar³

¹Clínica Las Condes - Universidad de Chile, Santiago, Chile, ²Clínica Alemana de Santiago - Universidad del Desarrollo, Santiago, Chile, ³Clínica Avansalud, Santiago, Chile

Introduction
Periacetabular osteotomy (PAO) is frequently the surgical treatment of choice for symptomatic hip dysplasia in skeletally mature patients. Intraoperative monitoring of the corrected acetabular position before definitive fixation is considered mandatory. Prior studies have compared intraoperative fluoroscopic correction with postoperative radiographic correction with a moderate agreement. However, there are not studies comparing the results of the intraoperative x-ray and fluoroscopic images. The purpose of this study is to compare the agreement between the intraoperative fluoroscopy and radiography with the correction seen on postoperative radiographs.

Methods
Retrospective study of 102 hips who underwent PAO for symptomatic hip dysplasia. Patients were included in the study if they had preoperative radiographs, intraoperative fluoroscopy and radiography, and minimum 6-week postoperative radiographs. The lateral centre-edge angle (LCEA), the acetabular index (AI) and the femoral head extrusion index (EI) on the fluoroscopic and intraoperative radiographic views and postoperative radiographs were measured. The concordance between the amount of correction on intraoperative fluoroscopy and radiography and postoperative measurements was analysed using the concordance correlation coefficient (rc) and a Bland–Altman analysis.

Results
The amount of intraoperative correction of LCEA as measured on intraoperative radiographs images demonstrated excellent agreement with postoperative radiographs (rc = 0.85; 95% confidence interval [CI], 0.79–0.91; p < 0.001), the LCEA correction measured on fluoroscopic images demonstrated moderate agreement (rc = 0.43; 95% confidence interval [CI], 0.26–0.60; p < 0.001), the AI measured on intraoperative radiographs demonstrated substantial agreement (rc = 0.75; 95% CI, 0.65–0.85; p < 0.001). The agreement for the AI for the fluoroscopy was moderate (rc = 0.51; 95% CI, 0.36–0.57; p < 0.001). Finally, for the EI the agreement of the intraoperative radiography was moderate (rc = 0.57; 95% CI, 0.43–0.71; p < 0.001) and for the fluoroscopy was fair (rc = 0.38; 95% CI, 0.21–0.56; p < 0.001).

Discussion
Intraoperative radiography is more accurate and reliable than fluoroscopic measure of correction of lateral coverage of the acetabular fragment, acetabular index and femoral head extrusion index during PAO. We conclude that the use of intraoperative pelvic radiographs during PAO procedures should not be replaced by fluoroscopy for an adequate confidence of the acetabular reorientation.
S17.5 Effect of post-free distraction arthroscopy on acute pain, discharge time and narcotic consumption

Dr Robert Kollmorgen¹, Dr Thomas Ellis², Dr Brian Lewis³, Dr Joshua Harris⁴
¹University Of California San Francisco Fresno, Fresno, United States, ²Orthopedic One, Columbus, United States, ³Duke University Medical Centre, Durham, United States, ⁴Houston Methodist, Houston, United States

Introduction
With the recent rise in the marketing of post-free distraction devices and techniques, these methods have shown to reduce the risk of pudendal nerve and peroneal injuries. Author’s adopting post-free techniques have noticed a subjective decrease in postoperative pain and improved recovery as compared to peroneal post procedures. We hypothesized that post-free distraction patients would have decreased acute post-operative pain, quicker time to discharge and require less narcotics in the acute phase as compared to techniques utilizing a peroneal post.

Methods
A multicentre retrospective matched study was performed comparing 50 peroneal post patients to 50 with post-free distraction. Inclusion criteria was patients undergoing primary hip arthroscopy, and exclusion criteria were patients undergoing peri acetabular osteotomy and revision hip arthroscopy. Post Anaesthesia Care Unit, PACU, Visual Analog Scale (VAS) initial, VAS max and VAS at discharge were reviewed as well as narcotic use in the PACU represented as Morphine Equivalents, MEQ. T-test was performed for significance.

Results
On average, the perineal post group surgery time, PACU time and time to discharge were 114, 102, and 152 minutes, and the post-free group had times of 113, 84, and 127 minutes respectively. VAS Initial, max and at discharge were 6.5, 6.7, and 4.2 for the perineal post group and 5.5, 5.4, and 4.0 for the post-free group. Narcotic use was 17.3 and 14.0 MEQ for the post and post-free group respectively. P-values were significant, < 0.05, for narcotic MEQ and VAS Max.

Conclusion
In this retrospective comparative study, all measures were decreased in the post-free distraction group and a significant decrease was observed in maximum pain and narcotics consumed. In conclusion, post-free distraction in this multicentre study has shown to decrease time to discharge, pain and narcotic requirement.
S17.6 Iliopsoas-related pathology, prevalence, and procedures findings and outcomes from a large hip arthroscopy study group

Dean Matsuda¹, Benjamin Kivlan², Shane Nho³, Andrew Wolff⁴, Jonathan Salvo⁵, Jonathan Christoforetti⁶, Thomas Ellis⁷, Dominic Carreira⁸

¹DISC Sports and Spine, Marina del Rey, United States, ²John G. Rangos School of Health Sciences, Pittsburgh, United States, ³Rush Medical Centre, Chicago, United States, ⁴Washington Orthopaedics and Sports Medicine, Washington DC, United States, ⁵Rothman Institute, Marlton, United States, ⁶Allen Orthopaedics and Sports Medicine, Allen, United States, ⁷Orthopedics ONE, Columbus, United States, ⁸Peachtree Orthopaedics, Atlanta, United States

S17 - Free Papers, Doblon, Ground Level, October 19, 2019, 08:00 - 09:20

Introduction
There appears to be a recent trend towards fewer iliopsoas tenotomies, possibly because of recent studies reporting residual flexor weakness and/or anterior instability, but no studies have investigated this topic.

Purpose
Report the prevalence, associated findings, and rendered arthroscopic surgical procedures and outcomes of hips with iliopsoas-related pathology.

Methods
Level of evidence 3 controlled study with prospectively collected multicentre database. Enrolled patients that underwent isolated hip arthroscopy that reached 2-year minimum follow-up with PROs (iHOT-12, VAS for pain) were assigned to Iliopsoas group defined as pre-operative diagnosis of iliopsoas tendonitis and/or internal snapping symptoms and/or intra-operative anteroinferior labral pathology (below 3 O’clock) or control group. The prevalence of iliopsoas-related pathology, radiographic and intra-operative findings, and rendered procedures between study and control groups were compared using Chi square analysis. Minimum 2-year outcomes were compared using analysis of variance (a priori alpha set at 0.05).

Results
629 patients met the inclusion criteria of which 69 patients (11%) comprised the iliopsoas group and 560 patients (89%), the control group. Iliopsoas tenotomy was performed in 5 patients (7% of the iliopsoas group, 0.8% of the total patients undergoing hip arthroscopy), all via the trans capsular approach. Demographics did not differ between groups (p>0.05). There was no significant difference in the prevalence of cam deformity, global pincer deformity, or dysplasia between cohorts but there was a lower incidence of focal pincer impingement among patients with iliopsoas involvement (22 % vs 37%,p=0.001). Labral repair and debridement were more commonly performed in the group of patients without iliopsoas involvement and relatively more labral reconstructions in the iliopsoas group (p<0.05). Post-operative iHOT-12 scores similarly improved to 70.2 (SD:26.7) for the iliopsoas group and 73.0 (SD:25.1) for the control group (p=0.68). Post-operative pain scores similarly reduced to 21.9 (SD 23.0) for the iliopsoas group and 20.2 (SD: 22) for the control group (p=0.74).
Conclusion
The most significant finding from this large multicentre study is the extremely low incidence of arthroscopic iliopsoas tenotomies despite the not uncommon prevalence of iliopsoas-related pathology. The presence of iliopsoas–related pathology is not a predictor of poorer outcomes in patients treated with hip arthroscopy.
Femoroacetabular impingement randomised controlled trial (FIRST): A multi-centre randomized controlled trial comparing arthroscopic lavage and arthroscopic osteochondroplasty on patient important outcomes in the treatment of young adult FAI

PL2.6 - Evidence in FAI Syndrome, Auditorium (Plenary), Ground Level, October 17, 2019, 14:00 - 15:00

Biography
Dr Ayeni is an Associate Professor of Orthopaedic Surgery, Adjunct Professor in the Health Research Methodology, Evidence and Impact program, and Director of Orthopaedic Sports Medicine Research at McMaster University. He is also the Medical Director for the Hamilton Tiger Cats Organization. Dr Ayeni is an orthopaedic surgeon that specializes in the treatment of femoroacetabular impingement (FAI, or hip impingement), which is common in the active/athletic adult population. To date, most articles published concerning FAI have been initiated and written by Dr Ayeni and his research team at McMaster University.

Purpose
Femoroacetabular impingement (FAI) is a condition of the hip where there is a mismatch of the femoral head and hip acetabulum. A lack of definitive evidence regarding the efficacy of osteochondroplasty in treating FAI fuelled the design and execution of the FIRST randomized controlled trial (RCT). FIRST evaluated the impact of surgical correction of the hip impingement morphology with arthroscopic osteochondroplasty versus arthroscopic lavage on pain, function, and quality of life in adults aged 18-50 years diagnosed with non-arthritic FAI at one year.

Methods
This RCT (NCT01623843) enrolled patients with FAI requiring surgical intervention across 10 international clinical sites. Participants were randomized to either arthroscopic osteochondroplasty or lavage. The primary outcome was patient-reported pain within one year of the initial surgery measured using the Visual Analogue Scale (VAS). Secondary outcomes included function, health utility, and health-related quality of life using several general and hip-centric health questionnaires. An independent, blinded adjudication committee evaluated the quality of surgery, re-operations, and other patient complications. Patients and data analysts were blinded to the treatment groups.

Results
220 participants were enrolled into the FIRST trial over a six-year period (pilot phase: N=50, from 2012-2013 and definitive phase: N=170, from 2015-2018) at 10 clinical sites in Canada, Finland, and Denmark. The FIRST results will be released at the ISHA annual meeting as follows. Across both study groups, XX% (X/X) of patients had a labral tear, of which XX% were repaired. The absolute difference in rate of pain reduction between groups was XX (95% CI: YY-YY, p=X). The mean differences of the Short-Form 12 (SF-12, MCS and PCS), Hip Outcome Score (HOS), International Hip Outcome Tool (iHOT-12), and EuroQol 5-Dimensions (EQ-5D) between groups are XX (95% CI: YY-YY, p=X), respectively. Re-operations occurred in XX of 220 (X%) patients at one year (OR: XX, 95% CI: YY-YY, p=X) and non-operatively treated adverse events occurred in XX of 220 (X%) patients at one year (OR: XX, 95% CI: YY-YY, p=X).

Conclusion
This RCT represents major international efforts to definitively identify the optimal treatment strategy for FAI.
PL5.1 How can we define clinically important improvement in pain scores after hip arthroscopy for femoroacetabular impingement syndrome? minimum two-year follow-up study

Dr Edward Beck1, Mr. Kyle Kunze2, Dr Benedict Nwachukwu2, Dr Jorge Chahla2, Ms. Kyleen Jan1, Mr. Jonathan Rasio2, Dr Shane Nho2

1Department of Orthopaedic Surgery, Wake Forest School of Medicine, Winston-Salem, US, 2Department of Orthopaedic Surgery, Rush University Medical Centre, Chicago, US

PL5 - Trainee Competition Presentations, Auditorium (Plenary), Ground Level, October 19, 2019, 08:00 - 09:05

Biography
Dr Edward Beck is an orthopaedic resident and post-doctorate fellow in the Department of Orthopaedic Surgery at Wake Forest School of Medicine in Winston Salem, NC, USA. His surgical interests include hip arthroscopy and treatment of femoroacetabular impingement. During the past year he was selected as a research fellow for Dr Shane Nho at Rush University, where he published a number of clinical, biomechanical, and transitional science studies. He also collaborated with other hip arthroscopists including Dr Allston Stubbs, Dr Struan Coleman, Dr Olufemi Ayeni, and Dr Josh Harris. He hopes to pursue a career in sports medicine with a focus on hip arthroscopy and hip preservation.

In his time off, Dr Beck enjoys spending time with his fiancé, Kathryn Thayer, who is a dermatological nurse. He is also passionate about basketball, football, and soccer, and cheers for his alma mater, the University of Arizona, where he was a team member of the water polo team.

Background
Patient postoperative pain is being increasingly reported in the field of hip preservation surgery. The Visual Analog Scale (VAS) for pain is one of the most commonly utilized measures for perioperative pain assessment. Currently, there is limited understanding of clinically significant improvement in VAS pain.

Purpose
1) To define the Substantial Clinical Benefit (SCB), Patient Acceptable Symptomatic State (PASS), and Minimal Clinically Important Difference (MCID) for the VAS pain score in patients undergoing hip arthroscopy for femoroacetabular impingement syndrome (FAIS) after 2-year from surgery, and 2) to identify preoperative predictors of achieving each outcome end-point.

Methods
Data from consecutive patients who underwent primary hip arthroscopy between November 2014 and March 2017 were collected and analysed. Baseline data and postoperative patient-reported outcome (PRO) scores were recorded at 2-years postoperatively. In order to quantify clinical significance of outcome achievement for the VAS pain score, the MCID, PASS and SCB were calculated.

Results
A total of 976 patients were included in the final analysis. The VAS pain score threshold for achieving MCID was defined as a decrease of 14.8, PASS was defined as achieving a 2-year postoperative score of 21.6 points, and SCB was defined as a decrease of 25.5 or achieving a score of 15.4 points at 2 years. The rates of achieving MCID, PASS, and SCB were 97.6%, 66.4% and 71.2%, respectively. Regression analysis demonstrated that sports involvement, low BMI, smaller alpha angle, and absence of articular damage and chondromalacia were predictive of achieving PASS (all P<0.05). Preoperative predictors for achieving SCB included being male, no smoking history, smaller alpha angle, higher mHHS score, and lower VAS pain score (all P<0.05).
Conclusion
This study identified scores for VAS pain that can be used to define clinically significant outcome after arthroscopic treatment of FAIS. Specifically, a decrease in pain score of 14.8 was a clinically important improvement in VAS pain, while an absolute score below 15.4 or change of 25.5 represented the upper threshold of VAS pain improvement. Additionally, there were both modifiable and non-modifiable factors that predicted achieving clinically significant levels of post-operative pain improvement.
PL5.2 Femoroacetabular impingement syndrome is strongly predictive for development of hip osteoarthritis within 10 years follow-up: Data from the CHECK cohort

Dr Rintje Agricola1, Dr Michiel van Buuren1, Dr Joanne Kemp2, Dr Erwin Waarsing1, Dr Harrie Weinans3, Dr Jan Verhaar1, Dr Jos Runhaar4, Dr Sita Bierma-Zeinstra1,4

1Department of Orthopaedics, Erasmus University Medical Centre, Rotterdam, the Netherlands, 2LaTrobe Sports & Exercise Medicine Research Centre, La Trobe University, Melbourne, Australia, 3Department of Rheumatology and Orthopaedics, University Medical Centre Utrecht, Utrecht, the Netherlands, 4Department of General Practice, Erasmus University Medical Centre, Rotterdam, the Netherlands

PL5 - Trainee Competition Presentations, Auditorium (Plenary), Ground Level, October 19, 2019, 08:00 - 09:05

Biography

Rintje Agricola is a registrar in orthopaedic surgery at the Erasmus University Medical Centre Rotterdam, the Netherlands. He received his PhD (with honour) on the etiology of FAI in athletes during skeletal growth and its risk for development of osteoarthritis later in life. He collaborated with internationally renowned experts in the field and published articles on this topic in highly ranked journals including the Lancet and Nature reviews rheumatology. He was awarded fellowships at the Oxford university, UK and at Aspetar Orthopaedic Sports Medicine hospital, Qatar. During his orthopaedic training, he continued his line of research for which he received several awards and grants to further study the development of FAI in young athletes and its future risk of hip osteoarthritis.

Introduction

FAI syndrome is a motion related clinical disorder. FAIs includes symptoms, clinical signs and imaging findings. However, previous epidemiological studies only investigated the risk of cam morphology and hip OA.

Aim

To investigate the association between different features of FAIs at baseline and the development of hip OA within 10 years follow-up.

Methods

Individuals were extracted from a Dutch prospective cohort study of 1002 participants (CHECK). Participants were included in CHECK when they were aged between 45-65 years and presented for the first time to the general practitioner with either pain in the hip, knee, or both. Standardized hip or pelvic anteroposterior radiographs were obtained at baseline and 10 years follow-up. Only hips without definite signs of OA (KL ≤ 1) at baseline were included. FAIs was defined by an alpha angle >60°, the presence of hip and/or groin pain and limited internal rotation ≤25°. At 10 years follow-up, the primary outcome measure was end-stage hip OA as defined by a KL grade of 3 or 4, or a total hip replacement (THR). The association between FAIs at baseline and end-stage OA at 10 years follow-up was calculated by logistic regression with generalized estimating equations and adjusted for baseline gender, age, BMI and KL grade (0 or 1).

Results

Of the 1002 participants, 825 (1650 hips) had 10 years follow-up radiographs available for KL scoring. Of those 1650 hips, 1443 hips had a KL grade of ≤ 1 at baseline and were included for analysis. 73 hips developed end-stage OA within 10-years follow-up. There were only 21 hips fulfilling the FAIs criteria at baseline. A significant and strong association between hips with FAIs at baseline and the development of end-stage OA at follow-up was found (OR 26.31, 95%CI 4.4 - 156.5, p<0.001). The positive predictive value was 33%. The association between FAIs and OA became even stronger in the presence of large cam morphology (alpha angle >78°).
Conclusion

FAIs is strongly associated with future development of hip OA. The high positive predictive value of FAIs for future hip OA warrants preventative measures
PL5.3 Promising outcomes of hip mosaicplasty by minimally invasive anterior approach using osteochondral autografts from the ipsilateral femoral head

Dr Roxana Viamont-Guerra\textsuperscript{1,2}, Dr Nicolas Bonin\textsuperscript{2}, Dr Olivier May\textsuperscript{3}, Dr Augustin Le Viguelloux\textsuperscript{2}, Eng. Mo Saffarini\textsuperscript{4}, Dr Frédéric Laude\textsuperscript{1}

\textsuperscript{1}Clinique du Sport Paris V, Paris, France, \textsuperscript{2}Ortho-Lyon-Clinic, Lyon, France, \textsuperscript{3}Clinique Médipole-Garonne, Toulouse, France, \textsuperscript{4}ReSurg, Nyon, Switzerland

PL5 - Trainee Competition Presentations, Auditorium (Plenary), Ground Level, October 19, 2019, 08:00 - 09:05

**Biography**

Orthopaedic surgeon in São Paulo, Brazil, specializing in hip surgery (open and arthroscopic). She got her MD, orthopaedic surgery training and hip fellowship at Santa Casa de São Paulo Medical School. Recently completed her international fellowship in France with Dr Frederic Laude at Clinique du Sport (Paris), and Dr Nicolas Bonin and Dr Willaume Guicherd at Ortho-Lyon-Clinic (Lyon).

**Purpose**

Recent studies demonstrated promising results of mosaicplasty for femoral head osteochondral lesions using posterior and lateral approaches. This study aimed to evaluate outcomes of mosaicplasty using ipsilateral femoral head autografts by minimally invasive anterior approach. The hypothesis was that this surgical technique would grant satisfactory clinical outcomes with considerable improvement of clinical scores.

**Methods**

A consecutive series of 27 mosaicplasties, to treat osteochondral lesions of the femoral head measuring 1.6 ± 0.7 cm\textsuperscript{2} (range 0.8–4.0) in patients aged 28.7 ± 7.4 years (range 19–44), was evaluated using the mHHS and WOMAC scores at minimum follow-up of 12 months. All patients were operated by minimally invasive anterior (Hueter) approach and osteochondral plugs were harvested from the non-weight-bearing portion of the femoral head. Adjuvant osteoplasty was necessary for some patients at the acetabulum (n = 3), femur (n = 14) or both (n = 2).

**Results**

Three patients were excluded due to concomitant periacetabular osteotomies or shelf procedures, one patient could not be reached, and another was revised to THA. This left 22 patients for clinical assessment at 39.4 ± 23.2 months (12.0–90.2). Their mHHS improved from 56.3 ± 12.6 to 88.4 ± 9.9, and WOMAC improved from 45.1 ± 16.9 to 80.6 ± 13.0. Two patients (8.4\%) underwent arthroscopy at 13 and 30 months to remove painful residual cam-type deformities. Regression analyses revealed that net improvement in WOMAC decreased with lesion size (p = 0.002) and increased with follow-up (p = 0.004).

**Conclusions**

Hip mosaicplasty using autografts from the ipsilateral femoral head, performed by minimally invasive anterior approach, granted satisfactory outcomes and functional improvements. Caution is, however, advised for lesions >2 cm\textsuperscript{2} (diameter >16 mm) which may be a threshold limit for this procedure.
PL5.4 Does hip joint preservation surgery prevent total hip arthroplasty?

Mr Mark Sohatee1, Mr Mohammed Ali2, Mr Vikas Khanduja3, Mr Ajay Malviya4

1NHS, Newcastle, United Kingdom, 2South Tyneside and Sunderland NHS Foundation Trust, Sunderland, United Kingdom, 3Cambridge University NHS Foundation Trust, Cambridge, United Kingdom, 4Northumbria NHS Foundation Trust, Newcastle, United Kingdom

Despite the success of Total hip arthroplasty (THA), when considering the ‘young adult’ with hip pathology, it is important to be aware of hip preserving surgeries that look to provide pain relief and restore function, with the most commonly used being hip arthroscopy and periacetabular osteotomy (PAO). The aim of this review study was to determine whether; joint preservation surgery indeed preserves the hip joint, by reviewing manuscripts that report conversion rates to THA following joint preservation surgery.

Utilising PRISMA guidelines, two separate literature searches were undertaken using PubMed and Open Athens search engines. The search strategies used were to identify manuscripts, that looked at arthroplasty conversion rates, following either hip arthroscopy or periacetabular osteotomy.

When considering hip arthroscopy (HA) 1462 papers were screened and we found 64 eligible papers. Reviewing the data included in these studies there were 59,430 hips with 5,627 undergoing conversion to total hip replacement (9.47% [95% CI 9.2%-9.7%]) with a mean conversion time of 24.42 months.

When reviewing papers pertaining to periacetabular osteotomy, there were 47 eligible papers, from 570, including 4,862 patients who underwent PAO with subsequent conversion to total hip replacement in 404 patients (8.31% [95CI 7.5% – 9.1%]) with a mean conversion time of 70.11 months. This lower conversion rate, when analysing PAO papers, was in spite of them having longer mean follow-up compared with the hip arthroscopy papers of 89.29 ns 46.23 months respectively.

Certain features were associated with increased conversion to THA, including; increasing age, advanced arthritis and a reduced joint space of less than 2mm. It would therefore appear that careful patient selection based on these criteria is critical to successful outcomes.

This is the largest review study of its kind, looking at joint preservation in hip preservation surgery and the authors feel this demonstrates the efficacy of such surgery, with mean conversion rates of less than 10% for hip arthroscopy and periacetabular osteotomy and highlights that they are feasible surgical management options in young patients with femoroacetabular impingement or hip dysplasia.
PL5.5 Acetabular retroversion has increased prevalence in patients presenting with slipped upper femoral epiphysis: A significant risk factor?

Mr Pranai Buddhdev¹, Mr Jitendra Balakumar², Mr David Slattery²
¹NHS, Bushey, United Kingdom, ²Royal Children's Hospital, Melbourne, Australia

PL5 - Trainee Competition Presentations, Auditorium (Plenary), Ground Level, October 19, 2019, 08:00 - 09:05

Biography
Pranai Buddhdev is a paediatric orthopaedic and young adult hip surgeon in the UK. He completed fellowships at The Royal National Orthopaedic Hospital, Stanmore, UK & Royal Children's Hospital, Melbourne. He was awarded the ISHA Travelling Fellowship in 2019, visiting centres in the UK, Switzerland and USA.

Introduction
SUFE has well documented biochemical and mechanical risk factors, however the structure remains to be equally important with femoral retroversion documented as an association. Acetabular retroversion has a low prevalence in asymptomatic adults, however pathological hips with dysplasia, osteoarthritis and Perthes' have higher rates ranging from 18-48%.

Aim
To assess the prevalence of acetabular retroversion in patients presenting with Slipped Upper Femoral Epiphysis using both validated radiological signs and CT-angle measurements.

Methods & Results
A retrospective review of all cases involving surgical management for acute SUFE presenting to the Royal Children's Hospital, Melbourne were assessed from 2012-2018. Pre-operative plain radiographs were assessed for slip angle, validated radiological signs of retroversion (post wall/crossover/ischial spine sign) and standardised post-operative CT Scans were used to assess cranial and mid-acetabular version. 116 SUFEs presented in 107 patients who underwent surgical intervention; 47 females and 60 boys, with an average age of 12.7 years (range 7.5-16.6 years). Complete radiological data was available for 91 patients (99 hips) with adequate axial CT imaging of both hips. 82% patients underwent pinning in situ (PIS) with sub capital realignment surgery (SRS) performed in 18% (slip angles >75°). Contralateral prophylactic hip PIS was performed in 72 patients (87%). On the slip side, 68% of patients had 1 or more radiological signs of retroversion in the slipped hip, with 60% on the contralateral side. The mean cranial and mid-acetabular version measurements were -8° (range -30 - 8°) and 10.5° (range -10 - 25°), respectively.

Conclusion
Acetabular retroversion is rare in the normal population with studies reports ranging from 0-7%. This study showed an increased prevalence of 68% in SUFE patients, which is likely to be a primary anatomical abnormality, subsequently increasing the shear forces across the proximal femoral growth plate due to superior over-coverage. The resulting CAM lesion from SUFE in combination with the pincer lesion due to retroversion can lead to premature hip impingement and degeneration. Further larger studies are required to assess if acetabular retroversion is a true risk factor, and its role in helping guide management including prophylactic pinning.
PL5.6 Sharp ledge adjoining the articular cartilage following femoral osteochondroplasty does not create instability in the hip joint

Dr Lionel E. Lazaro1, Dr Daniel P. Lim2, Trevor J. Nelson3, Sam A. Eberlein3, Dr Michael B. Banffy2, Dr Melodie F. Metzger3

1Miami Orthopaedic and Sports Medicine Institute, Baptist Health South Florida, Miami, United States, 2Kerlan-Jobe Orthopaedic Clinic, Los Angeles, United States, 3Cedar Sinai, Los Angeles, United States

Introduction
Current teaching dictates that a femoral osteochondroplasty should create a smooth graded contour of the femoral neck. Leaving a sharp ledge at the margin of the articular cartilage is thought to compromise suction seal of the hip, increasing the likelihood of post-operative instability. The purpose of this study was to biomechanically test this assumption by quantifying the amount of rotation and distraction observed after a sharp ledge is created during femoral osteochondroplasty.

Methods
Six hemi-pelvises were repeatedly tested in the following four conditions: (a) intact, (b) T-capsulotomy, (c) 5mm Osteochondroplasty to the physical scar leaving a sharp ledge, followed by (d) 5mm deepening of the Osteochondroplasty. The pelvis was secured to a metal plate and the femur was potted and attached to a multi-axial hip jig. Specimens were axially distracted to 150N, and internally and externally torqued to 5Nm at 0 o, 15 o, 30 o, 60 o, 90o of flexion while the resultant displacement/rotation was recorded using a 3D motion tracking system. Repeated measures ANOVA was used with significance set at p<0.05.

Results
T-capsulotomy alone increased internal and external rotation and axial displacement of the femur at all angles of flexion, p<0.05. Subsequent resection of the femoral head to the physis scar left with a sharp ledge at the head and neck junction did not result in any further increase in rotation or distraction, even when the depth of resection was increasing another 5mm.

Conclusion
Creating a smooth, graded contour of the femoral neck during osteochondroplasty recreates a more natural femoral offset for a better radiographic outcome. However, our results suggest that leaving a sharp ledge does not compromise the distractive or rotational stability of the hip joint.
PHP.A.1.2 - Subjective scores and objective measures

Dr Nobuyuki Watanabe¹

¹Tosei General Hospital, Seto, Japan

To evaluate postoperative outcome properly, applying patient-reported outcome measures (PROMs= Objective Measures) rather than clinician-reported outcome (ClinRO= Subjective Scores) is important.

Intentionally or unintentionally, the outcome can be biased and unreliable if only ClinROs are chosen as assessment batteries. The importance of PROMs has been increasing, and nowadays, at least two different PROMs are required to describe an accurate outcome in a study.

Several international PROMs (For example, Non-Arthritis Hip Score, Hip Outcome Score, HAGOS, and so on) have published to evaluate an active patient who has undergone a hip preservation surgery because of labrum tear, Femoroacetabular Impingement syndrome (FAIs), or Borderline Developmental Dysplasia of Hip (BDDH). However, in Japan, our country, there were almost no PROMs to evaluate such patients. To adapt PROMs written in different languages, validation is a mandatory process in addition to translation. Their reproducibility, validity, and reliability should be examined to establish a Japanese version of PROMs using a strict methodology (e.g.: COSMIN checklists).

We developed two Japanese version of international PROMs: the Vail Hip Score (Vail10J) and the International Hip Outcome Terms (iHOT12J). We would like to review the process of these cross-cultural methods and introduce the current concept of PROMs.
PHP.A.1.3 Radiological assessment

Dr Seigo Oshima
Matsuyama Red Cross Hospital, Matsuyam, Japan

PHP.A.1 - Diagnosis of the Painful Hip, Escudo, Ground Level, October 16, 2019, 08:30 - 10:30

The chief complaint, physical findings, and diagnostic imaging are indispensable for diagnosing patients with hip pain and deciding treatment strategies. Regarding diagnostic imaging, in routine medical practice, we first evaluate the overall bone morphology by roentgenography and consider the diagnosis in conjunction with physical findings. In addition, when a soft tissue or intraosseous lesion is suspected, MRI is performed and evaluated. In addition to abnormal bone morphology, hip pain may be caused by soft tissue and intra-articular lesions. Thus, it is recommended that MRI is performed unless the hip pain is thought to be caused by obvious acetabular dysplasia. The use of high-resolution MRI is important for the examination of patients with hip joint diseases. It is also essential to obtain a fat-suppressed image for the diagnosis of soft tissue disease. We have obtained T1-weighted images, T2-weighted images, and fat-suppressed images in coronal and horizontal planes to evaluate intra-osseous lesions and the entire soft tissue around the pelvis and bilateral hip joints. When intra-articular lesions such as hip labral tear are suspected, it is difficult to grasp the details from the images of the bilateral hip joints; thus, only the affected side must be imaged. In addition to imaging of the bilateral hip joints, as described above, we have also obtained T2*-weighted images oblique axial, oblique coronal, radial and axial to the acetabulum on the affected side alone for the diagnosis of hip labral tear. When diagnosing a patient based on MRI, it is important to understand the precise anatomy, such as the run of each muscle, ligaments, and attachment sites, as well as to understand anatomical variants of the cartilage and labrum, in order to prevent an incorrect diagnosis. In this presentation, we will give an overview of diagnostic imaging for the diagnosis of pathologies causing hip pain, and to explain MRI imaging methods and the interpretation of findings in relation to diseases that cause hip pain that should be diagnosed by MRI.
The pathology: Femoroacetabular impingement syndrome

Dr Shingo Hashimoto

Kobe University Graduate School of Medicine, Kobe, Japan

PHP.A.1 - Diagnosis of the Painful Hip, Escudo, Ground Level, October 16, 2019, 08:30 - 10:30

Femoroacetabular impingement (FAI) has been reported as a cause of hip pain in young adults and is apparently associated with a distinct set of anatomical morphologies resulting in localized damage to the hip joint. Either cam and pincer impingement induce chronic and repeated mechanical injury of articular cartilage and labrum and has been thought to induce matrix damage and an inflammatory response. In addition, FAI has been reported as the cause of joint degeneration and osteoarthritis (OA) progression with some cohort studies. Thus, the detail pathology of FAI has been important for understanding the treatment target for hip pain, and the prevention against OA progression in future.

In the basic research, cartilage samples from femoral head neck junction were analysed with gene expression of inflammatory cytokine, chemokine, anabolic and catabolic matrix enzymes. From this study, articular cartilage from the impingement zone of hips with FAI was metabolically hyperactive, supporting the concept that such impingement is a structural precursor to hip OA. Other study with cartilage, labrum and synovium samples demonstrated that articular cartilage of FAI showed higher inflammation than synovium and labrum. And in FAI cartilage, metabolic changes were heightened by mechanical impingement from the result which higher gene expression of matrix enzyme in the cases with larger alpha angles (≥60°). This study also supports the concept that FAI may be a trigger for joint degeneration, especially in large cam type FAI. From these findings, intra-articular pathology of FAI syndrome can be determined as pre-arthritic hip, which cannot be diagnosed with regular imaging examination. Thus, surgical treatment for FAI lesion would have a benefit for intra-articular inflammation and degeneration process. In this session, I like to present the pathology of FAI syndrome and discuss the future prospective of treatment concept.
PHP.A.2.1 Hip arthroscopy surgical set-up: Position, portals

Dr Hao-Che Tang

Abstract

Hip arthroscopy can be performed on patients positioned in either the lateral decubitus or the supine position. There is no significant difference in clinical outcomes and complication rates between these two positions. A well-padded wide perineal post with a diameter of at least 9 cm should be used to ensure adequate lateralization and force distribution. A traction test before draping is highly recommended. Distraction of the hip joint with an 8-10 mm gap is considered to be safe for the central compartment assessment.

Appropriate placement of portals to both central and peripheral compartments of the hip is the key to successful hip arthroscopy. The proximal anterolateral portal is the first portal to be established under fluoroscopic control in peripheral compartment first technique. The anterior portal and anterolateral portal were placed in order under arthroscopic control. In central compartment first technique, the anterolateral portal is established first under fluoroscopic control, and followed by the placement of anterior portal under arthroscopic control. Other portals, such as distal anterolateral portal and posterolateral portals, can be established under arthroscopic control if necessary.

The anterior portal is close to lateral femoral cutaneous nerve, with a distance about 10-15 mm. Because the nerve is vulnerable to laceration as making the stab wound, it is recommended to cut the skin only and avoid getting into the deeper subcutaneous tissue. In the placement of posterolateral portal, it is important to assure the cannula does not stray posteriorly, which carries a risk of injury to the sciatic nerve.
Femoroacetabular impingement (FAI) is a common cause of hip pain and has been correlated with acetabular labral tears and also recognized as a significant contributing factor in the aetiology of osteoarthritis affecting the hip joint. The goal of surgical treatment is to achieve relief of pain, improved function and range of motion, and avoid further progression of osteoarthritis. The current surgical management including hip arthroscopy, surgical dislocation and mini-open anterior approach. They all have diffident advantages and disadvantages. For the mini-anterior approach surgery, the patients were prepared with supine position on a regular operating table. Around 4-cm incision was made from 1 cm lateral and distal to anterior superior iliac spine. Dissect and incise the tensors fascia lata and the interval between the Sartorius and tensor muscle. Retract the underneath rectus femoris medially and use a Cobb elevator to strip the pericapsular fat to expose the anterior hip joint capsule. Ligate the ascending branches of the lateral femoral circumflex artery if it is exposed during dissection. Perform the capsulotomy with an I-shaped incision along the axis of the femoral neck and then exposure the femoral neck and head-acetabular junction. Mobilize the acetabular labrum for full exposure of the bony acetabular ridge and follow by acetabular osteoplasty for pincer type FAI. Manual traction allows adequate subluxation of the hip and visualization of the central compartment of the hip. Then the femoral head-neck junction is exposed for evaluation of cam type FAI and the osteochondroplasty of the femoral neck is performed by the osteotome and pneumatic bur. Reattach the labrum with anchored sutures. Range of motion is finally checked before closing the capsule and the wound.
Surgical hip dislocation (SDH) is a technically demanding procedure which was developed in 2000, under the direction of Reinhold Ganz, M.D. The SDH technique can be addressed for many young patients with complex hip conditions, such as femoroacetabular impingement, deformity of Legg-Calve-Perthes disease, slipped capital femoral epiphysis, periarticular trauma and osteochondral lesions.

The surgical hip dislocation allows anterior dislocation of the femoral head for direct visualization of the hip joint while preserving femoral head vascularity and minimizing trauma to the abductor musculature.

The blood supply to the femoral head is mainly from the deep branch of the medial femoral circumflex artery (MFCA). During dislocation of the hip, this vessel is protected by the intact obturator externus muscle. Therefore, the integrity of the external rotator muscles should be respected during the whole procedure.

The trochanteric osteotomy should be performed with one fingerbreadth anterior to the posterior tip of the greater trochanter leaving some of the gluteus medius tendon on the stable trochanter. And the osteotomized fragment is approximately 15 cm in width. A step osteotomy, using osteotomes is recommended in adolescents and/or obese children as this results in more stable reattachment of the greater trochanter.

A Z-shaped capsulotomy should be performed to expose the hip joint. First, a longitudinal incision is made towards the acetabulum. Care must be taken not to cut into the labrum. The second cut runs along the distal anterior insertion of the capsule around the calcar. The third cut runs parallel to the edge of the acetabulum in a posterior direction. Femoral head can be dislocated or subluxated after capsulotomy. Giving a view of the femoral head and acetabulum of full 360° view.

In the end, the capsule is closed under minimal tension to avoid injury to the retinacular vessels and the trochanteric fragment is fixed with two or three 3.5- or 4.5-mm cortical screws.

In conclusion, by following the key points mentioned above, SHD is a safe and effective technique when dealing with complex hip conditions while arthroscopy cannot be addressed.
Hip stability not only comes from the bony articulation of the acetabular and femoral head but also from the surrounding soft tissues notably the capsuloligamentous tissue that reinforce 60% of the hip joint capsule, and the labrum, which provide static and also dynamic stability. Disproportionate amount of movement of the femoral head can occur from lack of bony articulation and/or from laxity of the soft tissues that can lead to intra-articular damage and pain resulting in the diagnosis of hip instability.

Undiagnosed atraumatic instability and the lack of recognition of this entity when performing arthroscopic hip surgery has led to reports of poor results and in some cases dramatic complications. As a result, atraumatic instability of the hip has become increasingly recognized as a significant cause of functional impairment. Arthroscopic treatment of this entity has been a challenge in part because of the difficulty in diagnosis and lack of an objective means of measurement and also because of the invasive nature of arthroscopic hip surgery in which a large proportion of the hip joint capsule may be incised and injured. I would like to pre-set the improvements and innovations the arthroscopic hip society have made to realize and tackle this entity and as result also have improved surgical results of hip arthroscopy surgery as a whole.
Rational indications for either conservative or surgical treatment of the painful non-arthritic hip present significant challenges. As we consider the numerous variables both subjective and objective that impact treatment decision-making it becomes obvious why we see such variation in care recommendations even among those skilled in the art.

The upper limit of the number of treatment variables the human mind can productively hold, and process is limited. A decision-making strategy must include a disciplined review of the pertinent variables so that a small collection of those that weigh most heavily may guide or indicate the best treatment plan. We will make a case for the importance of a care teams to enhance decision-making in place of the solo physician/surgeon directing care.

The subjective and objective variables will be briefly discussed as to their impact on conservative and surgical treatment indications.
The relationship between micro instability and outcomes in hip preservation surgery has received much interest recently, prompting investigations of osseous anatomy and pathologies of the labrum, ligamentum teres, and capsule. Notably, dysplastic hips and improper capsular management are correlated with inferior patient reported outcomes and higher revision rates. While the link between hip stabilizers and self-reported function after arthroscopy is becoming clearer, micro instability remains a diagnosis which is difficult to make particularly in light of the difficult of quantifying laxity. No definitive hip-specific criteria exist.

This talk reviews the diagnosis of hip micro instability and the thresholds of dysplasia, the known consequences for outcomes, and techniques for arthroscopic management with focus on borderline dysplastic and capsular factors. Imaging modalities and clinical tests critical to the diagnosis of micro instability are reviewed. Decision-making algorithms for capsular management are discussed, along with technique tips presented alongside real-time demonstrations of capsulotomies, closures, and plications. Our aim is to provide practical nuggets for current hip arthroscopists in recognizing and addressing micro instability.
There is currently limited high-quality evidence on return to sport (RTS) after hip FAIS. Casartelli et al (2015; SR) found that on average 87% of the athletes with symptomatic FAI returned to sport after hip surgery, while 82% of them could return to the same level of sport as before the occurrence of symptoms. The level of competition, the time of evaluation after hip surgery, and the amount of cartilage lesions at the time of hip surgery may all influence the RTS. In addition, the rate of RTS was not always positively associated with the actual satisfaction and sport ability of athletes. Reiman et al (2018; SR) reported that based on evidence of limited to moderate strength (level 3b to 4 studies), athletes return to sport at preinjury level post-surgery for FAI syndrome at a rate of only 74%. Further, only 14% of studies reported on athletic pre-surgery and post-surgery athletic performance, and no studies reported on the specific criteria used to permit players to RTS. Ishoi et al (2018; cross-sectional study of 189 athletes, all levels), found that 57% of athletes returned to preinjury sport at their preinjury level (a stricter definition of return to sport was used, comparing to most studies in the literature). One-third of athletes who returned to preinjury sport at preinjury level reported their sports performance to be optimal, and athletes who were playing preinjury sport at preinjury level had better self-reported hip and groin function. In general: considering all case series published so far, elite and professional athletes have higher RTS rates than amateur/recreational athletes.

There’s a lack of evidence based RTS protocols, criteria and of outcome measures in athletes after FAIS. Both PROMs (i.e. HAGOS, HOS) and performance-based (i.e. strength, sport-specific tests) outcomes are relevant. Literature on rehabilitation and RTS following FAIS is mostly limited to clinical commentaries and case series. Some detailed RTS protocols have been published in case reports (i.e. professional ice hockey and American football).

Future research should focus on a standardized approach to defining, measuring and reporting RTS outcomes, and identifying valuable prognostic factors for RTS.
The dysplastic and hypermobile hip population presents numerous challenges in rehabilitation. In addition to concerns related to bony and capsuloligamentous changes, strength, coordination, and pain impairments can affect a patient’s functional performance. A structured approach to evaluation of the musculoskeletal system and task performance is crucial to developing a comprehensive rehabilitation program. Intervention should include exercise to optimize strength of the pelvic girdle, neuromuscular efficiency, endurance, and patient education to optimize clinical outcomes.
PHP.PT.3.4 Pre-operative physiotherapy

Mrs Louise Grant 1
Physiocure Physiotherapy Clinic, Leeds, United Kingdom

PHP.PT.3 - Hip Instability, Comendador, Ground Level, October 16, 2019, 11:30 - 13:15

Biography
Louise qualified as a Chartered Physiotherapist in 1992 and has worked in the UK within the NHS, private practice and additionally with the England Sport Jujitsu Squad. Since the year 2000, Lou has worked predominantly with hip patients at her private practice in Northern England with her business partner Anna Higo and their multi-disciplinary team. The team see hip patients from all over the UK, helping in preparing for surgery, with post-operative rehabilitation and also with non-operative management for a variety of hip conditions. Louise undertook a Postgraduate Certificate in Health Research at Leeds University and a Master’s Degree in Musculoskeletal Medicine.

She has had her research published in the ‘Journal of Hip Preservation Surgery’ in January 2017 and has presented as Faculty over the last 8 years at numerous hip preservation seminars and conferences internationally and in the UK. She additionally has a special interest in Hypermobile Ehlers Danlos (hEDS) Syndrome.

This talk will provide an overview of Pre-operative Physiotherapy in FAIS and hip arthroscopy with key points and include clinical case studies.

This session will include the clinical presentation of hip and pelvis problems (functional and structural) in people with Hypermobile Ehlers Danlos (hEDS).

I will provide an overview, key points to consider in hip/pelvic assessment and include clinical cases.
PHP.PT.3.5  Is there a connection between pelvic floor dysfunction and FAI?

Yael Mass-Steinfeld

Maagalim Health, Kadima, Israel

Introduction
Pain in the hip and pelvis region is a common complaint among the young population. The hip joint is often the source of pain, with FAIS being a common cause. However, considering the anatomy of the acetabular labrum in relation to the pelvic floor structures, there is undeniable a connection. Therefore, a complete consideration of all the potential causes of the patient’s symptoms will allow the most effective treatment. The purpose of this lecture is to present a review of the literature regarding the connection between pelvic floor dysfunction and FAIS and to enhance the awareness regarding the possible connection.

Summary
There are many different causes for hip pain including intra-articular, extra-articular structures, radiating pain from the back, SIJ and soft tissues such as the Obturator internus and Levator Ani muscles. Apart from the musculoskeletal conditions mentioned, there may be other differential diagnosis for hip pain, including gynaecologic, urologic, gastrointestinal and/or neurological conditions (such as Pudendal neuralgia and other nerve entrapments).

The pelvic floor muscles assist in maintaining upright posture, supporting abdominal and pelvic organs, and help to control bladder, bowel and sexual activity. Pelvic floor dysfunction (PFD) refers to a wide range of problems that occur when the muscles of the pelvic floor are not functioning normally and are often too tight, and/or too weak. Due to the complexity of the anatomy and multiple functions of the pelvic and hip region, the underlying cause of pain is difficult to determine, and the entire body must be treated holistically to resolve symptoms.

Conclusion
It is important to recognize pelvic floor dysfunction as a potential cause for FAIS and vice versa. In addition, further high-quality studies are needed in order to strengthen our understanding of this connection.
<table>
<thead>
<tr>
<th>Name</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bizzini, Mario</td>
<td>PHP.PT.1.5</td>
</tr>
<tr>
<td>Carreira, Dominic</td>
<td>PHP.E.3.1</td>
</tr>
<tr>
<td>Enseki, Keelan</td>
<td>PHP.PT.2.2</td>
</tr>
<tr>
<td>Grant, Louise</td>
<td>PHP.PT.3.4</td>
</tr>
<tr>
<td>Hashimoto, Shingo</td>
<td>PHP.A.1.4</td>
</tr>
<tr>
<td>Oshima, Seigo</td>
<td>PHP.A.1.3</td>
</tr>
<tr>
<td>Shibata, Kotaro</td>
<td>PHP.A.3.1</td>
</tr>
<tr>
<td>Tang, Hao-Che</td>
<td>PHP.A.2.1</td>
</tr>
<tr>
<td>Wang, Sheng-Hao</td>
<td>PHP.A.2.5</td>
</tr>
<tr>
<td>Watanabe, Nobuyuki</td>
<td>PHP.A.1.2</td>
</tr>
<tr>
<td>Hsieh, Shang-Lin</td>
<td>PHP.A.2.6</td>
</tr>
<tr>
<td>Mass-Steinfield, Yael</td>
<td>PHP.PT.3.5</td>
</tr>
<tr>
<td>West, Hugh</td>
<td>PHP.E.1.7</td>
</tr>
<tr>
<td>Name</td>
<td>Affiliation</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Abd El-Radi, Mohammed</td>
<td></td>
</tr>
<tr>
<td>Atsushi Kasuya, Victor</td>
<td></td>
</tr>
<tr>
<td>Brugiatti, Miguel</td>
<td></td>
</tr>
<tr>
<td>Abarra, Selim</td>
<td></td>
</tr>
<tr>
<td>Abdud, Nurhan</td>
<td></td>
</tr>
<tr>
<td>Abd El-Radi, Mohamed</td>
<td></td>
</tr>
<tr>
<td>Abdel Hamid, Mohamed</td>
<td></td>
</tr>
<tr>
<td>Abdelazeem, Ahmed</td>
<td></td>
</tr>
<tr>
<td>Abdelkader, Khaled</td>
<td></td>
</tr>
<tr>
<td>Abdelkarim, Mahmoud</td>
<td></td>
</tr>
<tr>
<td>Abe, Hiroo</td>
<td></td>
</tr>
<tr>
<td>Abu-Amer, Wahid</td>
<td></td>
</tr>
<tr>
<td>Ackert-Bicknell, Cheryl</td>
<td></td>
</tr>
<tr>
<td>Acuña, Alexander</td>
<td></td>
</tr>
<tr>
<td>Adeyemi, Temitope</td>
<td></td>
</tr>
<tr>
<td>Adib, Farshad</td>
<td></td>
</tr>
<tr>
<td>Adler, Kelly</td>
<td></td>
</tr>
<tr>
<td>Aframian, Arash</td>
<td></td>
</tr>
<tr>
<td>Agatstein, Lauren</td>
<td></td>
</tr>
<tr>
<td>Agricola, Rintje</td>
<td></td>
</tr>
<tr>
<td>Aguilera-Bohórquez, Bernardo</td>
<td></td>
</tr>
<tr>
<td>Ahldén, Mattias</td>
<td></td>
</tr>
<tr>
<td>Aisbett, Brad</td>
<td></td>
</tr>
<tr>
<td>Aizpurua, Beatriz</td>
<td></td>
</tr>
<tr>
<td>Akhtiamov, Ildar</td>
<td></td>
</tr>
<tr>
<td>Akita, Keiichi</td>
<td></td>
</tr>
<tr>
<td>Larson, Christopher</td>
<td></td>
</tr>
<tr>
<td>Utsunomiya, Hajime</td>
<td></td>
</tr>
<tr>
<td>Amar, Eyal</td>
<td></td>
</tr>
<tr>
<td>Aminova, Leisan</td>
<td></td>
</tr>
<tr>
<td>ANCHOR Group,</td>
<td></td>
</tr>
<tr>
<td>ANCHOR GROUP, Andrade, Antonio</td>
<td></td>
</tr>
<tr>
<td>Andrade, Tony</td>
<td></td>
</tr>
<tr>
<td>Andricchi, Thomas</td>
<td></td>
</tr>
<tr>
<td>Andronic, Octavian</td>
<td></td>
</tr>
<tr>
<td>Ankori, Ran</td>
<td></td>
</tr>
<tr>
<td>Anthony, Christopher</td>
<td></td>
</tr>
<tr>
<td>Anthony</td>
<td></td>
</tr>
<tr>
<td>Aoki, Daniel</td>
<td></td>
</tr>
<tr>
<td>Araujo, Daniel</td>
<td></td>
</tr>
<tr>
<td>Arriaza, Carlos R.</td>
<td></td>
</tr>
<tr>
<td>ARRIAZA-GUTIERREZ, CARLOS RODRIGO</td>
<td></td>
</tr>
<tr>
<td>Arsoy, Lyall</td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>EP/PL Numbers</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Al Mana, Latifah</td>
<td>EP11.1</td>
</tr>
<tr>
<td>ALFONSO FERNANDEZ, ANA</td>
<td>EP17.53</td>
</tr>
<tr>
<td>ALFONSO-</td>
<td></td>
</tr>
<tr>
<td>FERNANDEZ, ANA</td>
<td></td>
</tr>
<tr>
<td>Ali, Mohammed</td>
<td>PL5.4</td>
</tr>
<tr>
<td>Al'Khafaji, Ian</td>
<td>S15.5</td>
</tr>
<tr>
<td>Alpoim, Francisco</td>
<td>EP6.5</td>
</tr>
<tr>
<td>Alter, Thomas</td>
<td>EP19.2</td>
</tr>
<tr>
<td>Alves, Victor</td>
<td>EP5.17</td>
</tr>
<tr>
<td>Amar, Eyal</td>
<td>EP17.3</td>
</tr>
<tr>
<td>Atzmon, Ran</td>
<td>EP17.3</td>
</tr>
<tr>
<td>Atzmon, Ran</td>
<td>EP19.11</td>
</tr>
<tr>
<td>Atzmon, Ran</td>
<td>EP17.3</td>
</tr>
<tr>
<td>Atzmon, Ran</td>
<td>EP19.11</td>
</tr>
<tr>
<td>Axibal, Derek</td>
<td>EP1.2</td>
</tr>
<tr>
<td>Ayeni, Olufemi</td>
<td>EP11.1, EP13.2,</td>
</tr>
<tr>
<td></td>
<td>V7.5, S2.8, PL2.6</td>
</tr>
<tr>
<td>Ayeni, Olufemi R.</td>
<td>EP13.23</td>
</tr>
<tr>
<td>Azofra, Juan</td>
<td>EP6.3, S5.8</td>
</tr>
<tr>
<td>Bacon, Catherine J</td>
<td>EP13.9</td>
</tr>
<tr>
<td>Bailowitz, Zachary</td>
<td>EP10.13</td>
</tr>
<tr>
<td>Bajwa, Ali</td>
<td>EP13.4, S7.7</td>
</tr>
<tr>
<td>Balakumar, Jitendra</td>
<td>PL5.5</td>
</tr>
<tr>
<td>Baldini, Todd</td>
<td>EP1.27, EP1.3</td>
</tr>
<tr>
<td>Bali, Kamal</td>
<td>S1.5</td>
</tr>
<tr>
<td>Banffy, Michael</td>
<td>EP13.25, EP17.41</td>
</tr>
<tr>
<td>Banffy, Michael B.</td>
<td>EP13.20, PL5.6</td>
</tr>
<tr>
<td>Bankes, Marcus</td>
<td>S7.5</td>
</tr>
<tr>
<td>Baranto, Adad</td>
<td>EP13.23</td>
</tr>
<tr>
<td>Barbosa, Tiago</td>
<td>EP2.2</td>
</tr>
<tr>
<td>Barkay, Gal</td>
<td>EP17.14</td>
</tr>
<tr>
<td>Baron, Jacqueline E.</td>
<td>EP17.5</td>
</tr>
<tr>
<td>Baron, Samuel</td>
<td>EP10.7, EP16.1,</td>
</tr>
<tr>
<td></td>
<td>S14.5</td>
</tr>
<tr>
<td>Baroni Carvalho, Rafael</td>
<td>EP11.20, EP15.21,</td>
</tr>
<tr>
<td></td>
<td>EP17.6, EP6.1,</td>
</tr>
<tr>
<td></td>
<td>EP6.8, EP6.9</td>
</tr>
<tr>
<td>Barrett, Joshua</td>
<td>EP16.5</td>
</tr>
<tr>
<td>Barter, Lindsay</td>
<td>EP13.5, EP17.25,</td>
</tr>
<tr>
<td></td>
<td>S16.7</td>
</tr>
<tr>
<td>Bartlett, Jonathan</td>
<td>EP16.2, EP17.42,</td>
</tr>
<tr>
<td></td>
<td>S16.6</td>
</tr>
<tr>
<td>Bierma-Zeinstr, Sita</td>
<td>PL5.2</td>
</tr>
<tr>
<td>Bilbao, Ane Miren</td>
<td>EP6.3, S5.8</td>
</tr>
<tr>
<td>Bixby, Elise</td>
<td>EP16.11</td>
</tr>
<tr>
<td>Black, Marianne</td>
<td>EP10.11</td>
</tr>
<tr>
<td>Blackwell, Ryan</td>
<td>EP16.18</td>
</tr>
<tr>
<td>Bloom, Shlomo</td>
<td>S16.5</td>
</tr>
<tr>
<td>Bolia, Ioanna</td>
<td>EP10.5, EP10.6,</td>
</tr>
<tr>
<td></td>
<td>EP12.4, EP13.10,</td>
</tr>
<tr>
<td></td>
<td>EP13.11, S9.6</td>
</tr>
<tr>
<td>Bonin, Nicolas</td>
<td>PL5.3</td>
</tr>
<tr>
<td>Bordner, Haley</td>
<td>S14.6</td>
</tr>
<tr>
<td>Boutris, Nickolas</td>
<td>EP13.5</td>
</tr>
<tr>
<td>Boykin, Robert</td>
<td>S16.8</td>
</tr>
<tr>
<td>Brady, Alex</td>
<td>EP11.17, EP11.18,</td>
</tr>
<tr>
<td></td>
<td>EP11.19, S7.6</td>
</tr>
<tr>
<td>Brandão, Pedro Henrique</td>
<td>EP5.17</td>
</tr>
<tr>
<td>Brassett, Cecilia</td>
<td>EP17.42</td>
</tr>
<tr>
<td>Bretschneider, Katharina</td>
<td>S15.8</td>
</tr>
<tr>
<td>Bretz Gomes dos Santos,</td>
<td>EP6.9</td>
</tr>
<tr>
<td>Fernanda</td>
<td></td>
</tr>
<tr>
<td>Brick, Claudia R</td>
<td>EP13.9</td>
</tr>
<tr>
<td>Name</td>
<td>Pages</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Battaglia, Muriel</td>
<td>EP17.15, S3.6</td>
</tr>
<tr>
<td>Baumhauer, Judith</td>
<td>EP19.10</td>
</tr>
<tr>
<td>Beaulé, Paul</td>
<td>EP11.2, S1.6</td>
</tr>
<tr>
<td>Bedard, Nicolas</td>
<td>S13.8</td>
</tr>
<tr>
<td>Bedi, Asheesh</td>
<td>EP10.3</td>
</tr>
<tr>
<td>Begly, J.P.</td>
<td></td>
</tr>
<tr>
<td>Beling Gonçalves</td>
<td>EP6.1</td>
</tr>
<tr>
<td>Soares, Cláudio</td>
<td></td>
</tr>
<tr>
<td>Belzile, Etienne</td>
<td>EP13.3</td>
</tr>
<tr>
<td>Belzile, Etienne</td>
<td>S1.5</td>
</tr>
<tr>
<td>Bhatia, Sanjeev</td>
<td>EP17.51</td>
</tr>
<tr>
<td>Calabrese, James</td>
<td>EP16.15</td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Cabello, Joan</td>
<td>EP4.5</td>
</tr>
<tr>
<td>Cakic, Josip</td>
<td>EP12.16, EP4.6, S12.6</td>
</tr>
<tr>
<td>Name</td>
<td>Page(s)</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Campos-Dorador, Salvador</td>
<td>S6.5</td>
</tr>
<tr>
<td>Cancienne, Jourdan M.</td>
<td>EP8.4</td>
</tr>
<tr>
<td>Cancienne, Jourdan</td>
<td></td>
</tr>
<tr>
<td>Cannamela, Peter</td>
<td>EP17.36</td>
</tr>
<tr>
<td>Cantor, Erika</td>
<td>EP12.5</td>
</tr>
<tr>
<td>Carrera, Anna</td>
<td>S12.7</td>
</tr>
<tr>
<td>Carto-Ñate, Ana</td>
<td>EP17.11</td>
</tr>
<tr>
<td>Name</td>
<td>Pages</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Cates, William</td>
<td>EP17.29</td>
</tr>
<tr>
<td>Cavalcante, Alessandro</td>
<td>EP6.6</td>
</tr>
<tr>
<td>Chacón, Gabriel</td>
<td>EP1.16, S4.7</td>
</tr>
<tr>
<td>Chaharbakshhi, Edwin</td>
<td>EP15.3, EP17.14,</td>
</tr>
<tr>
<td>Chahla, Jorge</td>
<td>EP17.15, EP4.2</td>
</tr>
<tr>
<td>Chahla, Jorge</td>
<td>EP1.43, EP7.1</td>
</tr>
<tr>
<td>Chaloumas, Dimitris</td>
<td>EP12.3, EP13.28,</td>
</tr>
<tr>
<td>Chan, Denise</td>
<td>EP17.48</td>
</tr>
<tr>
<td>Chana, Rishi</td>
<td>S15.6</td>
</tr>
<tr>
<td>Chapman, Reagan</td>
<td>EP16.3, EP19.6,</td>
</tr>
<tr>
<td></td>
<td>S14.7</td>
</tr>
<tr>
<td>Charles, Tatiana</td>
<td>EP5.4</td>
</tr>
<tr>
<td>Çepni, Şahin</td>
<td>EP17.42</td>
</tr>
<tr>
<td>da Glória Soares , Ana Rita</td>
<td>EP17.48</td>
</tr>
<tr>
<td>de Carvalho Guedes, Euler</td>
<td>EP11.20</td>
</tr>
<tr>
<td>D</td>
<td>EP17.57</td>
</tr>
<tr>
<td>Da Ponte Prieto, Ariadna</td>
<td>EP17.57</td>
</tr>
<tr>
<td>Dabeld, David</td>
<td>EP7.3</td>
</tr>
<tr>
<td>Darden, Christon</td>
<td>S14.8</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Pages</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>DeFroda, Steven</td>
<td>EP17.61</td>
</tr>
<tr>
<td>Delgado, Domenica</td>
<td>S16.7</td>
</tr>
<tr>
<td>Della Rocca, Federico</td>
<td>EP15.10, EP17.36</td>
</tr>
<tr>
<td>Depuydt, Cedric</td>
<td>EP15.16</td>
</tr>
<tr>
<td>Desai, Veeral</td>
<td>EP11.1</td>
</tr>
<tr>
<td>Dezontini</td>
<td>EP6.9</td>
</tr>
<tr>
<td>Bernades, Karen</td>
<td>EP15.10</td>
</tr>
<tr>
<td>Di Francia, Vincenzo Paolo</td>
<td></td>
</tr>
<tr>
<td>Di Stasi, Stephanie</td>
<td>EP16.19, S14.6</td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>Eberlein, Samuel</td>
<td>EP17.41</td>
</tr>
<tr>
<td>Economopoulos, Kostas</td>
<td>S5.6</td>
</tr>
<tr>
<td>Edelstein, Adam</td>
<td>S1.8</td>
</tr>
<tr>
<td>Eizenberg, Gilad</td>
<td>EP16.6</td>
</tr>
<tr>
<td>Ejnisman, Benno</td>
<td>EP10.4</td>
</tr>
<tr>
<td>El Daou, Hadi</td>
<td>S7.5</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Elhakeem, Osama</td>
<td>EP10.16</td>
</tr>
<tr>
<td>El-Hakeem, Osama</td>
<td>EP10.19</td>
</tr>
<tr>
<td>Elias, Luis Felipe</td>
<td>EP6.6</td>
</tr>
<tr>
<td>Elisman, Katerina</td>
<td>EP5.5</td>
</tr>
<tr>
<td>El-Sayed, Osama</td>
<td>EP10.19</td>
</tr>
<tr>
<td>Engermann, Emmanuel</td>
<td>EP7.8</td>
</tr>
<tr>
<td>Erickson, Mark</td>
<td>EP1.3</td>
</tr>
<tr>
<td>Escobar, Valeria</td>
<td>S9.8</td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Fagotti, Lorenzo</td>
<td>S17.3</td>
</tr>
<tr>
<td>Falcão, Gilson</td>
<td>EP6.6</td>
</tr>
<tr>
<td>Faucett, Scott</td>
<td>EP8.1</td>
</tr>
<tr>
<td>Faulk, L. Wade</td>
<td>EP1.26</td>
</tr>
<tr>
<td>Favilla, Sara</td>
<td>EP15.5, EP17.20, S4.5</td>
</tr>
<tr>
<td>FERNANDEZ-ESCAJADILLO, LINDA</td>
<td></td>
</tr>
<tr>
<td>Fernández-ESCAJADILLO, NATALIA</td>
<td></td>
</tr>
<tr>
<td>Filan, David</td>
<td>EP10.8</td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
</tr>
<tr>
<td>Garabekyan, Tigran</td>
<td></td>
</tr>
<tr>
<td>Garces Burbano,</td>
<td></td>
</tr>
<tr>
<td>Esteban Javier</td>
<td></td>
</tr>
<tr>
<td>Garcia-Benitez,</td>
<td></td>
</tr>
<tr>
<td>Boris</td>
<td></td>
</tr>
<tr>
<td>Garcia-Mansilla,</td>
<td></td>
</tr>
<tr>
<td>Agustin</td>
<td></td>
</tr>
<tr>
<td>Garden, Steven</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Gee, Albert  S5.6
Genelin, Matthew EP1.27  Goodrich, Jesse  S12.8
Genovessi, Eduardo EP1.42  Goodspeed, David  EP17.63
Genuario, James  EP8.5  Gosey, Max  EP1.18
Genuario, James W. S8.4
Georgy, David  EP1.5, EP16.4
Georgy, Jessica EP1.5
Gerhardt, Michael EP13.25
Gerrie, Brayden  S16.7
Ghanem, Mohamed EP17.2
Gibly, Romie  EP1.26
Ginai, Abida  EP9.1
Giordano, Brian EP12.18
Giotis, Dimitrios P. EP15.20
Glaws, Kathryn  S14.6
Glaws, Kathryn  EP16.19
Gnatowski, Maciej EP15.12
Goble, Haley S16.7
Godbey, Ruth  EP8.4
Godshaw, Brian EP17.24

H
Ha, Yong Chan  EP13.13
Ha, Yong-Chan EP17.13
Hachisuka, Akiko EP17.67
Haggis, Paul EP11.8, EP13.16, S3.8
Hajewski, Christina EP1.39
Hall, Kimberly  S10.4

Henrique Ferreira  EP17.6
Garrido, Fernando EP1.1, S9.5, S17.4
Herrera, Cristhian S16.5
Hibscher, Daniel EP17.32
Higashihira, Shota

Higuchi, Shuto EP17.67
Hirano, Fumitaka S6.8
<table>
<thead>
<tr>
<th>Name</th>
<th>Page Numbers</th>
<th>Name</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hall-Craggs, Margaret</td>
<td>EP1.31</td>
<td>Hirano, Fumitaka</td>
<td>S2.6</td>
</tr>
<tr>
<td>Hartigan, David</td>
<td>EP15.3</td>
<td>Hobson, Taylor</td>
<td>S3.7</td>
</tr>
<tr>
<td>Hartmann, Albrecht</td>
<td>S15.8</td>
<td>Hod, Keren</td>
<td>S16.5</td>
</tr>
<tr>
<td>Hartwell, Matthew</td>
<td>EP16.5, S13.6</td>
<td>Holmich, Per</td>
<td>EP15.6</td>
</tr>
<tr>
<td>Hashimoto, Shingo</td>
<td>EP17.65</td>
<td>Hontomin, Shaun</td>
<td>EP16.10</td>
</tr>
<tr>
<td>Haskel, Jonathan</td>
<td>S14.5</td>
<td>Hopkins, Justin</td>
<td>EP5.7</td>
</tr>
<tr>
<td>Hatakeyama, Akihisa</td>
<td>EP13.27, S2.6</td>
<td>Hoppe, Daniel</td>
<td>EP5.14</td>
</tr>
<tr>
<td>Haus, Brian</td>
<td>EP9.6</td>
<td>Houck, Darby</td>
<td>EP15.7</td>
</tr>
<tr>
<td>Haviv, Barak</td>
<td>EP17.3</td>
<td>Hsueh, Yang</td>
<td>EP17.75</td>
</tr>
<tr>
<td>Hayashi, Shinya</td>
<td>EP17.65, EP5.6</td>
<td>Huard, Johnny</td>
<td>EP17.68</td>
</tr>
<tr>
<td>Hechenleitner, Jorge</td>
<td>EP7.3</td>
<td>Hutyra, Carolyn</td>
<td>S6.7</td>
</tr>
<tr>
<td>Iafrate, Julia</td>
<td>EP10.13</td>
<td>Investigators, FIRST</td>
<td>PL2.6</td>
</tr>
<tr>
<td>Ibrahim, Mazen</td>
<td>EP1.12, S1.5</td>
<td>Irie, Taichi</td>
<td>EP16.13</td>
</tr>
<tr>
<td>Inaba, Yutaka</td>
<td>EP17.32</td>
<td>Ishøi, Lasse</td>
<td>EP15.6</td>
</tr>
<tr>
<td>Inawashiro, Takashi</td>
<td>EP16.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jackson, Timothy</td>
<td>EP4.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jaiswal, Parag</td>
<td>EP17.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jayankura, Marc</td>
<td>EP5.4</td>
<td>Jónasson, Páll</td>
<td>EP13.23</td>
</tr>
<tr>
<td>Jean-Pierre, Lilly</td>
<td>EP1.12</td>
<td>Jones, Kay</td>
<td>S4.8</td>
</tr>
<tr>
<td>Jean-Pierre, Lilly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jean-Pierre, Lilly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>EPs</td>
<td>Name</td>
<td>EPs</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------------------------------------</td>
<td>---------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Kaiser, William</td>
<td>EP8.4</td>
<td>Kivlan, Benjamin</td>
<td>EP13.21, ER5.9</td>
</tr>
<tr>
<td>Kalachi, Kourosh</td>
<td>EP12.9, EP17.26</td>
<td>Kizaki, Kazuha</td>
<td>S6.8</td>
</tr>
<tr>
<td>Kamenaga, Tomoyuki</td>
<td>EP5.6</td>
<td>Kleehammer, Dan</td>
<td>EP12.18</td>
</tr>
<tr>
<td>Kamenaga, Tomoyuki</td>
<td>EP17.65</td>
<td>Kliethermes,</td>
<td>EP17.63</td>
</tr>
<tr>
<td>Kameyama, Ryochi</td>
<td>EP16.13</td>
<td>Stephanie</td>
<td></td>
</tr>
<tr>
<td>Kanavathy, Sathisvaran</td>
<td>EP17.71</td>
<td>Knapik, Derrick</td>
<td>EP11.16</td>
</tr>
<tr>
<td>Kaneuji, Ayumi</td>
<td>EP17.21</td>
<td>Knapp, Brock</td>
<td>EP17.52</td>
</tr>
<tr>
<td>Kaplan, Daniel</td>
<td>EP17.27</td>
<td>Kobayashi, Naomi</td>
<td>EP17.32</td>
</tr>
<tr>
<td>Kapor, Slobodan</td>
<td>S6.6</td>
<td>Koenig, Scott</td>
<td>EP12.9</td>
</tr>
<tr>
<td>Karczewski, Alison</td>
<td>EP7.4</td>
<td>Kogan, Feliks</td>
<td>EP10.11</td>
</tr>
<tr>
<td>Kawahara, Norio</td>
<td>EP17.21</td>
<td>Kojima, Taiki</td>
<td>EP17.70</td>
</tr>
<tr>
<td>Kazum, Efi</td>
<td>EP16.6</td>
<td>Kollmorgen, Robert</td>
<td>EP17.34, S17.5</td>
</tr>
<tr>
<td>Kazzazi, Fawz</td>
<td>EP16.2</td>
<td>Kollmorgen, Robert</td>
<td></td>
</tr>
<tr>
<td>Keating, Timothy</td>
<td>EP13.28</td>
<td>Konan, Sujith</td>
<td>EP15.1</td>
</tr>
<tr>
<td>Kemp, Joanne</td>
<td>PL5.2</td>
<td>Kotov, Artur</td>
<td>EP16.10</td>
</tr>
<tr>
<td>Kendel, Leonid</td>
<td>EP4.4</td>
<td>Koulopoulos, Michael</td>
<td></td>
</tr>
<tr>
<td>Kehney, Raymond</td>
<td>EP12.18</td>
<td>Kraemer, Otto</td>
<td>EP15.6</td>
</tr>
<tr>
<td>Khan, Adam</td>
<td>S1.8</td>
<td>Kreviazuk, Cheryl</td>
<td>S1.6</td>
</tr>
<tr>
<td>Khan, Hussain</td>
<td>EP4.8</td>
<td>Krishnamoorthy,</td>
<td>EP14.3, S2.8</td>
</tr>
<tr>
<td>Khazi, Zain M.</td>
<td>EP17.5</td>
<td>Krüger, David</td>
<td>S15.7</td>
</tr>
<tr>
<td>Name</td>
<td>EP Numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>---------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Khoury, Anthony</td>
<td>EP14.2, EP17.54,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S6.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kunze, Kyle</td>
<td>EP12.3, EP13.6,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP15.2, EP19.1,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP4.1, EP7.2, S2.8,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PL5.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kilicarslan, Kasim</td>
<td>EP17.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim, Chul-Ho</td>
<td>EP13.22, EP17.49,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.50, EP5.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.50, EP5.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP9.4, S11.6, S17.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP12.3, EP17.10,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.31, EP17.9,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kuroda, Ryosuke</td>
<td>EP17.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim, Jae Yoon</td>
<td>EP17.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kurata, Hirotaka</td>
<td>EP16.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim, Sujin</td>
<td>EP13.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kuroda, Yuichi</td>
<td>EP17.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP7.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim, Young-Jo</td>
<td>S9.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP16.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kushevlev, Michael</td>
<td>Kweon, Christopher</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kyin, Cynthia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP10.9, EP11.4,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim, Chul-Ho</td>
<td>EP13.22, EP17.49,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.50, EP5.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.50, EP5.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kurata, Hirotaka</td>
<td>EP16.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim, Sujin</td>
<td>EP13.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kuroda, Ryosuke</td>
<td>EP17.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim, Young-Jo</td>
<td>S9.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP16.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kushevlev, Michael</td>
<td>Kweon, Christopher</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kyin, Cynthia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP10.9, EP11.4,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>La Camera, Francesco</td>
<td>EP15.10, EP17.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>La Camera, Francesco</td>
<td>EP15.10, EP17.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labelle, Marc</td>
<td>EP6.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lall, Ajay</td>
<td>EP10.9, EP11.3,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP11.4, EP11.5,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP11.6, EP12.6,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP13.14, EP15.3,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.14, EP17.17,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.18, EP17.77,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP19.7, EP4.3,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP9.3, S3.6, S11.7,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S17.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lambers, Floor M.</td>
<td>S8.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lambert, Bradley</td>
<td>EP10.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lan, Roy</td>
<td>EP10.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lan, Roy</td>
<td>EP10.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lindman, Ida</td>
<td>EP13.23, S10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lara, Joaquin</td>
<td>EP1.1, S9.5, S9.8,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S17.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lasaeter, Joseph</td>
<td>EP12.6, S3.6, S11.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lau, Brian C.</td>
<td>EP10.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laude, Frederic</td>
<td>EP5.4, PL5.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lawrence, John</td>
<td>EP16.2, S16.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lawton, David</td>
<td>EP12.18, EP19.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lizano, Xavier</td>
<td>EP17.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lladó-Carbó, Estela</td>
<td>EP1.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lall, Ajay</td>
<td>EP10.9, EP11.4,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Li, Chunbao</td>
<td>EP17.38, EP17.40,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Li, Xinning</td>
<td>EP17.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Li, Zhongli</td>
<td>EP17.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lim, Daniel</td>
<td>EP17.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lim, Jae-Young</td>
<td>EP17.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lim, Tao Shan</td>
<td>EP16.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lim, Daniel P.</td>
<td>EP13.20, PL5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LANGNER, JOANNA</td>
<td>EP10.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lara, Joaquin</td>
<td>EP1.1, S9.5, S9.8,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S17.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lasater, Joseph</td>
<td>EP12.6, S3.6, S11.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lau, Brian C.</td>
<td>EP10.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laude, Frederic</td>
<td>EP5.4, PL5.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lawrence, John</td>
<td>EP16.2, S16.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lawton, David</td>
<td>EP12.18, EP19.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lizano, Xavier</td>
<td>EP17.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lladó-Carbó, Estela</td>
<td>EP1.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lim, Daniel P.</td>
<td>EP13.20, PL5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lin, Benjamin</td>
<td>EP17.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lindman, Ida</td>
<td>EP13.23, S10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lina, Roy</td>
<td>EP17.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lin, Zhongli</td>
<td>EP17.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lim, Daniel</td>
<td>EP17.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lim, Jae-Young</td>
<td>EP17.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lim, Tao Shan</td>
<td>EP16.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lim, Daniel P.</td>
<td>EP13.20, PL5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lin, Benjamin</td>
<td>EP17.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lindman, Ida</td>
<td>EP13.23, S10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lazaro, Lionel</td>
<td>EP17.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>EP References</td>
<td>Name</td>
<td>EP References</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------------</td>
<td>--------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Le Viguelloux,</td>
<td>PL5.3</td>
<td>Lobashov, Vladislav</td>
<td>EP17.43</td>
</tr>
<tr>
<td>Augustin</td>
<td></td>
<td>Long, Austin</td>
<td>EP1.17, EP17.44</td>
</tr>
<tr>
<td>Ledowski, Thomas</td>
<td>EP16.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee, Elaine</td>
<td>EP19.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee, Guen Young</td>
<td>EP13.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee, Jeong Kil</td>
<td>EP1.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee, Jeong-Kil</td>
<td>EP17.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee, Thay</td>
<td>EP4.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lee1, Elaine</td>
<td>EP16.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>León, Alfonso</td>
<td>EP6.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lerch, Till</td>
<td>EP13.15, S3.5, S13.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maak, Travis</td>
<td>EP11.15, S3.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MacKay, James</td>
<td>EP10.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maglione, Daniela</td>
<td>EP15.5, EP17.20, S4.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnani, Mauro</td>
<td>EP17.20, S4.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mahda, Fajar</td>
<td>EP11.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maia, Luis</td>
<td>EP2.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malsor, Yosif</td>
<td>EP17.15, EP4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malviya, Ajay</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malviya, Ajay</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malleck, Sarfraz</td>
<td>EP15.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mallett, Jason</td>
<td>EP17.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malviya, Ajay</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mansor, Yosif</td>
<td>EP17.15, EP4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malleck, Sarfraz</td>
<td>EP15.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mallett, Jason</td>
<td>EP17.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malviya, Ajay</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mansor, Yosif</td>
<td>EP17.15, EP4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mansor, Yosif</td>
<td>EP17.15, EP4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malviya, Ajay</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malleck, Sarfraz</td>
<td>EP15.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mallett, Jason</td>
<td>EP17.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malviya, Ajay</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malviya, Ajay</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mansor, Yosif</td>
<td>EP17.15, EP4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mansor, Yosif</td>
<td>EP17.15, EP4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malviya, Ajay</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malleck, Sarfraz</td>
<td>EP15.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mallett, Jason</td>
<td>EP17.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malviya, Ajay</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mansor, Yosif</td>
<td>EP17.15, EP4.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mansor, Yosif</td>
<td>EP17.15, EP4.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Marín-Peña, Oliver EP17.45
Marín-Peña, Oliver EP13.12
Marin-Peña, Oliver EP13.1
Marin-Peña MD, Oliver EP17.11
Marland, Jennifer EP16.22
Marom, Niv EP10.14
Marqués, Fernando EP6.2
Marquez-Lara, Alejandro EP10.15, S15.5
Marsden, Sam EP1.19
Marta, Ricardo EP2.2
Martin, Hal EP17.54, S6.8
Martin, Hal David EP14.1, S6.5
Martin, Rob Roy EP17.31, EP9.4
Martin, Hal David EP16.6
Martínez, Jesús EP13.1
Martinez Gimenez, Enrique S13.5
Martinez Zaragoza, Judit EP17.57
Marway, Prabhvir EP5.13
Mas Martinez, Jesus S13.5
Mes-Martinez, Jesus EP17.45
Mather, Richard EP17.7
Mather, Richard C. S8.4
Mather III, Chad EP11.16
Mather III, Richard C. S6.7
Menge, Travis EP16.21
Mercado, Arthur EP1.31
Mery, Pamela EP13.18
Metzger, Melodie EP17.41
Metzger, Melodie F. EP13.20, PL5.6
Meyers, William EP5.12
Mhetre, Tejas EP14.2
Middleton, Rory EP17.1
Mihailovic, Jelena S6.6
Miller, Caitlin EP17.72
Miller, Shannon EP15.7
Milligan, Kenneth EP15.1
Millis, Michael S13.8
Mitchell, Joseph EP7.4
Miyamoto, Osamu EP13.27
Mochida, Yuichi EP17.32
MOHTADI, Nicholas EP17.48
Monckeberg, Juan EP1.21
Moon, Jun-Ki EP17.50
Morales Santias, Manuel S13.5
Morehouse, Hannah EP12.8
Moreira Teixeira, Luiz Eduardo EP6.1
Morgan, Allison S13.6
Morgensteren, David EP4.4
Morrish, Madison EP1.5, EP16.4
<table>
<thead>
<tr>
<th>Name</th>
<th>EPs</th>
<th>Name</th>
<th>EPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matsumoto, Tomoyuki</td>
<td>EP17.65</td>
<td>Murakami, Satona</td>
<td>EP17.70</td>
</tr>
<tr>
<td>May, Olivier</td>
<td>PL5.3</td>
<td>Murakami, Satona</td>
<td>EP19.12</td>
</tr>
<tr>
<td>Mayer, Stephanie W</td>
<td>EP1.2</td>
<td>Murata, Yoichi</td>
<td>EP13.27</td>
</tr>
<tr>
<td>Mazek, Jacek</td>
<td>EP15.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nakashiro, Jiro</td>
<td>EP5.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nakayama, Keisuke</td>
<td>S2.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nakonezny, Paul</td>
<td>EP1.22</td>
<td>Nho, Shane J.</td>
<td>EP7.1</td>
</tr>
<tr>
<td>Nelson, Patrick</td>
<td>S13.6</td>
<td></td>
<td>S8.8</td>
</tr>
<tr>
<td>Nelson, Trevor J.</td>
<td>EP17.41</td>
<td>Nieto Gongora, Catalina</td>
<td>EP17.68</td>
</tr>
<tr>
<td>Nepple, Jeffrey</td>
<td>EP13.20, PL5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nepple, Jeff</td>
<td>EP4.20</td>
<td>Nocerino, Elisabetta</td>
<td>EP15.5</td>
</tr>
<tr>
<td>Netto, Lauren</td>
<td>EP10.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Norcross, William</td>
<td>EP1.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nortje, Kathleen</td>
<td>EP12.16, EP4.6, S12.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Norton, John</td>
<td>EP16.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Norton, Mark</td>
<td>EP17.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Novais, Eduardo</td>
<td>EP17.47</td>
</tr>
</tbody>
</table>

Nho, Shane  EP1.43  Nwachukwu, Benedict U.

O

O’Connor, Michaela  EP11.11
O’Connor, Michaela  EP16.20
O’Donnell, John  EP13.17
O’Donnell, John  S4.6
Ogunkoya, Elijah  EP16.5
Ohara, Hidetsugu  EP17.70
Oishi, Takayuki  EP17.32
Ojeda-Levenfeld MD, Jorge  EP17.11

O

O’Connor, Michaela  EP11.11
O’Connor, Michaela  EP16.20
O’Donnell, John  EP13.17
O’Donnell, John  S4.6
Ogunkoya, Elijah  EP16.5
Ohara, Hidetsugu  EP17.70
Oishi, Takayuki  EP17.32
Ojeda-Levenfeld MD, Jorge  EP17.11

Ö

Öhlin, Axel  EP13.23, S10.6

P

Pace, Fabrizio  EP17.20, S4.5
Pachón-Vasquez, Mauricio  EP12.1, S12.7
Padaki, Ajay  EP12.13
Padin, Manuel  EP17.35, EP6.10
Padin, Manuel  EP6.5
Paiva Costa, Lincoln  EP15.21

P

Pace, Fabrizio  EP17.20, S4.5
Pachón-Vasquez, Mauricio  EP12.1, S12.7
Padaki, Ajay  EP12.13
Padin, Manuel  EP17.35, EP6.10
Padin, Manuel  EP6.5
Paiva Costa, Lincoln  EP15.21

Perez-Carro, Luis  EP12.2
PEREZ-CARRO, LUIS  EP13.24
Perez-Carro , Luis  EP17.53
Perka, Carsten  S15.7
Peters, Christopher  S3.7
<table>
<thead>
<tr>
<th>Name</th>
<th>Citation</th>
<th>Name</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinn, Matthew</td>
<td>EP17.61</td>
<td>Quinn, Patrick</td>
<td>EP5.15</td>
</tr>
<tr>
<td>Rabe, Stephanie</td>
<td>EP4.3</td>
<td>Rezansoff, Alex</td>
<td>EP17.48</td>
</tr>
<tr>
<td>Rafols, Claudio</td>
<td>EP7.3</td>
<td>Ribas , Manel</td>
<td>EP1.28</td>
</tr>
<tr>
<td>Rai, Santosh</td>
<td>EP3.2</td>
<td>Ribera , Juan</td>
<td>EP17.45</td>
</tr>
<tr>
<td>Raible, Daniel</td>
<td>S12.8</td>
<td>Richard, Heather M.</td>
<td>EP12.17</td>
</tr>
<tr>
<td>Rahl, Michael</td>
<td>S12.8</td>
<td>RIFCON , JAIRO</td>
<td>EP1.29</td>
</tr>
<tr>
<td>Rafols, Claudio</td>
<td>EP1.21</td>
<td>Rivkin, Gurion</td>
<td>EP4.4</td>
</tr>
<tr>
<td>Ramírez, Luis</td>
<td>EP12.5</td>
<td>Röder, Tobias</td>
<td>EP17.56</td>
</tr>
<tr>
<td>Ramírez-Núñez, Luis</td>
<td>EP1.16</td>
<td>Rodriguez, Michelle</td>
<td>S10.5</td>
</tr>
<tr>
<td>Ramos, Laylai</td>
<td>EP12.11</td>
<td>Rodriguez y Baena, Ferdinando</td>
<td>S7.5</td>
</tr>
<tr>
<td>Ramos-Cardozo, Orlando</td>
<td>EP12.1</td>
<td>Rojas, Claudio</td>
<td>EP13.18</td>
</tr>
<tr>
<td>Rath, Ehud</td>
<td>EP17.3</td>
<td>Ross, Lexie</td>
<td>S10.4</td>
</tr>
<tr>
<td>Rath , Ehud</td>
<td>V6.11</td>
<td>Ruggeri, Riccardo</td>
<td>EP15.10</td>
</tr>
<tr>
<td>Ratner, Drew</td>
<td>EP8.5</td>
<td>Ruiz Ollero, Antonio</td>
<td>S8.8</td>
</tr>
<tr>
<td>Ravipati, A P</td>
<td>S8.6</td>
<td>Runhaar, Jos</td>
<td>PL5.2</td>
</tr>
<tr>
<td>Tejaswi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reider, Evgeny</td>
<td>EP16.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>EP/PL Numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reina, Francisco</td>
<td>EP6.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remtulla, Mohammedabbas</td>
<td>EP3.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reuter, John</td>
<td>EP19.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reynolds, Alan</td>
<td>S10.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryan, John</td>
<td>EP16.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryan, John M</td>
<td>EP16.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sabatino, Meagan J.</td>
<td>EP12.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saffarini, Mo</td>
<td>PL5.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safran, Marc</td>
<td>EP10.11, EP15.13,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP5.5, EP5.7, S10.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safran, Marc</td>
<td>EP5.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Said, Hatem Galal</td>
<td>EP13.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sakai, Akinori</td>
<td>S2.6, S6.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salata, Michael</td>
<td>EP11.16, EP12.7,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP6.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salazar, Eduardo</td>
<td>EP17.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salfiti, Catherine</td>
<td>EP11.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salgado, Pedro</td>
<td>S9.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salih, Saif</td>
<td>EP1.30, EP1.31,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP1.37, S1.7, S3.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salvo, Jonathan</td>
<td>EP17.10, EP17.31,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP17.9, EP9.4,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S11.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salvo, Jonathan</td>
<td>EP1.20, EP13.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S17.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Samuel, Linsen</td>
<td>EP17.27, EP17.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP1.32, EP16.16,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP16.17, EP17.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Samuelsen, Brian</td>
<td>EP13.26, EP17.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanchez, Miguel</td>
<td>S12.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanchez, Mikel</td>
<td>EP6.3, S5.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanchez-Soler, Juan</td>
<td>EP2.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanchis-Alfonso, Vicente</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sansone, Mikael</td>
<td>S10.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sansone, Mikael</td>
<td>EP13.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santore, Richard</td>
<td>EP1.17, EP1.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanz-Reig, Javier</td>
<td>S13.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanz-Reig, Javier</td>
<td>EP17.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shin, Jessica</td>
<td>S3.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shlaifer, Amir</td>
<td>EP16.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shoman, Haitham</td>
<td>EP17.4, EP17.60,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP5.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siagian, Andreas M.H</td>
<td>EP1.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siebenrock, Klaus</td>
<td>EP13.15, S3.5,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S13.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sierra, Rafael</td>
<td>S13.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silverman, Ariel</td>
<td>EP17.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silvester, Rony</td>
<td>EP7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sim, Hon Earn</td>
<td>EP16.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simunovic, Nicole</td>
<td>EP11.1, EP13.2,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP13.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sivasundaram, Lakshmanan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sivasundaram, Lakshmanan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EP6.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skopal, Lauren</td>
<td>EP10.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slattery, David</td>
<td>PL5.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slattery, Michael</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slattery, Mike</td>
<td>S12.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slullitel, Pablo</td>
<td>EP1.33, EP15.14,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smit, Kevin</td>
<td>S1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sobau, Christian</td>
<td>EP15.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sobti, Anshul</td>
<td>S15.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sochacki, Kyle</td>
<td>EP12.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sogbein, Olawale</td>
<td>EP13.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sohatee, Mark</td>
<td>PL5.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soldan, Macarena</td>
<td>EP7.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sanz-Reig, Javier  EP13.1
Sasaki, Daizo  EP16.13
Sasetyo, D R  EP11.10
Scaleni, Paolo  EP11.13
Scatigna, Bruno  EP5.17, EP5.2
Scatigna, Bruno  EP5.17, EP5.2
Schaffer, Joseph  EP12.18
Schallmo, Michael  EP10.15
Schlachtner, Jakob  EP10.12
Schmaranzer, Florian  EP13.15, S3.5, S13.7
Schoenecker, Perry  S7.8
Schröder, Jörg  S15.7, S15.8
Schröder, Ricardo  S6.5
Schwabe, Maria  S5.5
Schweitzer, Daniel  EP13.18
Scibetta, Alex  EP17.68
Searls, William C.  EP12.17
Segovia, Nicole  EP5.7
Selley, Ryan  EP16.5
Shah, Ajay  EP13.3
Shamshoon, Saif  EP13.2
Shapira, Jacob  EP11.7
Shapiro, Lauren  EP5.14
Sharfman, Zachary  EP16.6
Sharfman, Zachary  EP19.11
Shelton, Trevor  EP9.6
Sheth, Ujash  S13.6
Sole, Gillian  EP15.9
Somers, Jan  EP15.16, EP15.17, EP15.18
Sonnery-Cottet, Bertrand  EP6.8
Speirs, Andrew  S1.6
Spencer, John  EP15.3
Spiker, Andrea  EP17.63, EP7.4
S11.8
Steinl, Gabrielle  EP11.11
Steppacher, Simon  EP12.13
Stevens, Cyrielle  EP15.16
Stewart, Max  S16.6
Stone, Austin  EP4.9
Strazar, Klemen  S8.7
Stubbs, Allston  EP10.15, S15.5
Suarez-Ahedo, Carlos  EP12.2
Sucato, Daniel  S9.7
Sucato, Daniel J.  EP12.17
SUPILLERA  EP13.24
GARCIA, MANUEL  EP17.53
SUMILLERA  EP13.24
GARCIA, MANUEL  EP17.53
Sun, Yuhang  S14.8
Suppaksorn, Sunikom  EP8.3
<table>
<thead>
<tr>
<th>Name</th>
<th>EP References</th>
<th>Name</th>
<th>EP References</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T</strong></td>
<td></td>
<td>Thorborg, Kristian</td>
<td>EP15.6</td>
</tr>
<tr>
<td>Tabaddor, Ramin</td>
<td>EP17.61</td>
<td>Thorey, Fritz</td>
<td>EP15.20</td>
</tr>
<tr>
<td>Takada, Shinichiro</td>
<td>S2.6</td>
<td>To, Kendrick</td>
<td>EP16.2</td>
</tr>
<tr>
<td>Takagawa, Shu</td>
<td>EP17.32</td>
<td>Tobar, Carlos</td>
<td>EP1.1, S9.5, S9.8, S17.4</td>
</tr>
<tr>
<td>Takahashi, Makoto</td>
<td>EP17.67</td>
<td>Todd, Jocelyn</td>
<td>EP11.15</td>
</tr>
<tr>
<td>Takayama, Koji</td>
<td>EP5.6</td>
<td>Tomdio, Shirley</td>
<td>EP8.1</td>
</tr>
<tr>
<td>Takayama, Koji</td>
<td>EP17.65</td>
<td>Tornetta III, Paul</td>
<td>EP17.52</td>
</tr>
<tr>
<td>Tannast, Moritz</td>
<td>EP13.15, S3.5, S13.7</td>
<td>Toyoshima, Takamasa</td>
<td>S2.6</td>
</tr>
<tr>
<td>Tara, Carmen</td>
<td>EP2.1</td>
<td>Trammell, Amy</td>
<td>S15.5</td>
</tr>
<tr>
<td>Tateishi, Satoshi</td>
<td>EP17.67, EP17.70</td>
<td>Trattnig, Siegfried</td>
<td>S15.8</td>
</tr>
<tr>
<td>Taylor, Hayley</td>
<td>EP8.4</td>
<td>Trofa, David</td>
<td>EP17.52</td>
</tr>
<tr>
<td>Tey Pons, Marc</td>
<td>EP4.5</td>
<td>Tsikouris, Georgios</td>
<td>EP10.5, EP10.6</td>
</tr>
<tr>
<td>Tey-Pons, Marc</td>
<td>EP17.45</td>
<td>Tso, Chi Kin, Nathan</td>
<td>EP4.8</td>
</tr>
<tr>
<td>Thiagarajah, Shankar</td>
<td>EP1.34, EP1.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thier, Zach</td>
<td>S17.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thier, Zachary</td>
<td>EP19.8, EP19.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thompson, Kamali</td>
<td>EP17.66, S14.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**U**

<table>
<thead>
<tr>
<th>Name</th>
<th>EP References</th>
<th>Name</th>
<th>EP References</th>
</tr>
</thead>
</table>
**V**

Valderrama, Juanjose
Valera Pertegas, Màrius
Valles-Purroy MD, Alfonso
Van Thiel, Geoff
Varner, Kevin

Vasileff, W. Kelton
Vasileff, William
Vassalo, Carlos
Vassalo, Cesar
Veizi, Enejd
Vera, Angelina
Verdu Roman, Carmen

Van Thiel, Geoffrey
Verhaegen, Jeroen
Verhoogt, Wesley
Verma, Arjun
Viamont-Guerra, Roxana
Villar, Richard

Villegas, Diego
Visco, Christopher
Vlaserou, Panagiota
Vlaserou, Panagiota
Vogel-Abernathie, Laura
Vojvodic, Aleksandar

Vasileff, W. Kelton
EP16.18, EP17.58, S14.6

Vasileff, William
EP16.19

Vassalo, Carlos

Vassalo, Cesar
EP15.21, EP17.6, EP6.1

Veizi, Enejd
EP17.12

Vera, Angelina
EP10.10

Verdu Roman, Carmen
S13.5

van Thiel, Geoffrey
EP17.10, EP17.9, S11.6

van Buuren, Michiel
van Klij, Pim

W

Waarsing, Erwin
EP9.1, PL5.2

Wagner, Kurt
EP12.17

Wahab Zuriarrain, Sara
EP17.57

Walker, Rafael
EP11.7

Walker-Santiago, Rafael

Walker-Santiago, Rafael
EP4.3

Walla, Nicholas
EP17.58

Walrod, Bryant
EP16.19, S14.6

Walter, William
EP17.28

Wang, Xipeng
EP17.21

Wang, Zhigang
EP17.38,

Whitney, Darryl
EP10.7

Wilken, Jason
EP1.40, EP16.21

Wilkin, Geoffrey
EP12.19

Wilkin, Geoffrey
S1.5

Willey, Michael

Willey, Michael
EP16.7

Willa, Nicholas
EP17.58

Walrod, Bryant
EP16.19, S14.6

Walter, William
EP17.28

Wang, Xipeng
EP17.21

Wang, Zhigang
EP17.38,

Williams, Dale
V7.5

Williams, David
EP17.47

Willimon, S. Clifton
EP16.14

Willimon, S. Clifton
EP9.5

Winfield, Francis
EP16.10
<table>
<thead>
<tr>
<th>Name</th>
<th>EP Numbers</th>
<th>Name</th>
<th>EP Numbers</th>
<th>Name</th>
<th>EP Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weinans, Harrie</td>
<td>PL5.2</td>
<td>Wolff, Andrew</td>
<td>EP1.20, S17.6</td>
<td>Weinans, Harrie</td>
<td>PL5.2</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>EP17.73</td>
</tr>
<tr>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>EP17.73</td>
</tr>
<tr>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td>EP17.70</td>
</tr>
<tr>
<td>Yamamoto, Yasuhiro</td>
<td>EP17.70</td>
<td>Yin, QingFeng</td>
<td>EP17.76</td>
<td>Yamamoto, Yasuhiro</td>
<td>EP17.70</td>
</tr>
<tr>
<td>Name</td>
<td>Reference</td>
<td>Name</td>
<td>Reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------</td>
<td>-------------------</td>
<td>-----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yang, Hsueh</td>
<td>EP17.74</td>
<td>Youm, Thomas</td>
<td>EP10.7, S14.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yen, Yi-Meng</td>
<td>S9.7</td>
<td>Yuen, Leslie</td>
<td>EP13.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yetter, Thomas</td>
<td>S16.7</td>
<td>Yukisawa, Yohei</td>
<td>EP17.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yilma, Mahder</td>
<td>EP17.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zantop, Thore</td>
<td>EP10.12</td>
<td>Zoga, Adam</td>
<td>EPS.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zaottini, Federico</td>
<td>EP15.5</td>
<td>Zusmanovich, Mikhail</td>
<td>S14.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zaruta, Douglas</td>
<td>EP12.18</td>
<td>Zusmanovich, Mikhail</td>
<td>EP17.66</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>