

ISAKOS

ISAKOS NEWSLETTER 2019 • VOLUME I

Current Concepts on Arthroscopy, Knee Surgery & Orthopaedic Sports Medicine



12TH Biennial
ISAKOS
CONGRESS 2019

Cancun, Mexico • May 12-16, 2019

PRESIDENTIAL GUEST SPEAKER

2019 ISAKOS CONGRESS CANCUN TOURS

PG. 11

MICHAEL CASALE, PhD

Using Virtual Reality
to Improve Surgery,
Sports Medicine, and
Athletic Performance



- INSIDE 2** A MESSAGE FROM ISAKOS PRESIDENT, MARC SAFRAN
- 7** WELCOME TO CANCUN #ISAKOS2019
- 20** ACL REPAIR AND BIOLOGICS
- 23** REHAB AFTER ARTHROSCOPIC SHOULDER SURGERY
- 34** MICROINSTABILITY OF THE HIP
- 40** YOUNG INVESTIGATOR'S REPORT

in this issue

Editor's Message	1
President's Message	2
Welcome to Cancun	7
Presidential Guest Speaker	15
Current Concepts	20
Fellowship Reports	40
Approved Course Reports	42
Upcoming Approved Courses	51

EDITOR

Robert G. Marx, MD, MSc, FRCSC UNITED STATES

EDITORIAL BOARD

Iftach Hetsroni, MD ISRAEL, Associate Editor
Tahsin Beyzadeoglu, Prof., MD TURKEY
Raju Easwaran, MS (Orth) INDIA
Yee Han Dave Lee, MBBS, FRCS(Ortho), MD
SINGAPORE
Bruce A. Levy, MD UNITED STATES
Stephen L. Lyman, PhD UNITED STATES
Tatsuo Mae, MD, PhD JAPAN
Dipak Raj, FRCS (Tr & Orth), MCh Orth., MS Orth.
UNITED KINGDOM
Samuel A. Taylor, MD UNITED STATES
Daniel Whelan, MD, MSc, FRCSC CANADA
Kyoung Ho Yoon, MD, PhD, Prof.
REPUBLIC OF KOREA
Omer Mei-Dan, MD UNITED STATES, Past Editor



**International Society of
Arthroscopy, Knee Surgery and
Orthopaedic Sports Medicine**

2410 Camino Ramon, Suite 215
San Ramon, CA 94583 – 4318 USA
Telephone: +1 925 807 – 1197
Fax: +1 925 807 – 1199
Email: isakos@isakos.com

OFFICE MESSAGE

¡Bienvenido!

“Bienvenido” means “Welcome” in Spanish. It’s a very fitting word as we embark into 2019 and welcome a new year — a Congress year, in fact! We are only a few months away from the ISAKOS Congress in Cancun, Mexico, and we cannot wait to say, “**¡bienvenido a Cancun!**” The ISAKOS Program Committee has an exciting agenda lined up for our attendees — 1,500 presentations given by more than 550 presenters, 35 surgical demonstrations, 30 instructional course lectures, 54 symposia...and more! Also, as recently announced, Michael Casale, PhD, will be the Presidential Guest Speaker. Dr. Casale is a cognitive neuroscientist whose research is focused on understanding (1) the biological underpinnings of learning and memory and (2) how to optimize training in order to ensure maximum benefit to the learner. We hope that you will join us in Cancun in May. The registration discount ends March 31st—last chance to register and save!

A welcome is not only a greeting but also can be defined as “accepting with pleasure the occurrence or presence of.” ISAKOS has worked hard to implement opportunities and educational tools that our members would welcome most. The Knee Arthroplasty Committee has added the new Knee Arthroplasty Fellowship—applications are due by April 1st (isakos.com/Knee-Arthroplasty-Fellowship). The Fellowship will provide an opportunity for two young orthopaedic surgeons, currently working in developing countries, to travel to various medical sites around the world and to be exposed to the techniques of expert surgeons. In other news, Global Link has also welcomed a new look and interface! Global Link is ISAKOS’ online education portal featuring access to the latest research presented at Congresses, resources for standard terminology, definitions, classification and scoring systems, committee projects, newsletter current concepts, and surgical demonstration videos/courses. Global Link now offers a more user and mobile-friendly library of information and knowledge. We invite you to visit the portal at isakos.com/GlobalLink.



ISAKOS welcomed Sue Reibold as its new CEO/Executive Director

Sue succeeds Michele Johnson, who retired from the Executive Director position this past December (but has continued to work in a consultant capacity toward a successful ISAKOS Congress). Sue is an experienced nonprofit leader with an outstanding record of organizational growth and demonstrated ability to energize and positively influence team members and others. Since 2015, Sue has served as the Executive Director of the CHEST Foundation, the charitable foundation of the American College of Chest Physicians (CHEST). Sue also has served as the Senior Vice President and Chief Marketing Officer for CHEST since 2013. CHEST has more than 19,000 members representing more than 100 countries and also holds congresses internationally. Prior to joining CHEST, Sue worked for 15 years in marketing and public relations in large health systems in Indiana and Illinois. Thus, she has 20 years of executive management experience in health care and with international non-profit health-related societies. Please join us in welcoming Sue to the ISAKOS Family.

Hangin' 'em up



Our longtime Executive Director, Michele Johnson, is “hangin’ ‘em up”. As sports medicine surgeons, we are familiar with this term, which is short for “hanging them up”, as in an athlete “hanging up their equipment for the final time”, indicating their retirement from their sport. A wrestler will symbolically leave their wrestling shoes on the mat after their final competition to indicate they are hangin’ ‘em up. Upon my recent retirement from recreational ice hockey, I gave away my barely used hockey gloves (I purchased them optimistically, prior to my last few games). I handed them over to Rob Kucera, a hockey-loving physician assistant at HSS who is also a part-time youth hockey coach. My colleague and friend, Dr. Steve Sanders, long time orthopedic surgeon for the Ultimate Fighting Championship (UFC) was visiting HSS the day I gave the gloves to Rob and pointed out the similarity to the wrestling tradition. Having decided that my best days on the ice were behind me, I felt it was time to move on and give up playing.

As surgeons, we must also give thought to when it is time to hang up the knife for the final time. For many of us it is not a pleasant or welcome thought. Operating on patients to fix pathology and relieve them of symptoms and restore their function is a powerful thing to be able to do. However, if all goes well and we are able to continue this work for decades, there comes a time when we stop doing surgery and move on. Past President of ISAKOS, Dr. John Bergfeld told me at dinner at the 2017 ISAKOS conference in Shanghai that he made that decision rather suddenly one morning prior to surgery – he decided that day he was about to perform his final operation. John has remained very involved with ISAKOS and the Cleveland Clinic, but that was indeed his final operation.

Dr. Bill Rennie was my medical school mentor at McGill University. He subsequently moved to Winnipeg to take over as Chairman of Orthopedic Surgery at the University of Manitoba. I met up with him again in 2012 when I was in Winnipeg. His successor Dr. Peter MacDonald explained to me that he had a well-planned and successful retirement from surgery and has remained involved in the department, and has also carried on with other professional responsibilities. Bill told me then that it is never too early to start thinking about hangin’ ‘em up. He also suggested that I start thinking about what I would plan to do after I put the knife down for the final time. I have since followed his advice and have started making a list for when that day comes.

Thankfully for us, Michele Johnson did a fantastic job of hangin’ ‘em up and planning how to move on from ISAKOS. She gave the Society considerable notice, helped find her replacement, and has remained very involved to this day. Michele is largely responsible for making ISAKOS the success it is today and we are all grateful to her for her dedication over the years! We welcome Sue Reimbold, who is very qualified to take over and who will also have very large shoes to fill. Good luck Sue and we look forward to working with you! Thank you Michele for your dedication and enjoy your next chapter!

Robert G. Marx, MD

ISAKOS Newsletter Editor 2017–2019



Greetings from ISAKOS

“I am looking forward to the future and feeling grateful for the past.”

–Mike Rowe, American Television Host and Narrator

As I mentioned in my speech when I was first elected to the presidential line of ISAKOS, I am humbled by the honor to serve as president of this great organization. I was filled with trepidation, knowing that I would be following in the footsteps of some of the great icons in Orthopaedic Sports Medicine and Knee Surgery — a truly humbling prospect indeed. It is amazing to me how quickly these 2 years have passed. It seems like just a short time ago that we were in Shanghai, watching Philippe Neyret deliver his Presidential Address and Yao Ming give his Presidential Speech, and it is hard to believe that my own tenure as ISAKOS President is already coming to an end. It has been a true honor to serve the membership of ISAKOS as your president for the 2017–2019 term.

During the 24 years of our existence, our organization has built a great tradition of excellence, cooperation, and collaboration around the world. We are a unique, truly international society built on friendships and mutual respect. Over the last 2 years, I have had the opportunity to help ISAKOS make some major changes that have the potential to significantly impact our future direction. During this time, Michele Johnson, our fearless leader, announced her retirement as the CEO/Executive Director of ISAKOS. Michele, along with her trusty crew at MCJ Consulting, has served ISAKOS for over 20 years. As a result, the bulk of my tenure as president of ISAKOS has been focused on keeping Michele in the fold; we are fortunate that she will still run the Cancun Congress later this year and will serve as a special consultant to our new CEO for the 2 years that follow, through our 2021 meeting in Cape Town. Another major change was that we hired Michele's employees at MCJ Consulting. Now Hilary, Kathleen, Joy, Sarah, and Chanel are all full-time employees of ISAKOS, and our society has its own, full-time, home office!

Obviously, the next big task was finding our new CEO/Executive Director. I was extremely fortunate to have a world-class search committee — namely, Willem van der Merwe (First Vice President), Guillermo Arce (Second Vice President), Philippe Neyret (Past President), and John Bartlett — to help with this very important process. Additional help during this international search was provided by Tom Nelson, who brought years of experience as a major orthopaedic society CEO and consultant, as well as the executive search firm of Tufts and Associates. This group worked tirelessly and vetted dozens of candidates before interviewing 7 people, live and in person, in San Francisco in September 2018. The search committee unanimously selected Sue Reimbold from the formidable group of finalists, each of whom brought years of experience and expertise. Sue comes to ISAKOS with undergraduate and master's degrees in communications as well as a certification in association management. She has served as the Executive Director of the CHEST Foundation and as the Chief Marketing Officer and Senior VP for Market Growth for the American College of Chest Physicians (CHEST), based in Chicago. Sue has had extensive experience in leadership, staff management, fiscal management of multimillion dollar budgets, and coordination of medical meetings both nationally and internationally.

The search committee was impressed with her foresight, her ideas for the future, and her answers to questions regarding the challenging, real-life scenarios that our society does, and potentially will, face. Her approaches to problems were well thought-out, organized, and consistent with the strategic plan set by the board. She has some great ideas that are both realistic and quite exciting, and we are confident that she will help lead us thoughtfully into the future, where yet-to-be-known challenges exist. As a committee, we all knew that filling the shoes of Michele Johnson would not be easy for any successor. However, throughout this entire selection process, the committee was absolutely confident that Sue's experience, knowledge, expertise, vision, and philosophy of association management makes her the best fit for ISAKOS as we move forward with our plans for continued growth and service to our members.

So what else has been going on at ISAKOS? Well, we have continued to have regular video conference calls with the executive committee, the board of directors, and the chairs of different committees. This regular communication, along with the work of David Parker and Jon Karlsson, has helped to keep our society moving forward and has provided a way for the board to help committees when problems or issues have arisen, allowing the committees to accomplish their goals and tasks without unnecessary delay. The committees have been working on a number of projects, including contributions to books, the newsletter, and *JISAKOS*, as well as helping to improve the Global Link Videos. This last task has been very challenging, as one might expect. However, over 600 videos have been vetted by more than one reviewer, helping to ensure that only the highest-quality, relevant, and industry-free videos are part of our educational library.

JISAKOS continues to grow in popularity, with all metrics trending in the upward direction. Under Niek van Dijk's leadership, and as a result of his provocative editorials, the journal is becoming more widely recognized, with both downloads and links increasing. With the addition of original scientific research, the journal likely will soon be approved for PubMed indexing and an impact factor. The journal advisory group has a new leader, Chris Harner, and a new name, the Journal of ISAKOS Board of Trustees.

ISAKOS continues to be active in supporting courses all over the world and continues to participate with our partner societies at their meetings. During the last 2 years, our society has been part of the ISKAST congress in Iran, SRATS in Romania, SLAHOC in Bolivia, the ESSKA congress in Glasgow, the APKASS meeting in Sydney, and the AOSSM congress in San Diego. Additionally, we participated in the SIA National Congress in Milan and the Argentine Arthroscopy Association meeting in October. We continue to work toward interim meetings and surgical skills courses throughout the world. We held a collaborative surgical skills course on hip arthroscopy with the AOSSM in Chicago in 2018, and we will be having another combined surgical skills course on osteotomies about the knee with the AOSSM in Chicago in April 2019. We will partner with the AOSSM and Major League Soccer on a soccer course in Miami in September 2019. In 2020, we will partner with ESSKA on a special course; the details on this 2020 meeting, which likely will be held in Scandinavia, continue to be clarified.



The last 2 years have seen the introduction of some new initiatives for our society. A new, expanded ISAKOS Global Traveling Fellowship will travel through South America in April and May, ending at the ISAKOS Congress in Cancun. There were nearly 200 applicants for this fellowship, which will include 5 fellows under the age of 45 years from all over the world (one from each region), with David Figueroa, an executive committee member from Santiago, Chile, serving as the Godfather. Other new offerings include ISAKOS ties, with blue ties for the membership (Fig. 1) and gold ties for presidents. In

addition, 3 new awards will be introduced at the 2019 Cancun conference. Made possible by a generous gift from Nicolaas Budhiparama, we will be introducing the Paolo Aglietti Arthroplasty award as well as a new arthroplasty fellowship, currently being developed by the Knee Arthroplasty Committee and Dr. Budhiparama, to help young surgeons travel to learn from an ISAKOS master knee arthroplasty surgeon.

50

Symposia

30

ICLs

5

Debates

35

Surgical
Demonstrations

5

Partner Society
Symposia



The Biennial ISAKOS Congress in Cancun may be the best congress yet. Stefano Zaffagnini and Volker Musahl and their program committee, along with the different committees have put together a tremendous program with 50 symposia, 30 ICLs, 5 debates, 35 surgical demonstrations, and 5 partner society symposia. Additionally, there will be a Sports Rehabilitation Concurrent Course (tell your physical therapists!) and pre-courses (including one in Spanish). We are also very excited to have **Michael Casale**, Chief Science Officer for Strivr, a company that uses virtual reality for training, as my **Presidential Guest Speaker**. His speech will focus on using virtual reality to improve surgery, sports medicine, and athletic performance. Strivr is known for training athletes and teams, including many college and professional football teams as well as the German national soccer team.

Additionally, we will have **Edwin Moses as a Special Keynote Speaker**. Dr. Moses is an American former track and field athlete who won gold medals in the 400-m hurdles at the 1976 and 1984 Olympics. Between 1977 and 1987, Dr. Moses dominated the field, winning 107 consecutive international finals and setting the world record in the event 4 times. He is the chairman of the US Anti-Doping Agency (USADA) and a board member of the World Anti-Doping Agency (WADA). Dr. Moses will provide insights into the current state of drug doping in athletics. As you can see, this meeting will be spectacular. The science will be a highlight, as always, and the offerings will be broad, current, and cutting-edge.



These are only the highlights of my term. These things could not have been accomplished without the hard work and contributions of so many society members, Michele Johnson, and our office staff. It has been a very busy 2 years, and I have much to be thankful for. We accomplished a great deal because our members deeply care about the society and volunteer their time to contribute to its success. I am particularly indebted to the members of the board, the executive committee, the program committee, and the search committee, all of whom did so much work this year to help us accomplish these tasks to make our society stronger as we continue to grow and evolve.

I want to thank the past presidents for setting the foundation for our society. These individuals have set a high bar for the presidents to come and have helped to position our society as an international educational leader in arthroscopy, knee surgery, and orthopaedic sports medicine. To that end, I want to congratulate João Espregueira-Mendes for his stewardship as the chairman of the publications committee, with another bounty of books being made available to our members, including 5-7 books that will be available in time for the Cancun meeting. I cannot thank my executive committee enough for their wisdom and drive as well as for their continuous and unwavering support: Willem van der Merwe (First Vice President), Guillermo Arce (Second Vice President), Philippe Neyret (Past President), João Espregueira-Mendes (Treasurer), Chris Harner (Assistant Treasurer), Jon Karlsson (Secretary), David Parker (Assistant Secretary). Along with my consultants Greg Bain, Ryosuke Kuroda, and David Figueroa, as well as John Bartlett, who has served in 2 important committees (the JISAKOS Board of Trustees and the search committee), this group has worked tirelessly, particularly during the last 2 years, to help our society accomplish its goals while running as smoothly as one could have hoped for. I am forever indebted to each of them.

As we approach our crown jewel, the Biennial Congress in Cancun, I welcome Sue Reibold, our new CEO/Executive Director. I wish her luck as we go forward and am confident that she will be successful, partly due to the groundwork that has been laid before her by others (including Michele, the past presidents, and the board members) and partly due to the fact she will have an excellent team (including Willem van der Merwe and Guillermo Arce as the next presidents, a supportive and hard-working board and committee members, and a committed staff at the home office). I know that our future as a society is truly bright, and I am grateful for all of the hard work that has put our society in this wonderful position. And finally, I want to thank Michele Johnson for all she has done for me as well as for this wonderful society.

I look forward to seeing you all in Cancun for another outstanding congress, an invaluable educational experience, and the opportunity to toast friendships!

Marc R. Safran, MD

ISAKOS President, 2017–2019

WELCOME

[SUE REIMBOLD, MA, CAE]

Named New ISAKOS CEO – Executive Director



ISAKOS is honored to announce that Sue Reibold has joined ISAKOS as the new CEO – Executive Director. With more than 20 years of executive management experience in healthcare and international health related non-profits, we are confident Sue is a great addition to the ISAKOS team. Sue plans to work with the ISAKOS Board of Directors and will be devoting her time to executive management, while also working to advance ISAKOS' educational initiatives. She will work in concert with the Board to expand ISAKOS by exploring partnerships and developing new programs.

**Please Welcome Sue Reibold
to ISAKOS**

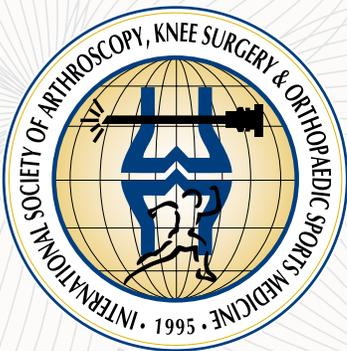




THANK YOU

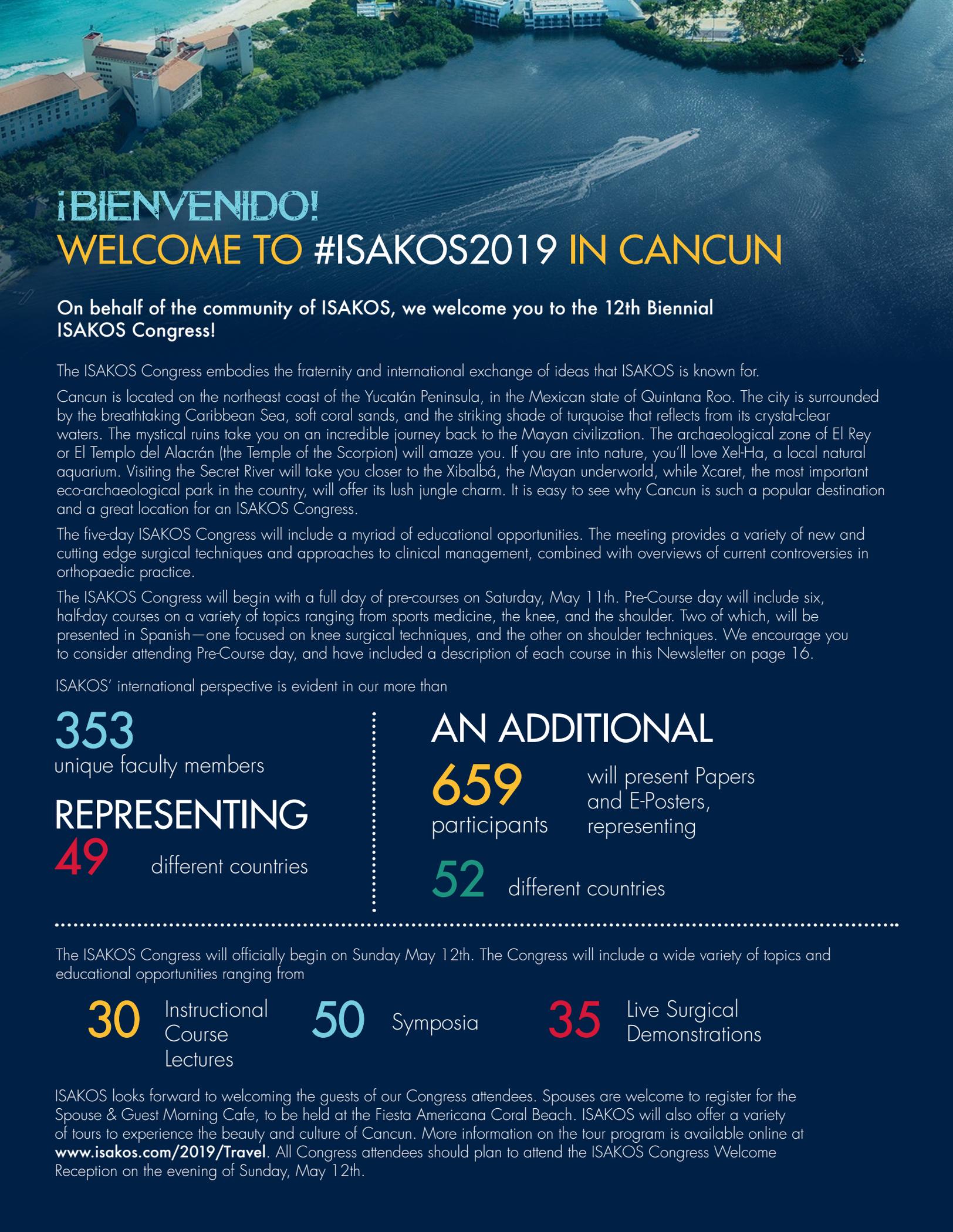
ISAKOS Congratulates **Michele Johnson**
on Her Retirement as ISAKOS Executive Director

Thank You for More than
20 YEARS of Dedicated Service



Education is the DNA of ISAKOS and has spread globally – through the Biennial Congress, workshops, collaborative meetings, publications, fellowships and establishment of the *Journal of ISAKOS* – all because of Michele’s vision, efforts and optimism. During Ms. Johnson’s tenure, ISAKOS has grown from a small society of fewer than **900 members** to what it is today: an international byword in the orthopaedic sports medicine community with more than **3,000 members** from **93 countries**.

Please join us in thanking Michele Johnson for her vast contributions to ISAKOS and in wishing her success in all her future endeavors.



¡BIENVENIDO!

WELCOME TO #ISAKOS2019 IN CANCUN

On behalf of the community of ISAKOS, we welcome you to the 12th Biennial ISAKOS Congress!

The ISAKOS Congress embodies the fraternity and international exchange of ideas that ISAKOS is known for.

Cancun is located on the northeast coast of the Yucatán Peninsula, in the Mexican state of Quintana Roo. The city is surrounded by the breathtaking Caribbean Sea, soft coral sands, and the striking shade of turquoise that reflects from its crystal-clear waters. The mystical ruins take you on an incredible journey back to the Mayan civilization. The archaeological zone of El Rey or El Templo del Alacrán (the Temple of the Scorpion) will amaze you. If you are into nature, you'll love Xel-Ha, a local natural aquarium. Visiting the Secret River will take you closer to the Xibalbá, the Mayan underworld, while Xcaret, the most important eco-archaeological park in the country, will offer its lush jungle charm. It is easy to see why Cancun is such a popular destination and a great location for an ISAKOS Congress.

The five-day ISAKOS Congress will include a myriad of educational opportunities. The meeting provides a variety of new and cutting edge surgical techniques and approaches to clinical management, combined with overviews of current controversies in orthopaedic practice.

The ISAKOS Congress will begin with a full day of pre-courses on Saturday, May 11th. Pre-Course day will include six, half-day courses on a variety of topics ranging from sports medicine, the knee, and the shoulder. Two of which, will be presented in Spanish—one focused on knee surgical techniques, and the other on shoulder techniques. We encourage you to consider attending Pre-Course day, and have included a description of each course in this Newsletter on page 16.

ISAKOS' international perspective is evident in our more than

353

unique faculty members

REPRESENTING

49

different countries

AN ADDITIONAL

659

participants

will present Papers
and E-Posters,
representing

52

different countries

The ISAKOS Congress will officially begin on Sunday May 12th. The Congress will include a wide variety of topics and educational opportunities ranging from

30

Instructional
Course
Lectures

50

Symposia

35

Live Surgical
Demonstrations

ISAKOS looks forward to welcoming the guests of our Congress attendees. Spouses are welcome to register for the Spouse & Guest Morning Cafe, to be held at the Fiesta Americana Coral Beach. ISAKOS will also offer a variety of tours to experience the beauty and culture of Cancun. More information on the tour program is available online at www.isakos.com/2019/Travel. All Congress attendees should plan to attend the ISAKOS Congress Welcome Reception on the evening of Sunday, May 12th.

SURGICAL DEMONSTRATIONS

SATURDAY, MAY 11 – WEDNESDAY, MAY 15

isakos.com/2019/Surgical-Demos

SATURDAY, MAY 11

Morning Pre-Course: Current Concepts in Shoulder Surgeries

Concurrent 4–Cozumel 2+A

07:55–08:10 **Placement of the Six O’Clock Anchor and Inferior Sutures**

Felix H. Savoie III, MD UNITED STATES

Moderator: Knut Beitzel, MD, MA GERMANY

08:10–08:25 **Bankhart Plus Remplissage / Capsular Repair**

Dan Guttman, MD UNITED STATES

Moderator: Andreas B. Imhoff, MD, Prof. GERMANY

08:25–08:40 **Open Bankart: The Repair and the Shift in Closing**

Jiwu Chen, MD, PhD CHINA

Moderator: Stephen C. Weber, MD UNITED STATES

08:40–08:55 **Open Latarjet**

Andreas B. Imhoff, MD, Prof. GERMANY

Moderator: Kevin P. Shea, MD UNITED STATES

10:35–10:50 **Lateral Acromioplasty: How to Change the CSA**

Francesco Franceschi, MD, PhD ITALY

Moderator: Enrique A. Salas, MD VENEZUELA

10:50–11:05 **Capsule and CHL Release in RCR Surgery**

Giuseppe Milano, MD ITALY

Moderator: Nahum Rosenberg, Prof. MD, FRCS ISRAEL

11:15–11:30 **Double Row Repair**

Knut Beitzel, MD, MA GERMANY

Commentator: Anthony A. Romeo, MD UNITED STATES

Morning Pre-Course: Knee Surgical Techniques (Presented in Spanish)

Concurrent 2–Cozumel 1+5

09:20–09:35 **Posterolateral Corner Anatomy and The Anatomic Reconstructions**

Robert F. LaPrade, MD, PhD UNITED STATES

Commentator: Jorge Chahla, MD, PhD UNITED STATES

Moderators: Pablo E. Gelber, MD, PhD SPAIN

Horacio F. Rivarola Etcheto, MD ARGENTINA

09:35–09:50 **Maximizing ACL Reconstruction. ALL Inside Quadriceps Tendon Graft**

Moises Cohen, MD, PhD, Prof. BRAZIL

Commentator: O. Rolando Suarez, MD PERU

Moderators: Horacio F. Rivarola Etcheto, MD ARGENTINA

Pablo E. Gelber, MD, PhD SPAIN

09:50–10:05 **Medial Patellofemoral Ligament Reconstruction and ATT**

João Espregueira-Mendes, MD, PhD PORTUGAL

Commentator: O. Rolando Suarez, MD PERU

Moderators: Horacio F. Rivarola Etcheto, MD ARGENTINA

Pablo E. Gelber, MD, PhD SPAIN

11:35–11:55 **The Perfect Measured Resections and Gap Balancing Techniques**

Philippe N. Neyret, MD, PhD FRANCE

Commentator: David Figueroa, MD, Prof. CHILE

Moderators: Guillermo J. Allende, MD, Prof. ARGENTINA

Fernando Motta, MD URUGUAY

Add “Pre-Course Day”* to Your Congress Registration to attend the Pre-Course Surgical Demonstrations

*Additional fee required.

Afternoon Pre-Course: Shoulder Surgical Techniques (Presented in Spanish)

Concurrent 2–Cozumel 1+5

13:55–14:10 **Arthroscopic Latarjet**
Emilio Calvo, MD, PhD, MBA SPAIN
Commentator: Enrique A. Salas, MD
VENEZUELA
Moderator: Benno Ejnisman, MD BRAZIL

15:45–16:05 **Superior Capsule Reconstruction.
The Technique by The Designer**
Teruhisa Mihata, MD, PhD JAPAN
Commentator: Pablo Adelino Narbona, MD
ARGENTINA
Moderators: Guillermo Arce, MD
ARGENTINA
Emilio Calvo, MD, PhD, MBA SPAIN
Benno Ejnisman, MD BRAZIL

16:25–16:45 **Reverse Shoulder Arthroplasty**
Anthony A. Romeo, MD UNITED STATES
Commentator: Vicente Gutierrez, MD CHILE
Moderators: Guillermo Arce,
MD ARGENTINA
Osvandré Luiz Lech, Prof. BRAZIL

SUNDAY, MAY 12

General Session–Gran Cancun

09:00–09:45 **Anatomical Variation of ACL as Related
to Reconstruction**
Christian Fink, MD, Prof. AUSTRIA
Freddie H. Fu, MD UNITED STATES
Moderator: Frank A. Cordasco, MD, MS
UNITED STATES

Concurrent 2–Cozumel 1+5

09:45–10:30 **Management of a First Time
Shoulder Dislocation**
Philippe Landreau, MD FRANCE
Moderator: Vicente Gutierrez, MD CHILE

Concurrent 4–Cozumel 2+A

11:00–12:00 **Arthroscopic Hip Surgery**
Olufemi R. Ayeni, MD, PhD, MSc, FRCSC
CANADA
Moderator: Nicolas Bonin, MD FRANCE

Concurrent 3–Cozumel 3+4

14:15–14:45 **Meniscal Root Repair**
Robert F. LaPrade, MD, PhD
UNITED STATES
Moderator: Sachin R. Tapasvi, MBBS, MS,
DNB, FRCS INDIA

Concurrent 4–Cozumel 2+A

15:30–16:30 **Arthroscopic Superior Capsule
Reconstruction for Irreparable Rotator
Cuff Tears**
Albert Lin, MD UNITED STATES
Moderator: Teruhisa Mihata, MD, PhD
JAPAN

MONDAY, MAY 13

Concurrent 3–Cozumel 3+4

11:00–12:00 **How to Perform a Safe and Reproducible
PCL Reconstruction**
Alan Getgood, MD, FRCS(Tr&Orth), DipSEM
CANADA
Moderator: Fabrizio Margheritini, MD ITALY

General Session–Gran Cancun

13:30–14:15 **Open Latarjet**
Andreas B. Imhoff, MD, Prof. GERMANY
Moderator: Giovanni Di Giacomo, MD
ITALY

14:15–15:00 **Arthroscopic Latarjet**
Ivan Wong, MD, FRCSC, MACM,
Dip. Sports Med CANADA
Moderator: Emilio Calvo, MD, PhD, MBA
SPAIN

Concurrent 3–Cozumel 3+4

15:30–16:30 **High Tibial Osteotomy**
Peter T. Myers, MBBS, FRACS, FAOrthA
AUSTRALIA
Moderator: Philippe N. Neyret, MD, PhD
FRANCE

Concurrent 4–Cozumel 2+A

16:15–17:00 **Arthroscopic Hip Labral Reconstruction**
Marc J. Philippon, MD UNITED STATES
Moderator: Allston Stubbs, MD, MBA
UNITED STATES

17:00–17:45 **Gluteus Medius**
J.W. Thomas Byrd, MD UNITED STATES

SURGICAL DEMONSTRATIONS CONTINUED

TUESDAY, MAY 14

Concurrent 3–Cozumel 3+4

10:30–11:30 **Standard Rotator Cuff Repair**
Enrique A. Salas, MD VENEZUELA
Moderator: Dan Guttman, MD
UNITED STATES

General Session–Gran Cancun

13:30–14:00 **How to Perform Extra
Articular Tenodesis**
Eivind Inderhaug, MD, PhD, MPH NORWAY
Moderator: Andy Williams, MBBS,
FRCS(Orth), FFSEM(UK) UNITED KINGDOM

14:00–14:30 **How to Perform an ALL Reconstruction**
Steven Claes, MD, PhD BELGIUM
Moderator: Bertrand Sonnery-Cottet, MD
FRANCE

General Session–Gran Cancun

15:30–16:30 **How to Surgically Manage the Medial
Structures Around the Knee**
Martin Lind, MD, PhD, Prof. DENMARK
Moderator: Daniel B. Whelan, MD, MSc,
FRCSC CANADA

16:15–16:45 **Posterior Lateral Corner Reconstruction**
Scott Faucett, MD, MS UNITED STATES

Concurrent 4–Cozumel 2+A

16:45–17:30 **Insertional Achilles Tendinopathy Repair
with Excision of Haglund's Deformity**
Markus Walther, MD GERMANY
Moderator: Mark Glazebrook MSc, PHD,
MD, FRCSC CANADA

WEDNESDAY, MAY 15

Concurrent 2–Cozumel 1+5

11:15–12:00 **Reverse Shoulder Arthroplasty**
Anthony A. Romeo, MD UNITED STATES

General Session–Gran Cancun

13:30–14:15 **Robotic-Assisted Bi-Cruciate Retaining
Total Knee Replacement**
Sebastien Lustig, MD, PhD, Prof. FRANCE

Concurrent 2–Cozumel 1+5

14:15–15:00 **Improving Healing for Massive Rotator
Cuff Repair**
Felix H. Savoie III, MD UNITED STATES

Concurrent 3–Cozumel 3+4

15:30–16:30 **Calipered Kinematic Alignment in Total
Knee Arthroplasty**
Stephen M. Howell, MD UNITED STATES
Moderator: Myles R. J. Coolican, FRACS
AUSTRALIA

Concurrent 4–Cozumel 2+A

16:30–17:30 **Combined MPTL and
MPFL Reconstruction**
Betina B. Hinckel, MD, PhD UNITED STATES
Moderator: Elizabeth A. Arendt, MD
UNITED STATES

CANCUN TOURS

EXPLORE ALL THAT CANCUN HAS TO OFFER!

ISAKOS arranged for Congress attendees and their guests to have the opportunity to register for day tours in Cancun and the surrounding areas. Please note, tour logistics and specifics are subject to change.

Important Note: Unsold tours will be shared with other attendees, not associated with the Congress. Tour prices are quoted in \$ USD, per person (additional taxes and fees may apply).

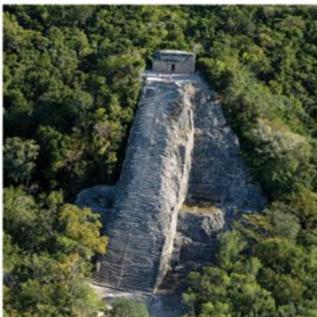
Book online at isakos.com/2019/Travel#Tours or at the **Tours Desk on-site at the **ISAKOS Congress****

COBÁ MAYAN ENCOUNTER

Visit the impressive archaeological site of Coba and discover the amazing Nohoch Mul, the tallest temple in the Yucatan Peninsula.

From the top, you will have stunning views of the jungle. Visit a secluded Mayan village and enjoy its well preserved natural beauties, lagoons, cenotes (sinkholes), jungle paths, and the natural reserve that protects the local flora and fauna.

Rappel down thrilling cenotes and soar the canopy in breathtaking ziplines, swim in hidden caves and walk through the jungle learning about the environment. Enjoy a lush meal of typical food, soft drinks and hand-made tortillas.



JUNGLA MAYA NATIVE PARK

Discover Jungla Maya—the main entrance into the amazing Sac-Actun system, the world's longest underground river (explored and recommended by National Snorkeler specialized cave divers). Snorkel surrounded by awesome rock formations. Ride through the jungle on our all-terrain Mercedes Benz Unimogs. Rappel down into a cenote (underground cave) and swim in a unique natural pool. Enjoy nature flying over the jungle's foliage on exciting ziplines. Participate in a traditional Maya purification ceremony.

XCARET PLUS

We invite you on a journey through Mexico, a charming tour of traditions and nature at Xcaret eco-archaeological Park. Come and enjoy an unforgettable experience that includes entertainment, exquisite food and the joy of a country that welcomes you with open arms!

Delve into the trails of Xcaret to discover how the Mayan jungle and culture of Mexico combine in more than 50 exciting attractions. Located on the seashore near Cancun in the Riviera Maya, Xcaret has attractions for everyone. Enjoy a traditional Fiesta Charra and the Mayan Ball Game, or if you are a nature lover visit the Jaguar Island and our colorful Butterfly Pavillion.

You can also enjoy the Caribbean Sea! Take a snorkeling tour, swim in underground rivers and have fun with the Dolphin Swim. When night falls, you will be our guest of honor at the presentation "Xcaret Mexico Espectacular", a celebration of light and color with 300 artists that will take you through the history of Mexico.



CANCUN TOURS CONTINUED

CHICHÉN ITZÁ

Discover the secrets surrounding the enigmatic architecture of Chichén Itzá and admire its most famous vestige, the pyramid of Kukulcán, testimony to the high mathematic and astronomical precision achieved by the Maya. Even today surprising events occur, such as the shadowy descent of the feathered serpent during the equinox, and the mysterious sound effects you can hear echoing during your tour.

Later at Valladolid, contemplate the beauty of Zací cenote, and finish your adventure with a buffet meal with unlimited beverages included at La Casona de Valladolid. Taste more than 70 dishes of Yucatecan cuisine, such as Cochinita Pibil (roasted pig marinated in sour orange juice and axiote), the Pok Chuk (pork prepared in citrus marinade) and the Tikinixik fish (fish with axiote cooked over the grill).



XENOTES

Four different kinds of Xenotes in one tour!

Dare to live a unique journey into nature with Xenotes Oasis Maya Tour, by Experiencias Xcaret. The adventure begins with a pick-up van with a friendly guide, who will take you from your hotel to four different kinds of cenotes in the heart of the jungle.

- Descend by assisted rappel to a wonderful turquoise blue water cenote, sheltered by an ancient cave.
- Fly with fun ziplines that slide into a refreshing splashdown.
- Practice kayaking surrounded by a landscape full of exotic vegetation.
- Swim in the refreshing waters of a paradisiac cenote.

In addition, your Tour includes food and beverages, and even the use of two towels, so you have nothing to worry about!

With Xenotes Oasis Maya Tour you can be the intrepid explorer you have always dreamed to be. All the activities are safe and performed in small groups, that allows a personalized attention from your guide. It's ideal for the whole family.



XENSES

Come and spend very special moments at Xenses, a half day park with activities and fantastic scenarios to arouse your senses to the fullest.

Inconsensible Circuit

Discover... a nonsensical Mexican Town that will test your balance, a fast descent on a Slip slide, a Bird Flight zipline, and a Natural Xpa with activities like being covered in mud, floating in a salt river, and purifying your skin with potent streams of water.

Consensible Circuit

Live... a tour through different ecosystems in pitch black darkness, a walkway to experience what it would be like to be a giant or a dwarf, a little piece of Eden to interact with nature, the inside of the Earth among caverns and caves, fun optical illusions, and a delicious lemonade tree at Xitric Garden.

Fantastic Scenarios

Capture extraordinary moments in more than 50 fantastic scenarios: pose in a tunnel of hearts, lift the weight of the world with your hands, float inside a pool without getting wet, kiss a giant stone face, be like Superman in the fortress of solitude, and visit the upside down house, among many others.

Xenses is a park where the sum of your emotions is greater than the totality of your senses!

XPLOR

Fly over the jungle on Ziplines, swim across an ancient river, paddle with your hands on board fun Rafts, drive an Amphibious Vehicle through the jungle, explore an underground world among caverns and impressive rock formations, and enjoy a unique activity at Xplor, an incredible Hammock Splash into a cenote.

Xplor is an all-inclusive park (no alcoholic drinks) where you can taste original and delicious beverages, as well as delight with an exquisite buffet available whenever you want, every time you want.

Whether flying, driving, swimming or paddling at Xplor, you can have thrilling experiences that take fun to the extreme.

ALL INCLUSIVE XEL-HA

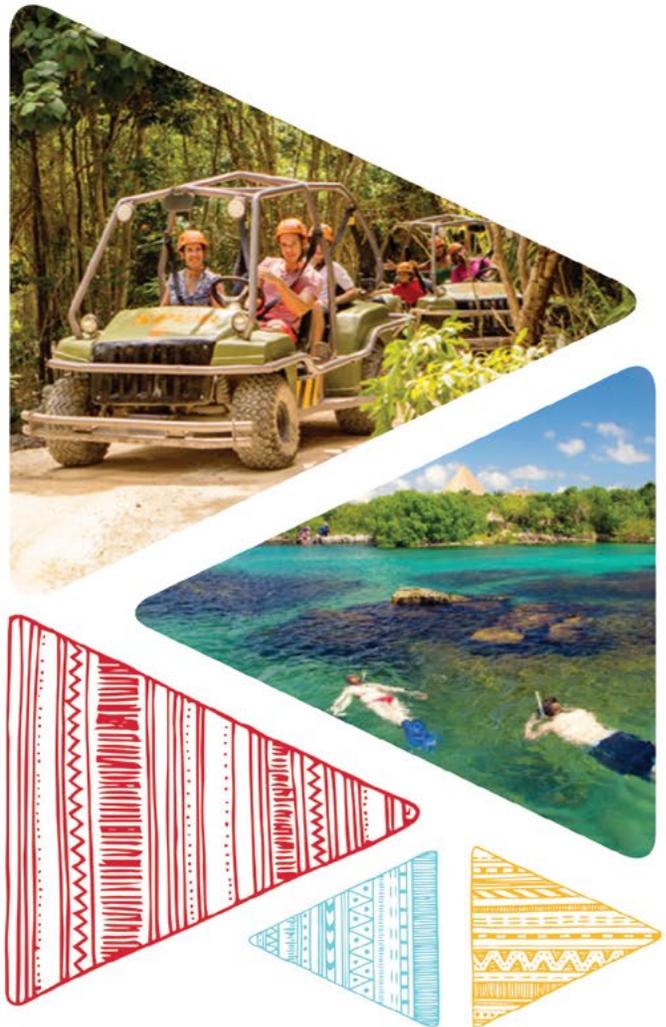
Xel-Há is a true paradise for nature lovers and an amazing natural aquarium. It is located in the Riviera Maya, Quintana Roo, Mexico, and since 1995 it is a model for sustainable tourism development, with unique family attractions.

The ancient Mayas baptized this wonderful site with the name Xel-Há, which in the Mayan language means "where the water is born".

Due to its privileged location, during pre-Hispanic times Xel-Há served as an inner port, trading center, place of pilgrimage and shelter for sailors, as well as being a food reserve during bad weather.

According to legend, Mayan gods joined together their wisdom, illusions and love for beauty to create a place that would bring together the best of nature, and that place was called Xel-Há. Once created, the gods were so pleased with this heavenly place that they decided to permit the entry of all mortals. To take care of it and the elements that surround it, the gods appointed three guardians: Huh, the Iguana, Guardian of the Land, Chuc Kay, the Pelican, Guardian of the Air, and Kay Op, the Parrotfish, Guardian of the Water. It is said that these guardians still protect and care for the Park and everyone who comes to visit.

This Natural Wonder is an unparalleled place of beauty. Swim and snorkel among tropical fish that have made the inlet of Xel-Há their home. Discover the jungle trails of this paradise by foot, bicycle or mini train. Admire different species of flora and fauna in their natural habitat during your tour. Enjoy an unforgettable experience in an All Inclusive Park. Indulge your taste buds with traditional Mexican dishes in any of the four restaurants or enjoy popular flavored drinks or a refreshing cocktail here at Xel-Há.



CANCUN TOURS CONTINUED

TOUR TULUM – XEL-HÁ

The Tour Xel-Há Tulum takes you through the impressive archaeological site of Tulum, an icon of the Mayan culture in the Mexican Caribbean, whose location is unique as it is located on the coast of Quintana Roo. Enjoy spectacular views of the Caribbean Sea from a privileged spot and contemplate the turquoise color of the ocean. Explore this ancient ceremonial center and get to know the history of this place with a certified guide that will reveal secrets of this walled city.

Afterwards, visit the most beautiful Natural Wonder of the Riviera Maya, Xel-Há, the perfect spot for snorkeling. You will witness lots of tropical fish and marine life thanks to its enormous natural cove that meets with the open sea. Have fun with your family and friends with various activities, among them ziplines, bicycles, inner tubes, and jumps from the Cliff of Courage, or visit the Meliponary and the Mayan Wall.



ISLA MUJERES / ISLA CONTOY

Enjoy an unforgettable experience crossing the crystal blue Caribbean Sea to a place that few have had the privilege to discover.

This virgin island, barely 5.2 miles long and only 70 feet at its narrowest point. It is located about 45 minutes north of Isla Mujeres, situated at the beginning of the second largest coral reef chain in the world. The beaches are shallow, clear, and calm, with an abundance of aquatic life that will thrill any snorkeler. Isla Contoy is internationally recognized for its flora and fauna, especially the birds, of which more than 90 species are considered either resident or migratory.

This natural paradise is a quality tour, uniquely and exclusively for Cancun and those visiting the island aboard The Asterix vessels. There is no more comfortable way to enjoy it.



SNORKEL ADVENTURE

Discover the incredible marine life by snorkeling in two different reefs of the National Park of Puerto Morelos, the second largest barrier reef in the world. Discover the underwater world inhabited by beautiful multicolored fish and spectacular reef formations. Learn about local biodiversity thanks to the explanations provided by our knowledgeable guides. Rest in the charming and exclusive beach club while admiring the turquoise tones of the Caribbean Sea and enjoy a delicious traditional snack and open bar (optional). Enjoy the best snorkel adventure in Riviera Maya.

XOXIMILCO

Xoximilco is from start to finish the most traditional Mexican party in Cancun and Riviera Maya. The night begins by having fun with family and friends in a traditional Mexican carnival with amusing games, esquites (corn snacks) to build up your appetite, and an entertaining musical surprise. The perfect send-off to a very special night.

The night continues along incredible canals on board colorful Mexican Gondolas that take you through the natural scenery of Xoximilco Cancun, where you will enjoy the delicious flavors of Mexican cuisine and the tequila, beer, soft drinks and fresh flavored water open bar, accompanied by live music with the most popular rhythms of Mexico that will make you sing and dance. Turn your night into a celebration of culture and traditions! All the folklore and passion of Mexico in a great celebration.





12TH Biennial
ISAKOS
CONGRESS 2019
Cancun, Mexico • May 12–16, 2019

MICHAEL CASALE, PhD PRESIDENTIAL GUEST SPEAKER



USING VIRTUAL REALITY TO IMPROVE
SURGERY, SPORTS MEDICINE, AND
ATHLETIC PERFORMANCE

General Session—Gran Cancun

Tuesday, May 14

09:35–10:10

Dr. Michael Casale is a cognitive neuroscientist whose research is focused on understanding the biological underpinnings of learning and memory. His research is aimed at understanding how to best optimize training for a variety of learning situations as well as understanding how to optimize training in order to ensure maximum benefit to the learner. He has also led multi-year / multi-million dollar research projects aimed at understanding how virtual technologies can be used to facilitate the effectiveness of behavioral therapy and the brain basis underlying such processes. His work has been published dozens of times in notable peer-reviewed journals such as *Memory & Cognition* and *the Journal of Cognitive Neuroscience*. At STRIVR, Dr. Casale is able to blend his academic and applied research expertise to help develop training methodologies that optimize performance using immersive technologies.

 @michaelbcasale

ISAKOS CONGRESS PRE-COURSES

SATURDAY, MAY 11, 2019

Add Pre-Course Day* to Your Congress Registration!

ISAKOS Congress Pre-Courses are to be held on Saturday, May 11, 2019. Pre-Course Day Registration includes admission to one morning and one afternoon Pre-Course.

Program information, agendas and faculty details are subject to change. Please check the Interactive Agenda for the most up-to-date information—isakos.com/2019/PreCourses

MORNING PRE-COURSES

Updating and Upgrading the Knee Surgical Techniques (Presented in Spanish)

Actualización y Perfeccionamiento de las Técnicas Quirúrgicas de la Rodilla (En Español)

Guillermo Arce, MD ARGENTINA
Moises Cohen, MD, PhD, Prof. BRAZIL
João Espregueira-Mendes, MD, PhD PORTUGAL
David Figueroa, MD, Prof. CHILE

During this pre-course, tips and tricks of the latest knee surgical techniques will be presented and thoroughly discussed in Spanish.

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of **3.75 AMA PRA Category 1 Credits™**.

Current Concepts in Shoulder Surgeries: New Insights in Instability and Rotator Cuff Repair

Andreas B. Imhoff, MD, Prof. GERMANY
Felix H. Savoie III, MD UNITED STATES

This pre-course will present the latest techniques in shoulder stabilization and also new insights in rotator cuff repair, including tendon to bone healing and superior capsule reconstruction. Each presentation will be moderated separately to involve attendees.

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of **5.0 AMA PRA Category 1 Credits™**.

Knee Arthroplasty: All You Need to Know

Myles R. J. Coolican, FRACS AUSTRALIA
Sebastien Lustig, MD, PhD, Prof. FRANCE

Following this pre-course, participants will be able to understand how to do a primary TKA and how to treat more difficult cases such as severe varus or valgus deformity by total knee arthroplasty. Indications and surgical techniques for unicompartmental knee arthroplasty and BCR TKA will also be reviewed and discussed.

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of **3.0 AMA PRA Category 1 Credits™**.

AFTERNOON PRE-COURSES

Updating and Upgrading the Shoulder Surgical Techniques (Presented in Spanish)

Actualización y Perfeccionamiento de las Técnicas Quirúrgicas del Hombro (En Español)

Guillermo Arce, MD ARGENTINA
Emilio Calvo, MD, PhD, MBA SPAIN
Benno Eijnisman, MD BRAZIL
Francesc Soler, MD, PhD SPAIN

Case-based pre-course approaching the latest shoulder controversies and surgical techniques with a thorough discussion in Spanish.

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of **4.0 AMA PRA Category 1 Credits™**.

*Additional Fee Required

AFTERNOON PRE-COURSES

The Sports Medicine Physician

João Espregueira-Mendes, MD, PhD PORTUGAL
 Scott C. Faucett, MD, MS UNITED STATES
 Mark R. Hutchinson, MD, FACSM UNITED STATES
 Sérgio R. Piedade, MD, PhD, Assoc. Prof. BRAZIL

The goal of this pre-course is to promote understanding of topics in sports medicine, discussing and sharing academic and clinical experiences of a sports medicine physician practice, and offering up-to-date information on such topics as: sports practice principles, special clinical conditions, biologic treatment in sports injuries, sports trauma of the head, face, spine, thoracic, abdomen, groin, and the role of the sports medicine physician at major events in sports including extreme sports, winter games, Olympic games and martial arts.

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of **4.5 AMA PRA Category 1 Credits™**.

Masterclass in Knee Sports and Preservation Surgery: A Case Based Approach

Elizabeth A. Arendt, MD UNITED STATES
 Mark Clatworthy, FRACS NEW ZEALAND
 Seth L. Sherman, MD UNITED STATES
 Sachin R. Tapasvi, MBBS, MS, DNB, FRCS INDIA
 Christopher J. Vertullo, MBBS, PhD, FRACS(Orth) AUSTRALIA
 Timothy S. Whitehead, MBBS, FRACS AUSTRALIA

This pre-course will offer participants advanced case-based surgical techniques in knee sports and preservation. The following topics will be presented: complex ACL and revision, PCL and multi-ligament knee surgery, meniscal repair, root and ramp lesion repair, combined ACL and HTO surgery, osteotomies for lateral compartment OA, treatment for large chondral defects, patella instability and OA treatment in the young and athletic.

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of **3.25 AMA PRA Category 1 Credits™**.

CME CERTIFICATION



This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American Academy of Orthopaedic Surgeons and the International Society of Arthroscopy, Knee Surgery and Sports Medicine. The American Academy of Orthopaedic Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

Congress Program

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of **33.5 AMA PRA Category 1 Credits™**

Sports Rehabilitation Concurrent Course

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of **17.75 AMA PRA Category 1 Credits™**

Visit isakos.com/2019/Program#CME for more information.



ISAKOS PUBLICATIONS



Full Access in myISAKOS

ISAKOS Members can access all official ISAKOS Publications through myPublications in myISAKOS—including *Journal of ISAKOS*!

isakos.com/books

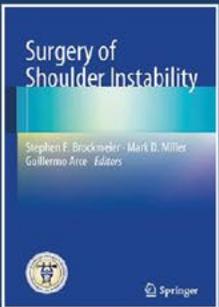
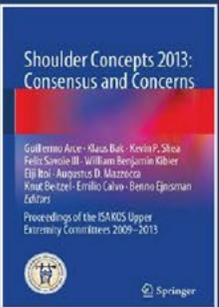
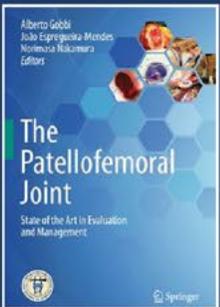
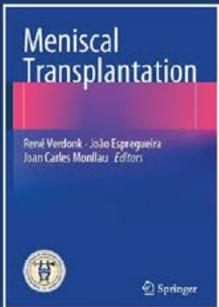
New ISAKOS Publications—USB Drives

ISAKOS Members Only

ISAKOS would like to present Members with a complimentary USB Drive, pre-loaded with the latest ISAKOS Publications!

Available at
the 2019
ISAKOS
Congress
Only!

Onsite at the Congress, redeem the ePubs USB ticket at the Backpack Distribution booth inside the Exhibit Hall. The Ticket can be found in the Congress packet you receive at Registration. USBs will be available on a first-come, first-served basis.



*Management of Knee
Osteoarthritis*

The Menisci

*Shoulder Instability Across
the Life Span*

Muscle and Tendon Injuries

Elbow Arthroscopy

*Shoulder Concepts 2013:
Consensus and Concerns*

Meniscal Transplantation

Surgery of Shoulder Instability

*Controversies: Technical
Aspects of ACL Reconstruction*

*Soft Tissue Balancing in Total
Knee Arthroplasty*

*Injuries and Health Problems in
Football*

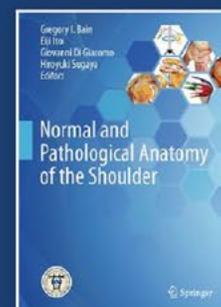
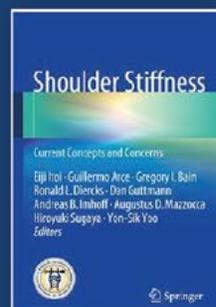
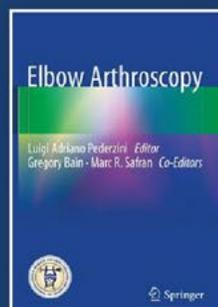
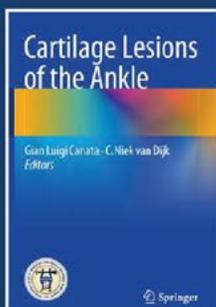
Bio-orthopaedics

Cartilage Lesions of the Ankle

*Normal and Pathological
Anatomy
of the Shoulder*

*Shoulder Stiffness—Current
Concepts and Concerns*

The Patellofemoral Joint



Is There a Role for Primary ACL Repair and Biologics?



Jorge Chahla, MD, PhD
Cedars Sinai Kerlan Jobe Institute
Santa Monica, CA UNITED STATES



John G. Lane, MD
Musculoskeletal and Joint
Research Foundation
San Diego, CA UNITED STATES



Graeme P. Whyte, MD, MSc
Cornell University, Weill Medical College;
New York Presbyterian Hospital/Queens
New York, NY UNITED STATES
O.A.S.I. Bioresearch Foundation NPO
Milan, ITALY



Alberto Gobbi, MD
O.A.S.I. Bioresearch Foundation NPO
Milan, ITALY

Abstract

Anterior cruciate ligament (ACL) injury is one of the most common injuries in orthopaedics; however, limited advancements have been made in recent decades regarding the treatment of this condition. One of the most concerning complications of such an injury is posttraumatic osteoarthritis resulting from progressive cartilage injury. This type of progressive cartilage damage is likely impacted by altered biomechanics, leading to subsequent intra-articular structural damage and changes to the intra-articular milieu. Improved understanding of the pathophysiology of ligamentous healing and several recent studies have shed further light on ACL repair procedures, which previously have been dismissed as a primary treatment option because of the high rate of failure. Our study of a small sample of carefully selected patients demonstrated that ACL primary repair in combination with biological augmentation can offer satisfactory clinical outcomes.

Keywords: anterior cruciate ligament, ACL repair, biomechanics, ACL reconstruction

ACL Injury and Treatment Considerations

It is well recognized that disruption of the ACL alters knee kinematics and significantly increases the risk for knee osteoarthritis (OA), with 60% to 90% of patients demonstrating evidence of knee OA 10 years after ACL reconstruction. Although current methods to reconstruct the ACL generally are perceived to be successful, recent analyses have indicated that normal structure and function of the knee may not be fully restored in many patients undergoing reconstruction. Furthermore, the literature suggests that ACL reconstruction does not reduce the risk of developing OA, as 42% to 90% of affected knees have radiographic evidence of OA within 7 to 12 years after ACL surgery.

Given the expected natural history of progressive articular cartilage injury in a notable proportion of ACL injuries, it is a high priority for treating orthopaedic surgeons to develop techniques that not only achieve good short- to long-term restoration of knee stability but also minimize or eliminate the long-term risk of OA. Previous clinical studies examining ACL repair procedures have demonstrated an excessively high failure rate, which has shifted the treatment paradigm away from primary repair. Importantly, however, advancements in modern surgical instruments must be considered, given their potential to allow for better fixation of injured ligamentous tissue as well as to provide biologic augmentation to overcome the limited native healing capabilities of the ACL.

Because of the evolving understanding of regenerative medicine, biological approaches to augment surgical repair procedures have been exponentially growing over the past several decades. The use of these biologic therapies (including growth factors, autologous blood products, and progenitor cells) has been a prominent focus of current research into ACL healing after repair and is regarded as a potential alternative to ACL reconstruction in well-selected cases. These adjunctive therapies, combined with modern methods of primary repair of the injured ligament, may be an important advancement in the treatment of certain injury patterns. These therapies may have the potential to better preserve joint kinematics by restoring function of the native ligament while also avoiding the risk of certain complications related to ACL reconstruction, such as donor-site morbidity resulting from autologous tendon harvest and postoperative muscular weakness.

Numerous factors have been shown to contribute to the suboptimal healing capacity of the ACL, including (1) the presence of synovial fluid within the intra-articular space (which contributes to persistent gapping between injured ligamentous fibers and inhibits blood clot formation), (2) variations in the post-injury inflammatory response and cell metabolism, (3) intrinsic cell deficiencies, (4) insufficient vascular supply and (5) altered load-bearing characteristics.

Because of the expected poor healing capabilities of the native ligament, the gold standard of treatment in cases of symptomatic ACL insufficiency is reconstruction of the damaged ligament with use of autograft or allograft tissue. While repair of the injured ACL potentially can provide expected long-term benefits, including the restoration of native joint kinematics, any repair procedure needs to adequately address the currently expected deficiencies of primary repair. Therefore, it is necessary to clearly delineate which ACL injury patterns are appropriate for such repair procedures.

The Role of Biologics

Transforming growth factor-beta1 (TGF- β 1), fibroblast growth factor-2 (FGF-2), growth and differentiation factors, and basic-FGF (bFGF) have been reported to regulate and improve cellular activities and proliferation, extracellular matrix (ECM) deposition, and influence the differentiation of mesenchymal stem cells (MSCs) into fibroblasts in the repair process of torn ligaments. Platelet-rich plasma (PRP) is known to contain a combination of bioactive agents that are capable of mediating tissue-healing processes during both the inflammatory and remodeling phases following an injury. Platelets are involved in homeostasis and clot formation, which are critically important components of tissue healing. These processes are mediated by the release of such factors as platelet-derived growth factor (PDGF), TGF- β 1, vascular endothelial growth factor (VEGF), bFGF, and epidermal growth factor (EGF) through the degranulation of alpha granules. Among these growth factors, PDGF and TGF- β 1 are particularly important modulators that contribute to increased fibroblast proliferation and collagen production during the healing process.

Cell therapy has been widely studied *in vitro* and in preclinical studies. Multipotent cells in the form of mesenchymal stem cells (MSCs) have been isolated from a number of tissues for clinical use, including bone marrow aspirate concentrate (BMAC) and lipoaspirate. An updated theory on the origins of mesenchymal stem cells has identified *pericytes* as the specialized cell of interest¹. Pericytes reside alongside blood cells as a component of the perivascular niche. These cells become activated in response to injury, subsequently releasing a complex assortment of bioactive molecules and creating a microenvironment for tissue repair by stimulating regenerative processes and retarding aggressive immune responses that may impair the healing process.

ACL Repair with Biologic Augmentation

Steadman et al. pioneered biologic treatment of ACL injury by using a healing response procedure (microfracture of the intercondylar notch) to treat these injuries and reported their initial findings in a study of skeletally immature athletes². This work was then expanded to include the treatment of ACL injuries in an older patient cohort³.

More recently, Gobbi et al. described a treatment method involving primary suture repair of the ACL combined with biologic augmentation. In their first report on this method, 26 athletes with symptomatic ACL insufficiency underwent primary repair and marrow stimulation and were followed for a mean of 25 months⁴. All patients had been diagnosed with incomplete proximal tears of the ACL and underwent surgical treatment within 4 weeks after the injury. High rates of return to the pre-injury level of activity were achieved as demonstrated by the mean Tegner and Marx scores at the time of the latest follow-up.

The mean side-to-side difference in anterior tibial translation decreased significantly, from 3.5 mm preoperatively to 1.3 mm postoperatively. In a subsequent study, 50 patients who underwent this treatment were assessed after an intermediate-term follow-up of 5 years⁵. At the time of the latest follow-up, 78% of the patients had returned to the pre-injury activity level, with postoperative IKDC objective scores being categorized as normal for 39 patients, nearly normal for 10 and severely abnormal in 1 patient. Recurrent ACL insufficiency was identified in 5 patients. Importantly, the technique of primary ligament repair and marrow stimulation may be further augmented by the addition of activated PRP and/or BMAC to the repair site, providing an array of critical bioactive molecules and cellular elements to help coordinate repair processes and to limit inflammatory responses that may be associated with degeneration of injured ligamentous tissue. Most recently, long-term outcomes (mean, 10 years; maximum, 14 years) have been examined after primary ACL repair with biologic augmentation (Gobbi et al., data submitted for publication). Activity levels at the final follow-up were comparable with the pre-injury status according to Tegner scores, and good to excellent outcomes were achieved according to IKDC subjective, Lysholm, and KOOS scores. Successful outcomes were also comparable between all types of partial ACL tears treated.

Surgical Technique: Primary ACL Repair with Biologic Augmentation (Fig. 1)

An examination is performed with the patient under anesthesia to identify instability consistent with ACL insufficiency. Diagnostic arthroscopy is then used to confirm the ACL injury and to characterize the specific injury pattern. ACL repair is performed by passing No. 1 PDS suture through the proximal and distal ligament segments of the torn bundle with use of an arthroscopic suture-passing device of the surgeon's choice. Two to 3 sutures are typically passed for each repair. The sutures are tied arthroscopically, reapproximating and tensioning the disrupted bundle fibers. With use of a microfracture awl, several perforations are created within the notch, about the anatomic footprint of the ACL. Bone marrow aspirate is obtained from the ipsilateral iliac crest, and BMAC is isolated with use of a commercially available system.

Is There a Role for Primary ACL Repair and Biologics?

BMAC is clot activated with use of batroxobin enzyme to create a malleable gel and is applied arthroscopically to the repair site.

Summary

ACL reconstruction with use of either autogenous or allograft tissue is the accepted standard of care for most cases of symptomatic knee instability resulting from ACL insufficiency. ACL repair has been considered to be prone to failure, and there has been limited recent research into repair techniques, particularly with regard to certain injury patterns. There is renewed interest in treating properly indicated lesions with repair techniques that may better restore normal joint kinematics.

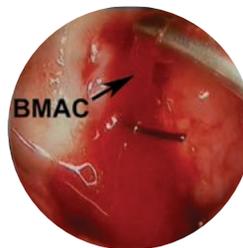
01 Arthroscopic images showing primary repair of an ACL injury.



01A No. 1 PDS suture is used to reapproximate the disrupted proximal and distal bundle tissue.



01B An awl is used to create several perforations of the lateral intercondylar notch about the anatomic footprint of the ACL to release marrow elements.



01C Activated bone marrow aspirate concentrate (BMAC) gel is applied to the repair site under dry arthroscopy.



01D Second-look arthroscopy at 6 months after primary ACL repair and biologic augmentation, demonstrating a healed ACL.

Commentary

This paper on primary ACL repair with biologic augmentation is of value to look at an older concept and see if it should be revisited. The initial work on primary repair by Feagin noted a high failure rate at 5 years. John Marshall attempted to improve this and noted a positive pivot shift in almost 40% of patients. As our surgical skills and techniques have improved, there is renewed interest in ACL repair. Gobbi et al. have added biologics to the suturing technique to aid healing. While this may help in theory, there is presently no proof of the value of biologics in this environment. The addition of stem cells from the iliac crest (BMAC) may be helpful, but it remains uncertain. It would also be helpful to know the number of stem cells present. In addition, some investigators believe that the peri-vascular stem cells required to promote healing are specific for each tissue.

The technique described by Gobbi et al. in this paper appears to be for mid-substance tears. If a repair was attempted, it may be better to work with avulsions. In Gobbi's paper in 2009, only patients with partial proximal tears were included. In this article, mid-substance tears were included.

As these techniques progress and appropriate injury patterns for such treatment are better delineated, it is possible that surgical options for ACL injuries will evolve.

References

1. Caplan AI, Correa D. The MSC: an injury drugstore. *Cell Stem Cell*, vol. 9, no. 1, pp. 11–15, 2011.
2. Steadman JR, Cameron-Donaldson ML, Briggs KK, Rodkey WG. A minimally invasive technique (“healing response”) to treat proximal ACL injuries in skeletally immature athletes. *J Knee Surg*. 2006;19(1):8-13.
3. Steadman JR, Matheny LM, Briggs KK, Rodkey WG, Carreira DS. Outcomes following healing response in older, active patients: a primary anterior cruciate ligament repair technique. *J Knee Surg*. 2012;25(3):255-260.
4. Gobbi A, Bathan L, Boldrini L. Primary repair combined with bone marrow stimulation in acute anterior cruciate ligament lesions: results in a group of athletes. *Am J Sports Med*. 2009;37(3):571-578.
5. Gobbi A, Karnatzikos G, Sankineani SR, Petrera M. Biological Augmentation of Acl Refixation in Partial Lesions in a Group of Athletes: Results at the 5-year Follow-up. *Tech Orthop*. 2013 Jun 1;28(2):180-4.

Steadman's work of creating a healing response with microfracture is noted, but most of his cases were older skiers with proximal avulsions, which in our experience can heal without surgery in some patients. I have treated a number of these non-operatively with rehabilitation and a follow up MRI in some has demonstrated good healing. In considering primary repair, the site of injury is important since mid-substance tears have injury throughout, while proximal avulsion may be more localized and possibly better candidates for repair in some patients. I have tried this recently with anchors and sutures in some older patients with proximal ACL tears. I have also done this suture repair for some PCL avulsions over the years. With mid-substance ACL tears, a reconstruction is more likely to be successful, as re-tensioning the injured tissue will be difficult and I believe they will tend to fail.

Overall, I have the impression that some healing after repair for partial tears or avulsions may occur and be of value. However, in my opinion, such cases are rare and reconstruction will more predictably result in a stable knee, particularly for competitive athletes with mid-substance tears.



Russell F. Warren, MD
Hospital for Special Surgery
New York, UNITED STATES

Rehabilitation After Arthroscopic Shoulder Surgery



Alfonso R. Barnechea, MD
Hospital Nacional Edgardo
Rebagliati Martins – EsSalud
Lima, PERU

As surgeons, our main objective after treating musculoskeletal injuries and conditions is to restore functionality and well-being to the patients under our care. To do so, we must focus first on the mechanical repair or reconstruction of injuries that otherwise would not heal appropriately (or at all). We also understand that, in patients with shoulder injuries, the specific organ or structure involved is not the only one that is affected; because shoulder function is dependent on soft-tissue balancing and neuromuscular coordination, shoulder injuries tend to compromise many adjacent (or even distant) musculoskeletal structures throughout the kinetic chain.

The shoulder is held in place by both static structures (e.g., the capsulolabral complex, glenohumeral ligaments, etc.) and dynamic structures (e.g., the rotator cuff and extrinsic muscles, scapular dynamic stabilizers, etc.). Also, the coordination and balance of the scapular muscles is fundamental to ensure stability of the scapula, which translates into a secure, stable platform on which all glenohumeral motion occurs.

Following an injury that comprises one or more structures within the shoulder, unconscious and conscious compensation occurs. Specifically, muscles that are used primarily for scapular stabilization start to produce motion, resulting in a loss of neuromuscular balance and, in turn, greater energy consumption, fatigue, and contracture of many peripheral stabilizers. In addition, the lack of glenohumeral motion due to pain or weakness starts a process of capsular shrinking and thickening, muscular atrophy, and chronic pain.

Challenges Related to Rehabilitation Therapy

Deciding Whether and When to Prescribe Physical Therapy

After performing an arthroscopic procedure, the surgeon must make several decisions regarding postoperative management. First, the surgeon must decide whether to send the patient to therapy; some surgeons still do not prescribe a formal therapy program for their patients.

Second, the surgeon must decide when to send the patient for therapy. Unfortunately, there is no consensus about when to start therapy, given the heterogeneity and low quality of evidence on the subject. Usually, this decision is made after considering the time that it will likely take for the repaired tissue to heal as well the magnitude of both the injury and the repair.

Designing and Implementing the Rehabilitation Plan

Once the decision has been made to send the patient to therapy, the surgeon must consider many factors regarding the rehabilitation system. One such factor is the number of steps that the patient must go through before finally reaching the therapist. In some systems, the surgeon sends the patient directly to the therapist, who evaluates the patient, designs a therapy plan, discusses the plan with the surgeon and, finally, applies the plan in conjunction with the patient. In other systems, a physiatrist interprets the surgeon's request and then designs a therapy plan, which is then executed by the therapist. In most cases involving the latter type of system, the patient receives therapy from different therapists, each with different ideas and manners of applying the techniques indicated by the physician, which can lead to either insufficient or overaggressive maneuvers and, ultimately, to undesirable results.

Type and Duration of Immobilization

The type and duration of immobilization after a repair also vary widely between surgeons; however, a 4 to 6-week immobilization period is generally preferred because of the time needed for tendons and/or capsulolabral structures to heal. With regard to the position of the limb when in a sling, there is no consensus about whether to leave the sling in rest position or to use abduction/rotation pillows.

General Principles of Shoulder Rehabilitation After Arthroscopic Surgery (Box 1)

Box 1

General Principles of Rehabilitation Following Shoulder Surgery

- Incorporate scapular stabilization exercises
- Protect the repair(s)
- Avoid or minimize stiffness
- Recover upper-limb kinetic chain

Three Stages of Recovery

Following a shoulder repair, there are three recognizable phases to recovery. The first phase, which usually lasts for 6 to 8 weeks, is characterized by healing of the repaired or grafted tissue into its osseous or soft-tissue attachment (e.g., cuff-to-footprint healing or labrum-to-glenoid healing).

Rehabilitation After Arthroscopic Shoulder Surgery

During this phase, the shoulder is immobilized with a sling or orthotic device in order to protect the repair, and therapy is focused on preserving joint range of motion as much as possible without compromising the repair. In addition, muscular contractures in the neck, scapula, upper thorax, and arm are treated and scapular exercises are started.

The second phase, which can last up to 3 months after surgery, is characterized by the recovery of motion and function. During this phase, the goal is to restore full passive and active motion of the glenohumeral and adjacent joints while strengthening and balancing the periscapular and dynamic stabilizer muscles.

The third phase, which usually lasts till 6 to 12 months after surgery, focuses on strengthening as well as on specific sports and/or occupational retraining. During this phase, the patient recovers strength and neuromuscular coordination throughout the entire kinetic chain and may return to sports or labor.

Scapular Stabilization

In order to achieve maximum functional recovery of the shoulder girdle, we also need to understand the role of scapular stabilization. Every movement that the upper limb performs occurs as a kinetic chain of sequential movements that proceed from proximal to distal. The initial transmission of energy from the core to the arm starts at the core, with lower extremity and trunk muscle activation. Then, scapular stabilizers hold the scapula in position for the energy to be transmitted through the glenohumeral joint and its associated structures and into the arm.

With this in mind, it is essential to start functional recovery of the shoulder by strengthening the scapular stabilizers, thereby increasing the efficiency of movement and minimizing energy consumption through incorrect activation and motion of periscapular muscles. Even in the setting of shoulder stiffness, this step is essential because of the need to retrain muscles that have become movers rather than stabilizers.

Rehabilitation After Specific Injuries

Rotator Cuff Injuries (Box 2)

It is commonly accepted that a period of immobilization of 4 to 6 weeks allows for tendon healing after an arthroscopic rotator cuff repair. However, immobilization itself leads to stiffness, muscular atrophy, and loss of function. There is no consensus on the optimal time after surgery to initiate physical therapy, and different protocols with different criteria have been described. So far, systematic reviews have shown that there is no statistically significant difference between early, accelerated-motion protocols and more conservative, protected-motion protocols.

Box 2

Key Points of Rehabilitation Following Rotator Cuff Repair

- Protect repair for 4 weeks on average
- Start passive motion/scapular exercises as soon as possible
- Progress to active-assisted and active motion according to tear size
- Start strengthening after full range of motion is achieved

A recent systematic review of systematic reviews¹ showed that there was no statistically significant difference between early and conservative therapy in terms of pain, function range of motion, and the retear rate; however, it should be noted there was great heterogeneity among the published studies. Some authors have suggested that smaller tears might be more amenable to earlier physical therapy than large or massive repairs². To avoid stiffness, the 3 to 4-week period is an acceptable time to start therapy; during that period, collagen fibers start to arrange their microarchitecture and therefore movement can help to avoid adhesions. Still, the quality of evidence is not great, and further high-quality studies may be necessary to further clarify this issue.

Shoulder Instability (Box 3)

In 2012, the American Society of Shoulder and Elbow Therapists published a consensus guideline regarding therapy after arthroscopic anterior capsulolabral repair³; to date, there is still a paucity of studies and protocols related to this issue. The principles that guide this consensus include protecting the repaired structures while selectively and progressively stressing neighboring, and also to progress motion and strengthening while protecting tissue healing. In the first phase (0 to 6 weeks), passive and active-assisted motion are initiated without exceeding stated external rotation goals. Initiating scapular strengthening has also begun. Range of motion should never be forced in this stage. In the second stage (6 to 12 weeks post-op), active exercises are initiated and neuromuscular control of the rotator cuff and scapular muscles is initiated, ending in full motion (except for 90° external rotation). In the third and final phase, the focus is on strengthening and neuromuscular balance, with the goal of achieving normal function. A recent systematic review indicated that there is no difference between early and conservative therapy programs in terms of recurrence rates and functional results⁴.

Shoulder Stiffness

Although physical therapy is the most widely used strategy for the treatment of primary frozen shoulder, current recommendations⁵ acknowledge there is no consensus regarding the effect, durability, and type of therapy.

Box 3**Key Points of Rehabilitation Following Instability Repair**

- Protect repair for 6 weeks on average (especially external rotation)
- Start passive motion/scapular exercises as soon as possible; avoid external rotation beyond neutral
- Progress to active-assisted and active motion, neuromuscular control
- Start strengthening after 12 weeks or after full range of motion is achieved

For maximum effectiveness, it is recommended that physical therapy should be combined with another intervention, such as steroid injections, capsular distention, mobilization, or capsular release. Preferably, physical therapy should be performed in the pain-free stage of the frozen phase. It should include scapular mobilization and retraining of scapular stabilizers. There is no difference between home-based and institutional programs in terms of effectiveness. If capsular release is indicated, therapy should start as soon as possible, both to continue improvement of range of motion and to avoid recurrent stiffness due to scarring after release.

Overview

Despite the lack of high-quality evidence regarding physical therapy after shoulder arthroscopic surgery, there is no significant difference between early and conservative therapy programs. All programs should include scapular neuromuscular stabilization and should take into account the healing times and phases of the different repaired tissues.

Future Directions

There is a clear need for high-quality, prospective, randomized controlled trials involving larger numbers of patients in order to determine the efficacy of rehabilitation strategies for each shoulder condition. It also will be necessary to establish consensus between surgeons and rehabilitation physicians/therapists in order to bridge the gap between specialties.

References

1. Mazuquin BF, Wright AC, Russell S, et al. Br J Sports Med 2018;52:111–121. 2. Thomson S, Jukes C, Lewis J. Rehabilitation following surgical repair of the rotator cuff: a systematic review. Physiotherapy. 2016 Mar;102(1):20-8. doi: 10.1016/j.physio.2015.08.003. Epub 2015 Sep 8 3. Gaunt BW, Shaffer MA, Sauers EL, et al. The American Society of Shoulder and Elbow Therapists' consensus rehabilitation guideline for arthroscopic anterior capsulolabral repair of the shoulder. J Orthop Sports Phys Ther 2010;40:155–68. 4. Brand H, van der Linde JA, van Deurzen DFP, et al. Lacking evidence for rehabilitation following arthroscopic Bankart repair: a systematic review JISAKOS 2017;2:14–20 5. Itoi, Eiji et al. Shoulder Stiffness: Current Concepts and Concerns. Arthroscopy 2016;32(7):1402 – 1414



ISAKOS GLOBAL CONNECTION

Education, Research and Collaboration

DONATE TO ISAKOS

Donations to ISAKOS directly support initiatives that ensure the growth of our specialty, the professional development of our members and enhanced patient care. Your generosity will enable the Society to implement programs in education and research for its members around the globe.

Ways to Give:

- ISAKOS Annual Fund
- ISAKOS Godfather Initiative
- Corporate Giving

Donate Today at
isakos.com/GlobalConnection

Quick Report: Anterior Cruciate Ligament Rupture in Females



Meghan E. Bishop, MD
The Rothman Orthopaedic Institute
New York, NY UNITED STATES



Anthony Romeo, MD
The Rothman Orthopaedic Institute
New York, NY UNITED STATES

Introduction

The elevated risk of anterior cruciate ligament (ACL) tears in female athletes has been well documented, with females being shown to have a 2 to 8 times higher risk of tearing the ACL than their male counterparts¹. Numerous studies have investigated this finding and have demonstrated sport-specific risks, with one meta-analysis showing female-male ACL tear incidence ratios of 3.5 in basketball, 2.67 in soccer, and 1.18 in lacrosse¹. Anatomical, hormonal, and neuromuscular sex-specific factors have all been associated with an increased risk of ACL injury. Understanding the multifactorial elements that contribute to a higher incidence of ACL injuries in female athletes is important for optimizing treatment and prevention strategies and providing the best care for these individuals. This report will provide a review of the most up-to-date literature regarding the extrinsic and intrinsic risk factors unique to females, prevention strategies, and treatment outcomes.

Risk Factors (Table I)

Extrinsic Risk Factors

With the rise of female participation in youth sports, the number of ACL injuries has increased, with a 2017 study by Beck et al. showing that the number of ACL tears per 100,000 person-years increased by 2.5% per year in females 6 to 18 years of age (compared with 2.2% in males) over a 20-year period. While the peak incidence of ACL tears appears to be in athletes in their late teens and early 20s, particularly in females after puberty¹, Nicholls et al., in a 2017 Icelandic nationwide database study of knee MRIs, found a second peak of ACL tears in women in their early 40s.

While the reasons for this second peak were not entirely clear, this finding suggests that females are remaining active longer and emphasizes the importance of recognizing that ACL injury is still a risk for the active adult female population.

Table I Risk Factors for ACL Injuries in Females

Extrinsic Risk Factors		
Epidemiology		
<ul style="list-style-type: none"> Increased female sports participation Parental history of ACL injury 		
Intrinsic Risk Factors		
Anatomic	Hormonal	Neuromuscular
<ul style="list-style-type: none"> Increased Q-angle Decreased femoral notch width Decreased ACL size Increased tibial slope Increased ligamentous laxity Increased BMI Increased incongruent medial and lateral compartments 	<ul style="list-style-type: none"> Increased estradiol Follicular and pre-ovulatory phases of menstrual cycle Increased relaxin Decreased testosterone 	<ul style="list-style-type: none"> Increased peak knee abduction angles during landing Increased quadriceps to hamstrings activity Increased lateral trunk displacement leading to increased knee valgus Altered trunk and hip flexion angles; increased ranges of trunk motion Weakness or poor neuromuscular control in hip external rotators Increased hip adduction and internal rotation leading to increased knee abduction moments Decreased trunk and hip flexion on landing leading to increased ground-reaction forces on lower extremity

Intrinsic Risk Factors

Anatomical factors:

Several anatomical factors unique to females have been implicated in the disparity between the sexes in terms of ACL injuries, including increased quadriceps angle (Q angle), smaller femoral notch width, smaller ACL size, increased tibial slope, increased ligamentous laxity, and increased body mass index (BMI)¹. With regard to knee geometry, Sturnick et al. found that a 1-mm decrease in notch width and a 1° increase in posteroinferiorly-directed lateral tibial slope in females were associated with 50% and 32% increases in the risk of ACL injury, respectively. While many of these anatomical features are more common in females, they are not necessarily specific to the female sex and are independent risk factors associated with ACL injury.

Hormonal factors:

Hormonal factors also have been associated with an increased risk of ACL injury. Estradiol, progesterone, and relaxin are the main hormones that have been noted to be related to ACL laxity and phases of the menstrual cycle². Testosterone also has been suggested to be protective against ACL injury, with animal studies having shown a higher ACL load to failure and ultimate stress in rats with comparatively higher circulating levels of testosterone³. Studies have shown that estradiol exposure can lead to a dose-dependent decrease in fibroblast and collagen synthesis in the ACL and that this effect can be lessened by the presence of progestins². These cyclical hormonal levels have been correlated with a higher risk of ACL injury in the follicular and pre-ovulatory phases of the menstrual cycle. A number of studies have shown that oral contraceptive use may be associated with a reduced risk of ACL injury, with Gray et al. finding that females 15 to 19 years of age who underwent ACL reconstruction were 18% less likely to use oral contraceptives than matched controls. Similarly, a Danish registry study by Rahr-Wagner et al. showed that the relative risk of ACL injury was 0.82 (95% CI, 0.75-0.90) when “ever users” (defined as those who had used oral contraceptives in the previous 5 years) were compared with “never users.”

Biomechanical and neuromuscular factors:

Biomechanical and neuromuscular factors also may predispose female athletes to ACL injuries by contributing to risky landing mechanics¹. Much research has focused in these areas as they encompass potential dynamically modifiable factors. Females tend to specifically recruit the quadriceps muscles at a greater rate than the hamstrings, resulting in a relative weakness of the hamstrings and a possible decrease in their knee-stabilizing properties. Additionally, research has suggested that preferential firing of the lateral hamstrings and lateral quadriceps in females increases the valgus stress on the knee. Decreased core and pelvic stability in females as compared with males also has been linked to inefficient lower-extremity landing mechanics.

All of these factors have been implicated as causing increased knee abduction angles and an increased risk of ACL injury.

Management and Outcomes

The treatment options for ACL injuries include both nonoperative measures (e.g., rehabilitation and bracing) and surgical reconstruction. The Delaware-Oslo ACL Cohort study showed that 53.6% of patients with ACL tears that were treated with rehabilitation alone had successful outcomes and that female patients and older patients were more likely to have a good outcome in association with nonoperative treatment. Females have also been found to be less likely to undergo ACL reconstruction than males³. Numerous studies evaluating sex-related disparities in terms of treatment outcomes following ACL reconstruction have revealed that subjective and functional outcomes and the ability to return to sports were inferior in females (Table II). Although some studies have suggested that females may be at greater risk for graft failure or contralateral ACL injury¹, others have shown no significant differences in terms of the risk of graft failure, the risk of contralateral ACL rupture, or postoperative knee laxity on physical examination³.

Table II Treatment Considerations and Outcomes Related to ACL Injury in Females

Treatment Considerations	Outcomes
<ul style="list-style-type: none"> Improved outcomes for females vs. males with nonoperative treatment Possible increased risk of graft failure in association with use of hamstring autograft vs. bone-patellar tendon-bone autograft in females Possible increased risk of postoperative arthrofibrosis in females 	<ul style="list-style-type: none"> Studies have shown inferior results in females concerning: <ul style="list-style-type: none"> - Functional outcome scores - Ability to return to sports - Postoperative knee laxity - Postoperative limb symmetry - Graft failure - Contralateral ACL injury

With regard to surgical factors, graft choice and sizing are important considerations for the female patient. Several studies have shown that females who undergo ACL reconstruction with hamstring autograft are at a higher risk for failure postoperatively than those managed with bone-patellar tendon-bone autograft^{4,5}. Nwachukwu et al. reported that female sex was a specific risk factor for postoperative arthrofibrosis after ACL reconstruction in patients 7 to 18 years old. Su et al., in a retrospective study, found that 65% of arthrofibrosis cases after ACL reconstruction occurred in females even though fewer than half the patients in the study were female and that a 1-mm increase in graft size was associated with a 3.2-times increased odds of arthrofibrosis.

Quick Report: Anterior Cruciate Ligament Rupture in Females

With regard to long-term outcomes, post-traumatic tibiofemoral knee arthritis was found to be a risk in both males and females³. However, females were more likely to undergo total knee arthroplasty at 15 years after ACL reconstruction than their male counterparts.

Prevention Programs

Primary prevention programs focus on correcting motor patterns and landing mechanics that contribute to the modifiable neuromuscular and biomechanical risk factors for ACL injuries in females. Multiple meta-analyses have been performed to determine the efficacy of these primary prevention programs in female athletes³. Michaelidis et al., in a 2013 meta-analysis that included 13 studies on primary prevention programs for female athletes, found that programs that featured a combination of strength and balance training, plyometrics, and technique analysis with feedback provided the best results, specifically for soccer and handball players; the investigators found no effective training program for basketball players. Noyes et al., in a study in which 3 training programs were found to be successful for reducing the incidence of noncontact ACL injury among female athletes, reported that 70 to 98 athletes needed to participate in the training in order to prevent 1 ACL injury and that the relative risk reduction ranged from 75% to 100%. A more recent analysis by Ramirez et al. showed that the risk of ACL tear was 1.83 times higher in females who did not participate in a neuromuscular training prevention program and 2.62 times higher for soccer athletes who did not participate. While the content of prevention programs is variable, studies have shown that the most successful programs are begun in the preseason and are continued 3 times per week for at least 8 weeks during the season to allow for adaptive change (Table III)¹.

Table III Female ACL Injury Prevention Program Keys

Prevention Program Keys
<ul style="list-style-type: none"> • Include a combination of strength and balance training, plyometrics, and agility drills • Include technique analysis and feedback • Include sports-specific components • Started in preseason and continued 3 times per week for 15-20 minutes throughout season • Maintenance program in off-season • Screen for at-risk athletes

Conclusion

Female athletes are more at risk for ACL injuries than male athletes. Anatomical, hormonal, neuromuscular, and biomechanical risk factors may contribute to this increased risk. Primary prevention programs can be effective for reducing the risk of ACL injuries in females. Future considerations should be given to developing individualized training programs and return-to-play criteria for female athletes with modifiable risk factors. While more research is needed, the use of hormonal contraceptives may offer increased protection against ACL injury. Surgical outcomes in females are generally not equivalent to those in males, and careful consideration of unique characteristics specific to females should be considered through all phases of treatment. Understanding the mechanics behind the increased risk of ACL injuries in females is key to identifying at-risk athletes and providing the best care for patients.

References

1. Sutton KM, Bullock JM. Anterior cruciate ligament rupture: differences between males and females. *J Am Acad Orthop Surg.* 2013;21(1):41-50. 2. Herzberg SD, Motu'apuaka ML, Lambert W, Fu R, Brady J, Guise JM. The effect of menstrual cycle and contraceptives on ACL injuries and laxity: a systematic review and meta-analysis. *Orthop J Sports Med.* 2017;5(7):2325967117718781. 3. Lin CY, Casey E, Herman DC, Katz N, Tenforde AS. Sex differences in common sports injuries. *PM R.* 2018. 4. Shakked R, Weinberg M, Capo J, Jazrawi L, Strauss E. Autograft choice in young female patients: patella tendon versus hamstring. *J Knee Surg.* 2017;30(3):258-63. 5. Paterno MV, Thomas S, Hewett TE, Magnussen RA, Schmitt L. Increased risk of graft failure after ACL reconstruction in young female athletes with hamstring grafts. *Orthop J Sports Med.* 2017;5(7 suppl6):2325967117S00301. Published 2017 Jul 31. doi:10.1177/2325967117S00301

Stress Fractures in Footballers



Gonzalo Samitier, MD, PhD
*Hospital General de Villalba
Madrid, SPAIN*



Gustavo Vinagre, MD, PhD
Porto, PORTUGAL



André Pedrinelli, MD
*Hospital das Clínicas FMUSP
Sao Paulo, BRAZIL*



Lúcio Ernlund, MD
*Instituto de Joelho e Ombro
Curitiba – BRAZIL*

Introduction

A stress fracture is a partial or complete disruption of bone continuity and is among the most common overuse injuries in physically active individuals¹. Stress fractures represent 0.5% of all injuries in elite male football (soccer) players and 13.6% of those in elite female football players. Ekstrand et al.¹ in a study of professional football players in the UEFA League, reported that players sustained an average of 2.0 injuries of any kind per season.

Mechanism of Injury (Pathophysiology)

Although the exact pathophysiology of stress fractures is unknown, it can be understood as an imbalance between the strength of the bone itself (bone resistance) and chronic mechanical overload (due to forces of tension, compression, and/or impact) exceeding the range of bone elasticity.

Stress fractures can be divided, according to bone quality and load, into (1) fatigue fractures (those resulting from increased load and/or cyclic forces on normal bone, for example, as the result of a high volume of exercises in a short period of time) and (2) insufficiency fractures (those produced by normal load within weakened bones, for example, in patients with osteoporosis or osteomalacia).

Bone is a dynamic tissue, and its turnover cycle of remodeling and mineralization requires a period of 3 to 4 months. A stress fracture is a failure of bone resistance and remodeling in response to strain forces (known as “stress”). Such stress can be the result of repetitive loading and/or overloading associated with training parameters such as volume, intensity, playing surface, or inadequate recovery time. However, stress fractures are not only due to bone pathophysiology and biomechanical factors; hormonal, nutritional, genetic, and other intrinsic and extrinsic factors are involved as well (Table I).

Table I Intrinsic and Extrinsic Risk Factors for Stress Fractures²

Intrinsic Factors	Extrinsic Factors
<ul style="list-style-type: none"> Female gender (hypoestrogenic state/ menstrual dysfunction/ female athlete triad) Age (in males, incidence decreases after 17 years of age; in females, it increases after menarche) Low BMI (<19) Low physical activity Anatomic variations (lower extremities malalignment, leg length discrepancy, pes planus/cavus) 	<ul style="list-style-type: none"> Training schedule changes Inadequate/changing footwear High-volume and intensity training Hard surfaces Long-distance running Alcohol use Smoking Low vitamin D

Diagnosis

Clinical Presentation

A detailed history and focused physical examination with a presumptive clinical suspicion are key for a correct, non-delayed diagnosis of a stress fracture.

Most patients report an insidious onset of pain that is aggravated by weight-bearing or repeated physical activities and is relieved by rest. However, many athletes with stress fractures can be asymptomatic. Usually, there is no history of trauma. It is critical to have a high index of suspicion regarding the presence of predisposing risk factors as shown in Table I.

Stress Fractures in Footballers

Physical Examination

Physical examination usually reveals tenderness on palpation or percussion of the involved bone. Swelling, erythema, and warmth also may be present.

Imaging

Radiographs are the first-line imaging modality and have high specificity, although stress fractures can be missed initially. The earliest sign of a stress fracture on radiographs is localized periosteal thickening. In cases in which radiographs are negative and the index of suspicion of stress fracture is high, additional imaging studies should be considered. Magnetic resonance imaging (MRI) and 3-phase bone scintigraphy (bone scanning) have high sensitivity; however, MRI is preferred over bone scanning because of its higher specificity (Table II).

Table II Generic MRI Grading System for Stress Fractures

Grade	Findings
Low grade	
Grade 1	STIR* signal change
Grade 2	STIR and T2 signal change
High grade	
Grade 3	STIR, T1, and T2 signal change No fracture line present
Grade 4	STIR, T1, and T2 signal change Fracture line present

*STIR = short-T1 inversion recovery.

“High-Risk” and “Low-Risk” Sites

Ekstrand and Torstveit³, in a study of 2,379 elite male football players, reported a total of 51 stress fractures, all of which occurred in the lower extremities; the most common site was the fifth metatarsal (78%), followed by the tibia (12%) and the pelvis (6%). Twenty-nine percent of the stress fractures were reinjuries.

It is very important to be aware of “high-risk” stress fracture sites, including the fifth metatarsal (specifically zone 2, the metaphyseal-diaphyseal junction), talar neck, femoral neck, patella, anterior tibial diaphysis, medial malleolus, navicular, sesamoids of the hallux, and necks of the second to fourth metatarsals. Stress fractures in these sites are prone to complications such as displacement, delayed union, and nonunion, and the need for prolonged treatment.

“Low-risk” stress fracture sites include the posteromedial tibial shaft, metatarsal shaft, distal fibula, medial femoral neck, femoral shaft, and calcaneus; fractures in those sites often heal with proper diagnosis and treatment.

Treatment

Conservative Treatment

The treatment of stress fractures depends on the zone of the fracture but in most cases is conservative and should include decreased physical activity and training load, avoidance of pain-related activities, and weight-bearing restriction or immobilization. Pain control with oral analgesic medications, cold therapy, proper rehabilitation, and a personalized conditioning alternative physical program (minimal impact aerobic activities to maintain flexibility and strength) are recommended. NSAIDs should be avoided because of their negative effect on bone-healing.

Surgical Treatment

In patients with “high-risk” stress fractures or displaced fractures, especially athletes, early surgical fixation is preferred because of the high rates of treatment failure, extended healing time, the risk of nonunion, and the possibility of refracture⁸⁻¹⁰.

Strategies for operative intervention include intramedullary screw fixation, bone-grafting, and tension band wiring. In addition, some authors have advocated adding bone marrow aspirate concentrate (BMAC) to improve the biological environment and healing potential of the fracture site. Mallee et al.⁴, in a recent systematic review, found that surgical management was associated with proven benefits in terms of the times and rates of return to sport. Conservative management, however, remains a realistic option for the low-level athlete. The rate of refractures after surgical treatment of fifth metatarsal stress fractures has been reported to be as high as 10% to 30% in some series. The risk of refracture has been found to be associated with increased body weight, protrusion of the fifth metatarsal head, and Torg grade-2 and 3 fractures (Table III).

Table III Torg Classification of Fifth Metatarsal Stress Fracture

Grade 1	Grade 2	Grade 3
<ul style="list-style-type: none"> Acute fracture No periosteal reaction No intramedullary sclerosis 	<ul style="list-style-type: none"> Delayed union Periosteal reaction Intramedullary sclerosis Widened fracture line 	<ul style="list-style-type: none"> Non-union Periosteal reaction Intramedullary narrowing Widened fracture line

Fifth Metatarsal Stress Fracture

For primary stress fractures of the fifth metatarsal in high-level athletes who participate in high-intensity sports involving repetitive loading, our preferred method is intramedullary fixation with use of a partially threaded cancellous cannulated screw.

We prefer to use the largest possible cannulated screw (usually 3.2 to 5.5 mm diameter), with the threads extending just beyond the fracture site in order to generate maximum compression (Fig. 1).

- 01 23-year-old professional soccer player who had a symptomatic Torg grade-3 fifth metatarsal stress fracture in the right foot.



- 01A Standing posterior view of the feet, showing a neutral forefoot and a diminished subtalar arch.
- 01B Photograph made during open curettage and harvesting of cancellous autograft from the left calcaneus.
- 01C Oblique radiograph and direct photograph made during internal fixation with a cannulated compression screw.



- 01D Oblique radiograph and direct photograph made during internal fixation with a cannulated compression screw.
- 01E Radiographs made 1 month postoperatively. (Images from André Pedrinelli, Grupo de Medicina do Esporte e do Exercício HCFMUSP.)

Anterior Tibial Shaft Stress Fracture

Stress fractures involving the anterior cortex of the tibia have a different prognosis than those involving the posteromedial cortex and are associated with a high risk of chronicity and displacement under continuous loading. The severity of the fracture can be graded according to the presence of changes on MRI sequences; periosteal and bone marrow edema with the presence of a fracture line has been shown to be associated with an increased return to running time and delayed healing.

Current treatment protocols advocate a trial of 3 to 6 months of conservative management as the initial treatment of these injuries; if symptoms persist following attempted conservative management, surgical intervention (reamed tibial intramedullary nailing, compression plating, or drilling of the stress fracture with bone-grafting) should be advised. A recent systematic review by Robertson and Wood demonstrated that intramedullary nailing and compression plating provided the highest return rates and lowest return times of all the surgical treatments available.



02A

02B



02C

02D

- 2 02A, 02B, 02C and 02D Chronic bilateral anterior tibial stress fracture in a 29-year-old professional soccer player that failed initial treatment with reamed intramedullary nail; a compression plate in tension band mode and open tibial curettage anteriorly was associated to the initial treatment in a later surgery.

(Images from André Pedrinelli, Grupo de Medicina do Esporte e do Exercício HCFMUSP.)

That review also demonstrated that conservative management resulted in decreased rates of return to sport compared with surgical management (71% compared with 96%, respectively). Our preferred method is to use a locked reamed intramedullary nail in order to stimulate bone-healing; in chronic or revision cases and high-performance athletes, we may opt for tension band plating as described by Zbeda et al.⁵ (Fig. 2).

Stress Fractures in Footballers

Lateral (Tension-Side) Femoral Neck Stress Fracture

Because of the inherent risks of displacement and secondary osteonecrosis of the femoral head, current management protocols advocate for urgent surgical fixation of this fracture type in young active athletes. Surgical fixation is ideally performed with multiple cannulated 6.5 or 7.0-mm screws or with a Dynamic Hip Screw for more unstable shear patterns. There are limited data on return-to-sport rates and times for lateral femoral neck fractures because the majority of studies have been case reports or case series. In a recent systematic review that included all published reports on femoral neck stress fractures in runners, Neubauer et al. reported that 28 of 48 patients returned to running. Displaced fractures were associated with significantly lower return rates than nondisplaced fractures (6 of 18 compared with 22 of 30). The reported return-to-sport times ranged from 3 to 12 months.

Return to Play

The return-to-play decision depends on the location and pattern of the stress fracture. However, stress fractures can lead to prolonged absences from football. According to Ekstrand and Torstveit³, the mean absence from football was 3 months for patients with fifth metatarsal and tibial stress fractures and 4 to 5 months for those with pelvic stress fractures. We recommend that there be clear evidence of healing on both clinical examination and imaging studies (including supporting CT scans if necessary) before the athlete fully returns to play.

Prevention

The prevention of stress fractures in football is of paramount importance. Load controls through different training methods, injury-prevention programs, and the control of risk factors are crucial for the prevention of these injuries. Injury-prevention programs such as FIFA 11+ are very important, especially in low-skill-level youth teams.

References

1. Ekstrand J, Hägglund M, Waldén M. Injury incidence and injury patterns in professional football: The UEFA injury study. *British Journal of Sports Medicine*. 2011;45(7):553–8.
2. Dhillon MS, Ekstrand J, Mann G, Sharma S. Stress fractures in football. *Journal of ISAKOS: Joint Disorders & Orthopaedic Sports Medicine*. 2016;1(4):229–38.
3. Ekstrand J, Torstveit MK. Stress fractures in elite male football players. *Scandinavian Journal of Medicine and Science in Sports*. 2012;22(3):341–6.
4. Mallee WH, Weel H, van Dijk CN, van Tulder MW, Kerkhoffs GM, Lin CW. Surgical versus conservative treatment for high-risk stress fractures of the lower leg (anterior tibial cortex, navicular and fifth metatarsal base): a systematic review. *Br J Sports Med* 2015; 49: 370-376
5. Zbeda RM, Sculco PK, Urch EY, Lazaro LE, Borens O, Williams RJ, Lorich DG, Wellman DS, Helfet DL. Tension Band Plating for Chronic Anterior Tibial Stress Fractures in High-Performance Athletes. *Am J Sports Med* 2015 Jul;43(7):1712-8.

Knee Arthroplasty FELLOWSHIP

Sponsored by Nicolaas C. Budhiparama & Inge Widjaja
Nicolaas Institute of Constructive Orthopaedic Research
& Education Foundation for Arthroplasty & Sports Medicine



Two Knee Arthroplasty Fellowships are available on a competitive basis to young orthopaedic surgeons interested in the study and advancement of understanding of the Knee Arthroplasty.

The dual purpose of the fellowship is to improve knee arthroplasty in developing nations and to promote better understanding and communication amongst knee surgeons around the world.

Fellowships are awarded in alternate years during the ISAKOS Biennial Congress. Two recipients will receive a travel stipend, waived registration to the ISAKOS Congress, and one year of ISAKOS Membership.

Application Deadline:
April 1, 2019



isakos.com/Knee-Arthroplasty-Fellowship

**New &
Improved
Look!**

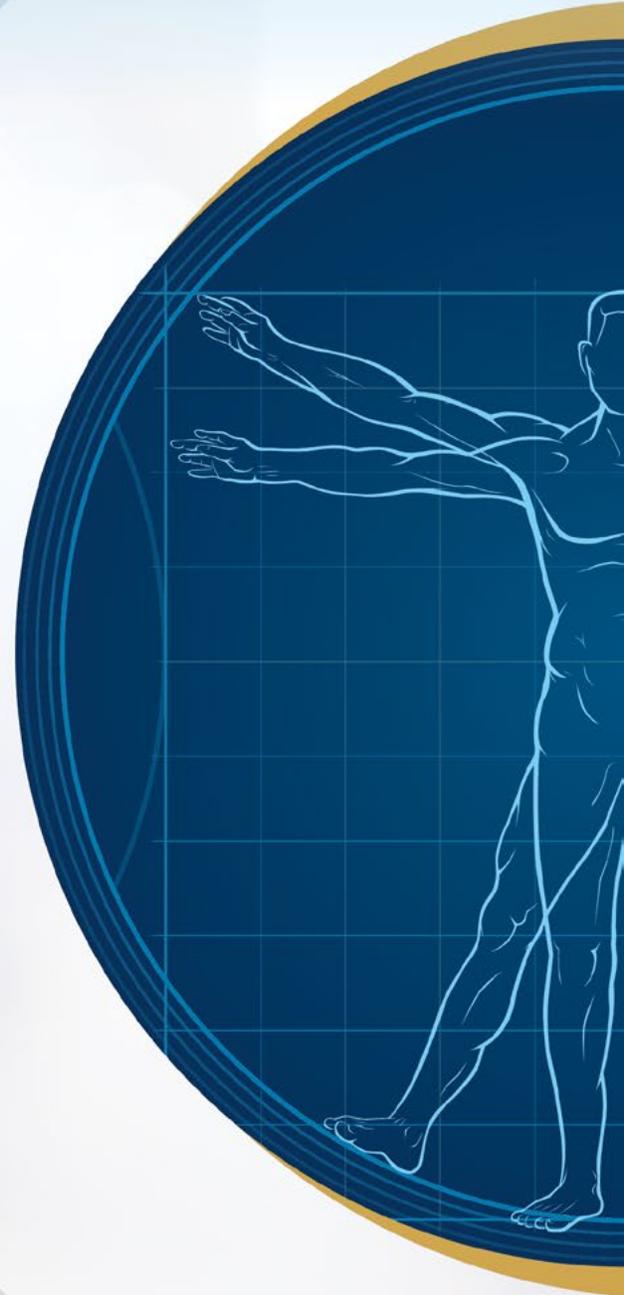
THE NEW
^ ISAKOS
global link

Access Congress presentations,
surgical demonstrations &
courses, committee projects,
current concept articles...
and more!

isakos.com/GlobalLink

New & Improved Features

- More User- and Mobile-Friendly
- Featured “Top Rated” Content
- More Powerful Search Tool
- Anatomic Location Navigation
- Sports Medicine Category Navigation
- Collection Navigation
- Search & Sort Functions
- Filter by Rating, Date, Format, etc.
- “Tagged” Categories
- 5-Star Rating Feature
- *More to Come!*



**The ISAKOS
Online Education Portal**

Microinstability of the Hip: Diagnosis and Treatment



Leandro Ejnisman, MD, PhD
University of São Paulo
São Paulo, BRAZIL



Marc R. Safran, MD
Stanford University
Redwood City, CA, UNITED STATES



Thomas G. Sampson, MD
Post Street Orthopaedics and
Sports Medicine
San Francisco, CA, UNITED STATES

Introduction

The past decade has seen a great increase in the comprehension regarding the mechanics and pathology of the non-arthritic hip. The concept of femoroacetabular impingement (FAI) changed how orthopaedic surgeons look at the hip joint. Moreover, the development of hip arthroscopy made access to the joint easier and led to an exponential increase in the number of hip arthroscopies performed worldwide. However, hip specialists soon realized that the osseous architecture was not the only factor responsible for hip pathology. The function of the acetabular labrum and the concept of the “suction seal” responsible for the negative pressure inside the joint demonstrated the need to preserve the labrum whenever possible.

Even so, some patients still present with hip pain even after correction of the osseous anatomy and repair of the labrum. New research has demonstrated the importance of the hip capsule in joint stability. These advances have led to the development of the concept of microinstability of the hip. This new entity, which may present by itself or in conjunction with FAI and/or hip dysplasia, is an evolving and exciting new field of research in hip sports medicine. The goal of this article is to describe its diagnosis and treatment.

Clinical Presentation

Patients presenting with hip microinstability typically complain of vague anterior groin pain. Females are more commonly affected than males. While the patient may describe a subjective feeling of instability or giving-way, these symptoms are uncommon. Mechanical symptoms, such as catching and locking, may be present. The patient might experience pain when walking, especially when the hip is extended, which levers the femoral head anteriorly. Lateral hip pain is frequently reported and is usually attributed to an overload of the gluteal tendons trying to compensate for an unstable joint. Moreover, the hip may exhibit audible clicking and snapping caused by the psoas tendon, which is also over-activated in an attempt to stabilize the joint. This condition typically is associated with participation in sports involving forceful external rotation of the hip, such as ballet, diving, gymnastics, and cheerleading. Repetitive external rotation leads to stretching of the anterior hip capsule, especially the iliofemoral ligament, causing increased micromotion of the femoral head relative to the acetabulum. Even though microinstability is more frequently observed in association with these rotational sports, it can occur in association with any sport activity and as well as in sedentary patients. It is important to look for signs of generalized ligamentous laxity. Patients frequently present with looseness of other joints and may report previous shoulder and/or patellar dislocations; however, many patients with generalized looseness of the joints do not have hip instability and not all patients with hip instability have generalized ligamentous laxity.

Physical Examination

Physical examination begins with an evaluation of hip range of motion. It is important to compare any side-to-side differences and discomfort during movement. The anterior impingement sign (pain with flexion, adduction, and internal rotation) is usually positive, suggesting an intra-articular cause of hip pain such as a labral tear. The most frequently used instability tests are the abduction-hyperextension-external rotation test, the prone instability test, and the hyperextension-external rotation test (Fig. 1). The goal of these tests is to stretch the anterior hip capsule to reproduce the pain. A recent study demonstrated that when these three tests were positive, there was a 95% chance that the patient had intraoperative signs of microinstability¹. The Beighton scale is another useful test and includes dorsiflexion of the little finger beyond 90°, passive dorsiflexion of the thumb to the flexor aspect of the forearm, hyperextension of the elbows beyond 10°, knee hyperextension beyond 10°, and forward flexion of the trunk with the knees extended while the palms and hands rest flat on the floor. Assessment of soft-tissue tenderness is important to confirm possible tendinopathies associated with microinstability, such as adductor and gluteal tendinopathy.

01 Tests used for hip microinstability.



01A Abduction-hyperextension-external rotation test.



01B Prone instability test.



01C Hyperextension-external rotation test.

Radiographic Evaluation

Radiographic evaluation includes an anteroposterior (AP) pelvic radiograph, a false-profile radiograph of the hip, and a profile radiograph of the proximal part of the femur. Many lateral views of the femur can be used, such as the Dunn view and the cross-table lateral view. On the AP pelvic radiograph, the clinician measures the joint space and observes any signs of subchondral sclerosis, which may indicate early degenerative disease. It is important to look for signs of FAI: the cross-over sign on the acetabular side is suggestive of pincer impingement, whereas loss of offset at the femoral head-neck junction is suggestive of cam impingement. The center-edge angle is used to measure the depth of the acetabular socket. Values of $>40^\circ$ demonstrate a global overcoverage typical of pincer impingement, and values of $<25^\circ$ demonstrate hip dysplasia (with values of 20° to 25° indicating borderline dysplasia).

It is important to keep in mind that hip microinstability may be associated with FAI and hip dysplasia. Hip instability may be associated with hip dysplasia, particularly if the Tönnis angle is high. Recently described radiographic signs have been used to identify hip instability. The Femoro-Epiphyseal Acetabular Roof (FEAR) index is defined by two lines. One is a line crossing the femoral head physeal scar, and the other is a line parallel to the sclerotic portion of the sourcil (similar to the Tönnis angle). A FEAR index of $>5^\circ$ is suggestive of instability. The Cliff sign, demonstrating a loss of femoral head offset, also has been seen in patients with hip instability. Magnetic resonance imaging (MRI) of the hip is used to check for labral tears and chondral status. In addition, magnetic resonance arthrography (MRA) can be performed to increase the sensitivity for labral tears. The MRA can include an injection of anesthetic, along with the dye, acting as a diagnostic test for an intra-articular cause of the pain. Typically, a decrease of 50% of the pain during the anterior impingement sign is considered a positive diagnostic test. Signs of instability on MRI or MRA include capsular defects, thin anterior hip capsule in the area lateral to the zona orbicularis on the axial view, and ligamentum teres tears.

Moreover, hip microinstability can appear as a complication after hip arthroscopy and is one of the main causes of postoperative pain. Microinstability occurs in cases in which the surgeon did not close the hip capsule and/or performed a large capsulotomy or even a capsulectomy, jeopardizing the function of the iliofemoral ligament. The clinical presentation of postoperative microinstability is similar that in nonoperative cases, with the patient complaining of anterior hip pain and presenting with similar findings on physical examination. An MRI may demonstrate a capsular defect in the anterior aspect of the hip.

Treatment

Initially, conservative treatment is instituted. The patient is advised to refrain from physical activities and to avoid hip rotation and deep flexion (i.e., squatting). A course of anti-inflammatory drugs may be prescribed to help alleviate acute pain. Physical therapy (PT) is the mainstay of this conservative trial. PT focuses on strengthening the hip girdle and stabilizing the hip joint. Core exercises are also important. It is necessary for the patient to be compliant with the proposed exercise regimen and to perform home exercises to complement the formal PT sessions. The idea is similar to that in cases of multidirectional atraumatic instability of the shoulder, in which a strong and developed musculature can overcome an unstable joint.

Microinstability of the Hip: Diagnosis and Treatment

When the patient feels too much pain to do the exercises, an intra-articular cortisone injection may reduce joint irritation and permit proper rehabilitation. We recently reported on the success of nonoperative treatment for hip instability, with over half of the patients avoiding surgery.

If PT fails, surgery is indicated. Hip arthroscopy can be performed according to the surgeon's preference (lateral vs. supine, outside-in vs. inside-out); however, it is essential that the surgeon is careful with the capsule. Excessive capsulectomies may render closure impossible at the end of surgery. Intraoperative signs of instability include the ease of distraction of the femoral head and/or the lack of reduction of the femoral head when releasing traction. Additionally, the location of labral or chondral lesions should clue the surgeon into the possibility that the patient has instability. Labral tears caused by hip microinstability tend to be more anterior than tears caused by FAI, with a typical location between the 4 and 2-o'clock positions. Ligamentum teres tears may also be a sign of instability. In cases of instability associated with FAI, cam and pincer impingement are corrected by resecting the excess bone in the femur and acetabulum, thereby improving the clearance for hip movement. Labral tears are repaired with anchors. In a patient with an unstable hip, preserving the labrum is paramount; therefore in cases of advanced labral degeneration, a labral reconstruction may be considered².

At the end of the procedure, a capsular plication is performed in order to tighten the hip capsule and stabilize the joint. Three different techniques have been described in the literature. The capsular shift technique is used when the surgeon performs a capsulotomy from the 12 to 3-o'clock position (in relation to the acetabulum). The capsule is closed with oblique sutures obtaining a bigger bite in the distal capsular flap so that the capsule is imbricated and an inferior capsular shift is produced³. The RICH (rotator interval closure of the hip) technique is performed by completing the central compartment part of the arthroscopy without a capsulotomy⁴.

When the peripheral compartment is addressed, a small capsulectomy (6–8 mm in width and 15 mm in length) is performed in the "bare area" of the hip capsule, between the iliofemoral and the ischiofemoral ligaments, in order to obtain a small capsular window. After the femoral osteoplasty is finished, the capsulotomy is closed, tensioning the capsule. The advantage of this technique is that it avoids iatrogenic injury to the iliofemoral ligament. The third option is the shoelace capsular closure technique⁵. A capsulotomy is performed in a fashion similar to the capsular shift technique; however, instead of closing the capsule with separate interrupted sutures, a continuous suture is performed, crisscrossing both limbs of the capsule with a strong suture.

The authors believe that this construct is more secure and stable than interrupted sutures. Postoperatively, independent of the technique, a hip brace is used to avoid hip extension, and anti-rotational boots are used to avoid external rotation when the patient is lying down. These restrictions are usually continued for 2 to 3 weeks.

The published results of capsular plication are promising. In a cohort of 22 patients with borderline dysplasia that was treated with the capsular shift technique, 77% of patients had good to excellent outcomes after a mean duration of follow-up of 27.5 months³. In a study of 32 patients who were managed with the RICH technique, the modified Harris hip score increased from 67 to 97 and the iHOT score increased from 41 to 85 after a minimum duration of follow-up of 12 months⁴. The authors of both studies acknowledged that longer follow-up studies are needed to determine if these favorable results are maintained.

Conclusion

Sports medicine physicians should understand the concept of hip instability and keep this diagnosis in mind when treating young patients who have hip pain, especially females. Rehabilitation is considered the first line of treatment. If conservative treatment fails, a hip arthroscopic plication yields favorable clinical results.

References

1. Hoppe DJ, Truntzer JN, Shapiro LM, Abrams GD, Safran MR. Diagnostic accuracy of 3 physical examination tests in the assessment of hip microinstability. *Orthop J Sports Med.* 2017 Nov;5(11):2325967117740121.
2. Sharfman ZT, Amar E, Sampson T, Rath E. Arthroscopic labrum reconstruction in the hip using the indirect head of rectus femoris as a local graft: surgical technique. *Arthrosc Tech.* 2016 Apr;5(2):e361–4.
3. Chandrasekaran S, Vemula SP, Martin TJ, Suarez-Ahedo C, Lodhia P, Domb BG. Arthroscopic technique of capsular plication for the treatment of hip instability. *Arthrosc Tech.* 2015 Apr;4(2):e163–7.
4. Kalisvaart MM, Safran MR. Hip instability treated with arthroscopic capsular plication. *Knee Surg Sports Traumatol Arthrosc.* 2017 Jan;25(1):24–30.
5. Uchida S, Pascual-Garrido C, Ohnishi Y, Utsunomiya H, Yukizawa Y, Chahla J, et al. Arthroscopic shoelace capsular closure technique in the hip using Ultratape. *Arthrosc Tech.* 2017 Feb;6(1):e157–61.

Posterolateral Rotatory Instability of the Elbow



Jose Carlos Garcia Jr., MD, PhD
NAEON
São Paulo, BRAZIL



Felipe Machado do Amaral, MD
NAEON
São Paulo, BRAZIL



Matheus Ribeiro Barcelos, MD
NAEON
São Paulo, BRAZIL

Introduction

O'Driscoll et al., in 1991, described posterolateral rotatory instability (PLRI) of the elbow as a condition resulting from an injury to the lateral ulnar collateral ligament (LUCL)¹. This lesion leads to posterolateral subluxation and/or dislocation of the radius over the capitellum without disruption of the proximal radioulnar joint and is most often caused by a traumatic event resulting in significant valgus stress combined with axial load and forearm supination.

Iatrogenic causes of PLRI include multiple corticosteroid injections and aggressive debridement for the treatment of lateral epicondylitis. Ligamentous attenuation resulting from chronic cubitus varus is also considered a potential cause.

Although O'Driscoll et al. initially described an injury to the LUCL as the primary cause of PLRI, this theory has become controversial in the literature. Some authors have shown that additional injuries to the remaining lateral soft-tissue structures of the elbow are also required in order for a patient to develop PLRI^{2,3}.

Pathoanatomy of Posterolateral Rotatory Instability

The osseous structures of the elbow stabilize the joint at the extremes of flexion (>120°) and extension (0° to 20°), whereas the lateral and medial ligamentous complexes are the primary stabilizers throughout the remainder of motion.

The LUCL is a thickening of the capsule that extends from the lateral epicondyle to the tubercle on the supinator crest.

The LUCL is a restraint to varus stress and stabilizes the radial head against posterior subluxation or dislocation.

The concept of the LUCL as the only soft-tissue stabilizer of the radiocapitellar joint is controversial. Multiple anatomical studies have demonstrated that, in order to create radiocapitellar instability, additional lateral elbow structures must also be injured, including the radial collateral ligament, part of the annular ligament, and/or the common extensor mechanism^{2,3}.

Clinical Presentation

Patients often present with lateral elbow pain, especially following activities in which the elbow is placed into extension and supination. Lateral elbow pain may be accompanied by mechanical symptoms such as clicking, locking, or snapping, which are most prominent at 40° of flexion as the arm is extending¹.

Stability of the lateral collateral ligaments (the radial collateral ligament and LUCL) and medial collateral ligaments (MCL) should be assessed with varus and valgus stress tests at 30° of flexion to unlock the olecranon from its fossa. A valgus stress test should be performed with the forearm in both full supination and full pronation. When the forearm is in full pronation, the interosseous membrane is not tense, which allows for proximal migration of the radius and thereby enhances the stability of the radiocapitellar joint. Thus, one can test the MCL with no risk of a false-positive valgus stress test. However, when the forearm is in supination, bone stability of the radiocapitellar joint is decreased and use of the LUCL is increased. If the patient has PLRI during the exam, this finding may be a false-positive result.

The pivot-shift test, described by O'Driscoll et al., is used to confirm PLRI¹. This test is performed with the patient supine on the examination table with the arm overhead, the shoulder in full external rotation to stabilize the shoulder joint, and the forearm in full supination. The maneuver starts with the elbow extended and supinated; in this position, the radial head will be subluxated. As the examiner brings the arm from extension to flexion, valgus stress and axial compression are applied to the elbow and the forearm is allowed to become less supinated. This allows the forearm to pivot around the MCL and results in reduction of the elbow joint as the triceps becomes taut at around 40° flexion, often causing an audible or palpable click. In the awake patient, it is unusual to be able to detect a positive pivot shift because of guarding by the patient. Therefore, apprehension during the pivot-shift maneuver is often considered to be a positive result even without frank instability.

The chair-up test can also be used to test for PLRI. For this test, the patient pushes up from a chair with the hands on the armrests. If apprehension or dislocation occurs, the test is considered to be positive for PLRI.

Posterolateral Rotatory Instability of the Elbow

Imaging

The diagnosis of PLRI is often based on clinical findings, but radiographs of the elbow should still be made to assess for any evidence of fracture, subluxation, and/or dislocation. Advanced imaging such as magnetic resonance imaging (MRI) is controversial as a lesion of the LUCL is not always identified on such studies.

Nonoperative Treatment

Nonoperative treatment is often unsuccessful in cases of chronic PLRI. For mildly symptomatic or asymptomatic patients, the avoidance of provocative activities may be attempted. Physical therapy, analgesics, and anti-inflammatory medications can also be used.

Operative Treatment

The majority of patients with chronic PLRI require operative treatment. Patients with acute lesions who present with good-quality ligamentous tissue may be treated with LUCL repair. Patients with chronic lesions usually do not have adequate tissue for direct repair and therefore require an open ligamentous reconstruction with use of either autograft or allograft. The two main reconstruction techniques are the overlay technique and the docking technique.

Overlay Technique

The overlay technique is performed through the Kocher approach with use of three transosseous tunnels at the humerus and two at the ulna and an overlay autologous graft. Our preferred graft is the ipsilateral palmaris longus tendon.

A small burr is used to create 2 holes just posterior to the supinator crest in the ulna. A snap is placed on the sutures to identify the point where even tension is maintained throughout flexion and extension of the elbow. This isometric point is then marked for later drilling of the docking humeral tunnel. This location is typically slightly posterior to the tip of the lateral epicondyle.

The tendon is then passed through the ulnar tunnels. The docking hole is then drilled with a 4.5-mm drill, just posterior and proximal to the isometric point on the lateral epicondyle. A 3.5-mm drill is then used to make two proximal tunnels in order to create a Y-shaped bone tunnel configuration in the lateral epicondyle. The tendon is then passed through the distal and proximal tunnels and is sutured to its other tip where they cross at the joint. The new ligament is also sutured into the capsule with use of non-absorbable number-2 sutures.

Docking Technique

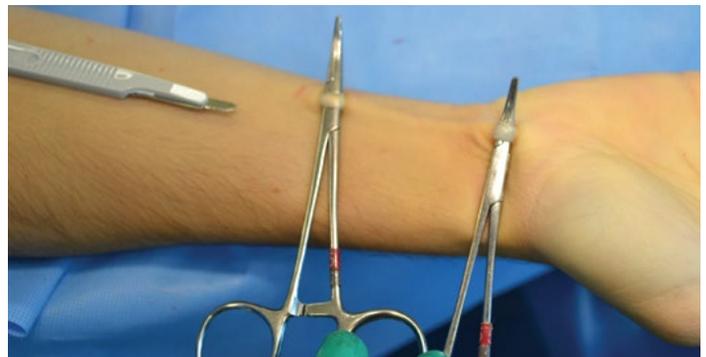
The docking technique is performed through the Kocher approach with use of an autologous palmaris tendon graft, which does not need to be as long as the graft used for the overlay technique. After the avulsed or attenuated ligament is identified, a number-1 non-absorbable braided suture is placed through one end of the tendon with use of either a Krackow or running stitch.

The capsule and the common extensor tendon are then incised longitudinally, immediately anterior to the posterior border of the extensor tendon, to expose the supinator crest and the lateral epicondyle. Two drill holes are made in the ulna with use of a 4-mm burr, with a 1 to 2-cm bridge between the holes to prevent fracture. The first hole is near the supinator crest, and the second is approximately 2 cm proximal, near the base of the annular ligament. The 4-mm burr is used to drill a hole at the isometric point on the humerus to a depth of approximately 15 mm.

A drill is then used to drill two small 15-mm exit holes slightly superoanterior and superoposterior to the isometric point. Non-absorbable sutures are then placed in the anterior and posterior capsules to later dock with the graft for capsular plication if deemed necessary. The graft is placed through the ulnar tunnel. The elbow is flexed to 30° to 40°. A suture passer is then used to pull the graft and the capsular sutures into the anterior humeral tunnel. The sutures are tied over the osseous bridge with the arm in 40° of flexion and full pronation.

Authors' Preferred Technique

We prefer to use small-diameter interference screws with a double palmaris longus tendon graft for this procedure. Such screws are typically 15 mm in length and 4.75, 5.5, or 6.25 mm in diameter, depending on the diameter of the graft. One screw is inserted at the supinator crest, and another is inserted at the isometric point (Figs. 1 to 5). This kind of fixation is easy and fast and will allow for suitable strength and resistance for cycling load, similar to bone tunnels and superior to anchors. If the palmaris longus tendon is absent, regardless of the technique that is chosen, then the gracilis or semitendinosus tendon can be used. Allografts also can be used.



01 Harvesting the ipsilateral palmaris longus autograft.



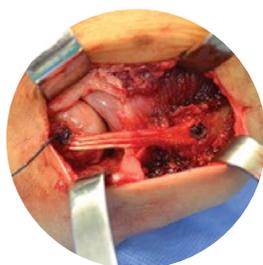
02 Appearance of the bone tunnel in the supinator crest of the ulna.



03 Insertion of the small-articulation interference screw.



04 Insertion of the humeral interference screw in the isometric point.



05 Final appearance of the reconstructed LUCL ligament, before capsular closure.

Clinical Results

Better results can be achieved with operative treatment than with a conservative approach. Sanchez-Sotelo et al.⁴ assessed 44 patients (including 12 who underwent repair and 32 who underwent ligamentous reconstruction) after an average duration of follow-up of 6 of years. Four patients in the repair group had some residual instability, and three of them required revision. Overall, the results in the reconstruction group were better than those in the repair group. Savoie et al.⁵, in a study of 54 patients who underwent arthroscopic or open repair of the LUCL for the treatment of PLRI, reported no statistical difference between the groups after an average duration of follow-up of 41 months. It should be noted that the arthroscopic approach requires a high level of skill.

For patients presenting with acute injuries and appropriate-quality tissues, a direct repair can achieve good results. However, for the majority of patients who present with chronic PLRI, reconstruction with use of autograft or allograft is required to prevent recurrent instability.

Rehabilitation and Return to Sport

Rehabilitation protocols vary among authors. Bracing with a limited range of motion to 30° of elbow extension is one of the main postoperative approaches. The duration of immobilization ranges from 1 day to 6 weeks postoperatively, depending on the technique and fixation method used.

We prefer to use a brace in a position of pronation and 30° of extension for a week and then to increase passive motion with use of an articulated brace for 2 more weeks.

In the third week, active movement with use of the brace and assisted exercises with the arm in the overhead position are begun. Passive supination is also allowed with care at this time. Active forced exercises are started 6 weeks after surgery. At 3 months, regular sports activities with low load are allowed in order to restore proprioception. Exercise load is progressively increased during the following 3 months. A return to regular sports activities is allowed at 6 months.

Although rehabilitation protocols typically are based on specific time frames following surgery, the decision to return to sport is ultimately based on a critical assessment of when acceptable function has been restored and the risk of reinjury is believed to be acceptably low.

Conclusion

PLRI of the elbow is due to a ligamentous lesion that is commonly the result of a traumatic event.

Lateral elbow pain is the most common clinical presentation, making diagnosis challenging. Some patients also will present with mechanical symptoms such as locking, catching, or clicking.

The diagnosis is usually based on clinical findings. Provocative tests tend to demonstrate apprehension rather than frank subluxation or dislocation because of pain and guarding by the patient.

Conservative measures are often unsuccessful for the treatment of chronic PLRI. In these cases, operative treatment with either LUCL repair or reconstruction is suggested as the best treatment option.

Good and excellent outcomes have been achieved with surgical treatment, mainly in patients with isolated injuries without arthritic joint damage.

Repair should only be performed when the ligamentous tissue is of sufficient quality; otherwise, a reconstruction with autograft or allograft is preferred.

References

1. O'Driscoll SW, Bell DF, Morrey BF. Posterolateral rotatory instability of the elbow. *J Bone Joint Surg Am.* 1991 Mar;73(3):440-6.
2. Dunning CE, Zarzour ZD, Patterson SD, Johnson JA, King GJ J. Ligamentous stabilizers against posterolateral rotatory instability of the elbow. *J Bone Joint Surg Am.* 2001 Dec; 83 A(12):1823-8.
3. Dunning CE, Zarzour ZD, Patterson SD, Johnson JA, King GJ. Muscle forces and pronation stabilize the lateral ligament deficient elbow. *Clin Orthop Relat Res.* 2001 Jul; (388):118-24.
4. Sanchez-Sotelo J, Morrey BF, O'Driscoll SW. Ligamentous repair and reconstruction for posterolateral rotatory instability of the elbow. *J Bone Joint Surg Br.* 2005 Jan;87(1):54-61.
5. Savoie FH 3rd, O'Brien MJ, Field LD, Gurley DJ. Arthroscopic and open radial ulnohumeral ligament reconstruction for posterolateral rotatory instability of the elbow. *Clin Sports Med.* 2010 Oct;29(4):611-8.

ISAKOS Young Investigator's Scholarship and Research Mentoring Program – 2018

Juan Pablo Martinez, MD, MSc
Fundación Valle del Lili
Cali, COLOMBIA

Mentor: Dr. Constance Chu
Stanford University
Palo Alto, UNITED STATES



My Bio

I am an orthopaedic surgeon living in Cali, Colombia. My practice mainly focuses on orthopaedic sports medicine, with a particular concentration on cartilage and patellofemoral problems, and involves both private and academic work with

Fundación Valle del Lili Hospital and ICESI University. I am also an Epidemiologist at the University of London and a PhD student in regenerative medicine at University del Valle.

ISAKOS Young Investigator's Scholarship and Research Mentoring Program

In 2016, young investigators from around the world were invited to send their research projects for evaluation by the ISAKOS Scientific Committee before the 11th Biennial ISAKOS Congress in Shanghai, China. The project that I submitted involved the use of stem cells for the treatment of knee arthritis. Twenty of us received a scholarship to travel to and participate in the ISAKOS Congress. At the conference, two of us were selected to share our projects with the Scientific Committee and were awarded the Young Investigator's Scholarship as well as the opportunity to participate in the Research Mentoring Program. The purpose of this program is to support young investigators from developing countries in their research projects.

The award was a great honor and allowed me to further enhance my project while also learning essential principles about both research in general and stem cells in particular. During my 2-week visit to Stanford University for the Research Mentoring Program, I gained a greater understanding about the University's work on the use of orthobiologics in the settings of arthritis and sports medicine, both in the lab and in clinical practice, as well as about important aspects of research, such as the process of applying for a grant, leading a research team, and even the different issues that have to be resolved by a researcher in his or her daily life.

My Tutor

The Scientific Committee assigned Dr. Constance Chu to serve as my mentor. During my 2-week visit to Stanford, I had the opportunity to shadow Dr. Chu during several research meetings and in other scenarios, which provided great insights into the qualities that make a great researcher, including hard work, determination, grit, and a true belief in your ability to accomplish your projects.

During my visit, I was able to learn about a number of ongoing and future studies being conducted or planned by Dr. Chu's team, which are mostly focused on posttraumatic knee arthritis. The team is taking a holistic approach to understanding the different elements that can contribute to this condition and is evaluating different interventions that could improve arthritis outcomes after an ACL injury, including the use of orthobiologics. This experience made it clear that the various aspects of research (including the measurement of appropriate variables and lab markers, gait analysis, MRI assessment, flow cytometry, the evaluation of PROMs, patient follow-up, and logistical considerations) are only possible through the efforts of a team of hard-working people. During my visit, I was able to take part in the team meetings, to see the team members interact, and to learn about different stages and processes in research.



01 Dr. Juan Pablo Martinez with Dr. Constance Chu.



02 Stanford University Campus.

Stanford University

As part of the program, I had the opportunity to visit several different sites affiliated with Stanford University, including the University Campus, the Stanford Medicine Outpatient Center in Redwood City, and the VA Palo Alto Health Care System. While at the campus, I was able to attend case presentations, grand rounds, and sports medicine lectures with faculty, residents, and fellows. One of the lectures involved BTB mismatch and other pitfalls in ACL reconstruction with Dr. Marc Safran. While at the VA, I visited the clinic with nurse Holly Burt, who is involved in a study investigating the use of PRP injections for the treatment of knee arthritis. One of the aims of that study is to better understand the relationship between certain PRP characteristics and clinical outcomes.

Lab Work

Most of my time in the lab was spent with Dr. Erika Leonardi, an orthopaedic surgeon originally from Italy who is now working as postdoc with Dr. Chu. As part of our work in the lab, we processed stem cells from fat and bone marrow, expanded cell cultures for stem cells, changed media, prepared media, observed the different morphology of cells in the microscope, and ran flow cytometry to evaluate the different cell populations. We also discussed the different theoretical concepts around stem cells and new research frontiers like those including induced pluripotent stem cells (iPSCs). Last, we performed dissections of rat knees in order to analyze the anatomy of the joint, the menisci, and the ACL and also evaluated the effect of a torn ACL in rats. Dr. Leonardi was an amazing teacher who generously shared her knowledge and helped me to develop new lab skills.



03 In the lab, processing bone marrow and fat with Dr. Erika Leonardi.



04 Processing fat to obtain stem cells and culture them.



05 Dissecting rat's knees in the lab and evaluating the ACL.

Surgery

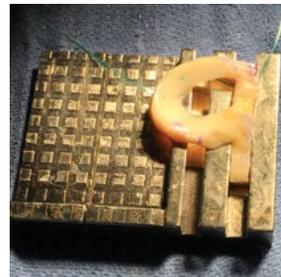
While at Redwood City, I was able to attend surgery with Dr. Marc Safran (who demonstrated hip arthroscopy) and Dr. Jason Dragoo (who performed some very interesting joint-preserving procedures such as meniscal transplantation, the treatment of cartilage lesions with osteochondral allograft, the treatment of cartilage lesions with fat-derived stem cells, and ACL reconstructions).



06 With Dr. Marc Safran in the OR.



07 With Dr. Jason Dragoo in the OR.



08 Lateral meniscal transplant surgery with Dr. Dragoo.

Marathon

During my visit, I was able to travel to Oregon for the weekend and run the first edition of the Grants Pass Marathon. The course tough and hilly, but the scenery was beautiful. Running is one of my passions and helps me to better understand my patients, whether they are professional athletes or amateurs like me.



09 Running the Grants Pass Marathon.



10 Eating the best sushi in bay area with Dr. Erika Leonardi and Dr. Constance Chu.

Conclusion

This program helped me grow as a both surgeon and a researcher and enabled me to improve my knowledge and skills, enrich my project, and become a better physician for treating my patients. I have already begun making improvements in our hospital regarding the use of orthobiologics. I want to thank ISAKOS, the Scientific Committee, Dr. Constance Chu, Dr. Erika Leonardi, and the whole Stanford team, for this amazing experience, which will make a difference in the quality of practice and research in our hospital and city. Finally, I want to thank my wife (Ana Sofia) for her continuous support during this fellowship, and my sister (Catalina) and brother-in-law (Sebastian) for cheering me on during the marathon.

Cadaveric Workshop on Advanced Reconstructive Knee Surgery

Khon Kean, THAILAND

Nineteen arthroscopic practitioners attended the cadaveric workshop on advanced reconstructive knee surgery that was held at the Faculty of Medicine, Khon Kean University, Khon Kean, Thailand. This course was approved by the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine (ISAKOS) and the Thai Orthopedic Society for Sport Medicine (TOSSM). Twenty national instructors, including the current president of TOSSM, Dr. Somsak Kuptniratsaikul, as well as many faculty members from Thailand shared their own experiences, participated in interactive discussions, and described their special techniques for advanced knee arthroscopic surgery. The 2-day program consisted of high-level scientific lectures and intensive knee arthroscopic cadaveric stations that allowed each participant to practice the principles of up-to-date reconstructive methods to address complex knee abnormalities. As such, the first day of the program focused on meniscal procedures and graft-harvesting techniques, whereas the second day focused on ligamentous reconstructions of the ACL, PCL, and MPFL.

After 3 sets of lectures, participants performed the cadaveric procedure that had been assigned by the table instructor and completed each task step by step.

The faculty highlighted topics such as hidden meniscal lesions (e.g., meniscal root/ramp lesions), PCL reconstruction with the tibial inlay technique, and many graft-harvesting techniques (e.g., bone-patellar tendon-bone, hamstrings, quadriceps tendon, and peroneus longus tendon).

The feedback from both participants and faculty members was highly positive, with participants reporting that they had had a great experience, had learned new techniques, and had developed more confidence to perform more advanced arthroscopic procedures. This outstanding academic program was another successful step on the part of TOSSM to provide participants with increased knowledge about arthroscopic knee surgery and its challenges.

Associate Professor Bancha Chernchujit

TOSSM Reconstructive Knee Cadaveric Workshop 2018
Course Chairman

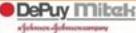





TOSSM
RECONSTRUCTIVE KNEE
CADAVERIC
WORKSHOP 2018

FACULTY OF MEDICINE, KHON KAEN UNIVERSITY
27TH – 28TH SEPTEMBER, 2018




Lyon Knee Surgery Days: Conference Recap

Lyon, FRANCE

Continuing a tradition that began 1971, the 18th edition of the Lyon Knee Surgery Days (Journées Lyonnaises du Genou) congress was held on September 20 to 22, 2018. This year's conference focused on the theme of revision knee surgery.

During this 3-day conference, a group of international experts on this very exciting subject provided attendees with unique perspectives on the range of diagnostic, therapeutic, and technical challenges facing patients, surgeons, and industry.

The organizers wish to warmly thank all of the participants, particularly (1) the large numbers of attendees, whose very dynamic participation in interactive sessions attested to the high level of interest in this subject, (2) the speakers from around the world, whose involvement demonstrated the quality of their interventions, and (3) our industrial partners, who provided strong and synergistic collaboration. The presence, support, and active participation of all attendees provided the congress with a great sense of momentum and created very open and friendly atmosphere.

During the conference, the organizers set up an organization and tools that will allow attendees to keep in touch with each other while waiting for the 19th edition, scheduled for September 24 to 26, 2020, which will be dedicated to the treatment of unicompartmental femorotibial lesions.

- Attendees will soon be able to relive the conference papers in podcast form by clicking directly on the program's communications.
- Attendees are invited to search for related information on the following sources:
 - The JLG 2018 app
 - The congress website www.lyon-knee-congress.com
 - The website of our association www.lyon-knee-surgery.com

The organizers welcome your opinion and would appreciate your completion of the following questionnaire: en.surveymonkey.com/r/JLG2018

Thank you again for your active participation. See you soon in Lyon!



Severance Arthroscopy Fresh Cadaver Workshops

Seoul, KOREA

The 69th knee and 70th shoulder cadaveric workshops were held at the Surgical Anatomy Education Center of Severance Hospital, Yonsei University Health System, a teaching center certified by ISAKOS, on the 1st and 9th of September this year in Seoul, respectively. The workshop which is one of the first and traditional arthroscopy cadaver workshops in Korea has been held at Yonsei University Health System in Seoul, Korea for 70 times since July 7th, 2001, and the Courses have been ISAKOS Approved since the 11th workshop on November 1st, 2003.

Lectures for anatomic structure and portals preceded the demonstration and practice sessions. The highlight of the program was the demonstration and individualized teachings by specialists of knee and shoulder arthroscopy surgery selected as instructors for the workshop. The emphasis was to have the “hands on” experience for the candidates after observing the demonstration by Prof. Sung-Jae Kim (Education committee ex-member) and instructors (Knee: Prof. Sung-Hwan Kim, Prof. Min Jung / Shoulder: Prof. Yong-Min Chun, Prof. Jong-hun Ji). Since the fresh cadaver offered participants with an environment similar to the real live operating field the participants were able to train themselves for various operative techniques under the special guidance of instructors. Additionally, elbow arthroscopy was also demonstrated by Prof. Sung-Jae Kim.

The workshops were very useful educational programs for the participants interested in the field of shoulder and knee arthroscopy. Each participant was able to obtain the one step forward needed in arthroscopic experience and capacity through the above workshops. In this workshop, we presented a plaque of appreciation to Smith & Nephew company, which donated surgical tools.

Course Chairman Prof. Sung-Jae Kim MD, PhD

Lab Instructors: 69th Knee Workshop

Name	Affiliation
Prof. Sung-Jae Kim	Yonsesarang Hospital
Prof. Jong-Hyuk Choi	Yonsei Univ. Severance Hospital
Dr. Jong-Min Kim	Modu Hospital
Prof. Sung-Hwan Kim	Yonsei Univ. Gangnam Severance Hospital
Prof. Min Jung	Yonsei Univ. Severance Hospital
Prof. Se-Won Lee	The Catholic Univ. Yeouido St. Mary's Hospital
Dr. Jaehun Jeong	ACE Hospital
Dr. Kwang-Yeol Park	Uri Hospital
Dr. Sanguk Ryu	Suhgwang Hospital
Prof. Tae hwan Yoon	Yonsei Univ. Yongjin Severance Hospital

70th Shoulder Workshop

Name	Affiliation
Prof. Sung-Jae Kim	Yonsesarang Hospital
Prof. Jong-Hyeok Choi	Yonsei Univ. Severance Hospital
Prof. Hyoung-Sik Kim	Yonsei Univ. Yongjin Severance Hospital
Prof. Yong- Min Chun	Yonsei Univ. Severance Hospital
Dr. Chang-Hun Sung	Yonsesarang Hospital
Prof. Jong-Hun Ji	The Catholic Univ. Daejeon St. Mary's Hospital
Prof. Doo-Hyung Lee	Ajou Univ. Hospital
Dr. Su-Keon Lee	Gwangmyeong Sungae Hospital
Dr. Jeonggi Choi	Choice Hospital



Surgical Anatomy Education Center of Severance Hospital



Join the ISAKOS Global Conversation!

Facebook.com/ISAKOSSociety

@ISAKOS



Join the ISAKOS Group on LinkedIn



Tweeting About The Congress?

Include hashtag #ISAKOS2019 in your Tweets to join the global conversation!

Ligament Reconstruction Seminar

Sapporo, JAPAN

The 13th Ligament Reconstruction Seminar and Live Surgery seminar was held at the Hokkaido University Faculty House “Enreisou” in Sapporo, Japan on July 19–20, 2018. This course was sponsored by the Department of Advanced Therapeutic Research for Sports Medicine and Orthopaedic Surgery at Hokkaido University Faculty of Medicine and Graduate School of Medicine. The president of this course was Prof. Eiji Kondo.

The course, which was attended by 20 participants, consisted of one day of theoretical lectures and one day of live surgical demonstrations at the Yagi Orthopaedic Hospital. Theoretical lecture topics included the fundamentals of knee ligament reconstruction (e.g., the clinical and biomechanical bases for reconstruction, basic techniques, arthroscopic anatomy, and so on). The surgical demonstrations included observation of anatomic double-bundle ACL reconstructions in an operating room, during which participants had opportunities to ask various questions to the instructors. Overall, this was a valuable opportunity for all participants and faculty to increase their knowledge of ligament reconstruction. Following the course, all participants received an ISAKOS-approved certificate of completion. The organizers thank ISAKOS for their support and for their acceptance of this seminar as an ISAKOS- Approved Course.



ISAKOS Members Receive Full Access to OrthoEvidence

OrthoEvidence's database has thousands of evidence-based summaries from more than 360 journals of the highest-quality research in orthopaedics.

1

Log in to myISAKOS at isakos.com/myISAKOS

myISAKOS

2

Click on myPublications



3

Click “Access” the ISAKOS/OrthoEvidence Portal

Access

OE ORTHOEVIDENCE⁺

in partnership with



14th Turkish Sports Traumatology, Arthroscopy and Knee Surgery Congress

Antalya, TURKEY

The 14th Turkish Sports Traumatology, Arthroscopy and Knee Surgery Congress was held in Antalya, Turkey, on October 2-6, 2018. This ISAKOS-approved Congress was held under the presidency of Prof. Merter Özenci and the honorary presidencies of Prof. Ramon Cugat and Prof. Semih Gür. During the congress, approximately 480 registered participants attended 98 conferences, 39 panels, 15 training courses, 1 live broadcast of a cadaveric procedure, and 97 oral presentations. The biannual Turkish Arthroscopy congresses have always had a strong international participation, and this tradition continued with the scientific support of ESSKA and EFOT, with 9 invited speakers from around the world. The Program Committee prepared a wonderful scientific program that featured experts and leaders from diverse fields and included a half-day shared program with sports medicine doctors and physiotherapists.

The congress was an opportunity to meet old friends and make new acquaintances, laying the groundwork for future scientific collaboration. The participants provided tremendously positive feedback on the quality of the scientific presentations and the organization of the congress.



For those interested, photographs taken during the scientific sessions and the social program will be available at the congress web site as soon as possible (www.tusyad2018.org/en.html).

The organizers gratefully acknowledge the scientific support of ISAKOS in making the congress a success and hope that this event provided an opportunity to cement ties and to improve relations between Turkey and the rest of the international arthroscopy and knee surgery community, with a view toward hosting an ISAKOS Congress in Turkey in the future.

Prof. Merter Özenci



THE INTERACTIVE AGENDA HAS A NEW LOOK!

Save the ISAKOS Congress Web App for Access on the Go!

Now more mobile, tablet and computer friendly! The Interactive web app includes:

- LIVE agendas by day, room, or session type
- Faculty Profiles
- Linked Abstracts, Outlines & Presentations
- Search and Sort Filters
- Collapsible and Expandable Viewing
- Save Favorites to mySchedule
- 5-Star Rating System
- Electronic Question Queue (On-Site)
- Interactive Exhibits Floorplan & Directory
- Congress PDF Programs & Downloads
- Online Attendee Directory
- And More!

isakos.com/interactiveagenda

ASSA-IOSSMA 2018

Semarang, INDONESIA

The combined 6th Annual Meetings of Association of Southeast Asian Nations (ASEAN) Society for Sports Medicine and Arthroscopy (ASSA) and the Indonesian Orthopaedic Society for Sports Medicine and Arthroscopy (IOSSMA) were successfully held at the Po Hotel and Dr. Kariadi Hospital in Semarang, Indonesia, on September 5–8, 2018.

Dr. Le Chi Dung (Past President of ASSA), Dr. IGM Febry Siswanto (President of IOSSMA), and Dr. Isa An Nagib (Chairman of the Organizing Committee) welcomed >300 participants to the meeting, which featured 25 distinguished International Speakers (including ISAKOS faculty members) and 30 National Speakers who shared their knowledge, expertise, and surgical techniques during both cadaveric workshops and live physical examinations. The symposium program focused on Arthroscopy and Sports Medicine and included 4 Plenary Lectures, 16 Satellite Symposia, and an Honorary Guest Lecture by Prof. John Bartlett. The Gala Dinner on September 7 included a ceremony for the new President of ASSA, Dr. Andri MT Lubis. Overall, the meeting provided an excellent opportunity to forge good friendships between the participants representing the countries of Southeast Asia and ISAKOS.



01 The Faculties of ASSA and IOSSMA.



02 ASSA Presidential Inauguration.



03 Professor Ronald Diercks performs a Live Physical Examination.

Iranian Society of Knee Surgery, Arthroscopy and Sports Traumatology

Kish Island, IRAN

The 5th International Biennial Congress of ISKAST (Iranian Society of Knee Surgery, Arthroscopy and Sports Traumatology) was held on February 14-17, 2018, on beautiful Kish Island, in the Persian Gulf region of Iran.

Approximately 300 orthopaedic surgeons from all corners of the world attended the 4-day congress, during which the ISKAST Executive Committee hosted 28 international faculties and about 50 local and Iranian experts presented cases covering wide range of topics, including the knee, hip, shoulder, foot and ankle, hand and elbow, sports trauma, and so on. In addition, the Scientific Committee received 64 articles, of which 58 were accepted (22 for oral presentation and 36 as posters). At the closing ceremony, the best 3 articles and the best poster received awards.

Throughout the meeting, representatives from the orthopaedic equipment and pharmaceutical companies that sponsored of the Congress exhibited and introduced their new products, organized scientific sessions and workshops with international instructors, and provided training in new techniques and products.

The ISKAST Scientific and Executive Committees gained valuable experiences during the 2018 Congress and hope that the event was a source of improvement and enhancement across the different fields of orthopaedic surgery and provided inspiration to the new generation of young surgeons.

Photographs from the event can be viewed here: congress.iskast.org/fa/gallerypic.php?rid=8&rriid=0

VISIT THE ISAKOS BOOTH IN CANCUN!

Located in the Gran Cancun Foyer—3rd Floor



STOP BY TO:

- Pick up complimentary copies of the Journal of ISAKOS
- Browse the latest ISAKOS Books & Booklets
- See available ISAKOS Fellowships & Research Grants
- Learn about ISAKOS Membership and how to apply!

**SUBMIT YOUR
ORIGINAL RESEARCH!**

ISAKOS is pleased to announce
that the Journal of ISAKOS is
publishing original research



JISAKOS.BMJ.COM



Follow @J_ISAKOS on Twitter!



BMJ

10th Global Musculoskeletal Ultrasound with Basic MRI Correlation Conference & Workshop for Physicians & General Practitioners

Holiday Inn Resort
Penang Island, MALAYSIA

March 17–18, 2019

Chair(s): Professor Dr. John George

For further information, please contact:

Tel: +6012-277 3799

Fax: +603 2690 1301

www.penangmskrad.com

All You Need to Know...Meniscus, Cartilage, Osteotomy and Uni

Royal Library of Belgium
Brussels, BELGIUM

March 23, 2019

Chair(s): Pr. René Verdonk,
Dr. Theofylaktos Kyriakidis

For further information, please contact:

Tel: +32475974269

Fax: +3225558360

allyouneedtoknow.be

International Congress on Cartilage Repair of the Ankle

Royal College of Surgeons in Ireland
Dublin, IRELAND

March 29, 2019

Chair(s): John Kennedy

For further information, please contact:

Tel: +353879333163

4th Edition Watch & Try
Verona Fiera Congress Center
Verona, ITALY

March 29–30, 2019

Chair(s): Claudio Zorzi, Ospedale Sacro Cuore – Don Calabria, Negrar

For further information, please contact:

Tel: +39 33838337991

Fax: +39 055 4641490

www.sigascot.com

APOA Sports Meeting 2019 Incorporating Orthopaedic Research
Hilton Hotel Kuala Lumpur
Kuala Lumpur, MALAYSIA

April 3, 2019

Chair(s): Dr. Charanjeet Singh

For further information, please contact:

Tel: +603 2276 0555

Fax: +603 6207 6795

apoasports.com

El Deporte y Sus Ciencias
Universidad Católica Argentina
Buenos Aires, ARGENTINA

April 11–12, 2019

Chair(s): Daniel Stumbo

For further information, please contact:

Tel: +541148012320

Fax: +541148012320

www.aatd.org.ar

XIII Congreso Bienal de Setrade
Palau De Congressos
Palma de Mallorca, SPAIN

April 25–26, 2019

Chair(s): Dr. Jordi Ardèvol Cuesta

For further information, please contact:

Tel: +34 902 190 848

Fax: +34 902 190 850

www.setrade.org/13setrade/presentacion.php

9th Pune Knee Course
JW Marriott
Pune, INDIA

April 26–27, 2019

Chair(s): Dr. Sachin Tapasvi

For further information, please contact:

Tel: +918805008475

Fax: +912030205050

www.punekneecourse.com

Football Medicine Meets the Universe of Sport
Wembley Stadium
London, UNITED KINGDOM

April 27–29, 2019

Chair(s): Stefano Della Villa

For further information, please contact:

Tel: +390512986814

Fax: +39 05119902200

www.footballmedicinestrategies.com

aossmTM
SURGICAL SKILLS

AOSSM & ISAKOS Surgical Skills Course

Osteotomies Around the Knee:

From Ligament Insufficiency to Cartilage/Meniscus Pathologies and Arthritis

Learn more and register today at sportsmed.org

EARLY BIRD PRICES END
MARCH 12, 2019
**REGISTER AT
SPORTSMED.ORG**

April 12–13, 2019

OLC Education and Conference Center
Rosemont, IL

Course Co-Chairs

Elizabeth A. Arendt MD

Alan M. Getgood MD, FRCS (Tr&Orth)

Robert F. LaPrade MD, PhD

DEMYSTIFY OSTEOTOMY TECHNIQUES

Gain a greater understanding of lower limb alignment and how it may be altered to improve patient function for a variety of knee conditions; from cartilage and meniscal injury, to ligament deficiency to osteoarthritis.

Attendees will learn techniques for realignment osteotomy that provide a clear rationale and practical treatment applications to implement into every day practice.

aossmTM
American Orthopaedic Society
for Sports Medicine



UPCOMING ISAKOS APPROVED COURSES

7th Arthroscopic Technique Symposium
(Advanced Course)
Korea University College of Medicine,
Seoul, REPUBLIC OF KOREA
May 26, 2019

Chair(s): Kyung-Ho Yoon, MD

For further information, please contact:

Tel: +82-2-2626-3296

Fax: +82-2-2626-1164

www.korarthro.com

Foot and Ankle Arthroscopy Sports
Traumatology course
Amsterdam Skills Centre
Amsterdam, NETHERLANDS
May 27–28, 2019

Chair(s): Prof. Dr. G.M.M.J. Kerkhoffs

For further information, please contact:

Tel: +31(0)205666419

Fax: +31(0)205169117

acesamsterdam.nl/courses/registration/

San Diego Shoulder Institute 36th Annual
Course: Arthroscopy, Arthroplasty, and
Fractures

Hilton San Diego Bayfront
San Diego, UNITED STATES

June 19–22, 2019

Chair(s): James C. Esch, MD,
Felix "Buddy" Savoie, MD

For further information, please contact:

Tel: +1 760-940-2066 / +1 760-445-2874

Fax: +1 951-695-6801

www.shoulder.com

2019 The Ligament Reconstruction Seminar
& Live Surgery in Sapporo
Faculty House "Trillium (Enreiso)" in Hokkaido
University

Sapporo, JAPAN

July 18–19, 2019

Chair(s): Eiji Kondo

For further information, please contact:

Tel: +81-11-706-5935

Fax: +81-11-706-6054

hokudai-med-sports-center.org

Combined 6th IHKS Scientific Meeting with
APKS Meeting and APIS Meeting
Tentrem Hotel

Yogyakarta, INDONESIA

August 21–25, 2019

Chair(s): Kiki Novito, MD

For further information, please contact:

Tel: +622152920303

Fax: +622152920303

www.event2019.ihks.or.id

The 3rd Congress and 7th Annual Meeting
of Indonesian Orthopedic Society for Sports
Medicine and Arthroscopy (IOSSMA)
Ritz-Carlton Mega Kuningan Jakarta
Jakarta Pusat, INDONESIA

September 3, 2019

Chair: Isa An Nagib

For further information, please contact:

Tel: +62217254424

Fax: +62217396261

iossma.org

Lyon Hip Arthroplasty 2019
LYON, FRANCE

September 12–13, 2019

For further information, please contact:

Tel: +33 (0) 4 81 88 02 92

Fax: +33 (0) 4 81 88 02 92

www.lyon-hip-arthroplasty.com

ICRS 2019–15th World Congress
Hyatt Regency Vancouver
Vancouver, CANADA

October 5–8, 2019

Chair(s): Alan Getgood & Lucienne Vonk

For further information, please contact:

Tel: +0041445037373

Fax: +0041445037372

www.cartilage.org

Current Concepts on Knee OA: From the Cell
to the Metal
Auditorium Paganini-Paganini
Congressi–Spazi Ipogei
Parma, ITALY

November 28–29, 2019

Chair: Paolo Adravanti

For further information, please contact:

Tel: +003933838337991

Fax: +0039055 4641490

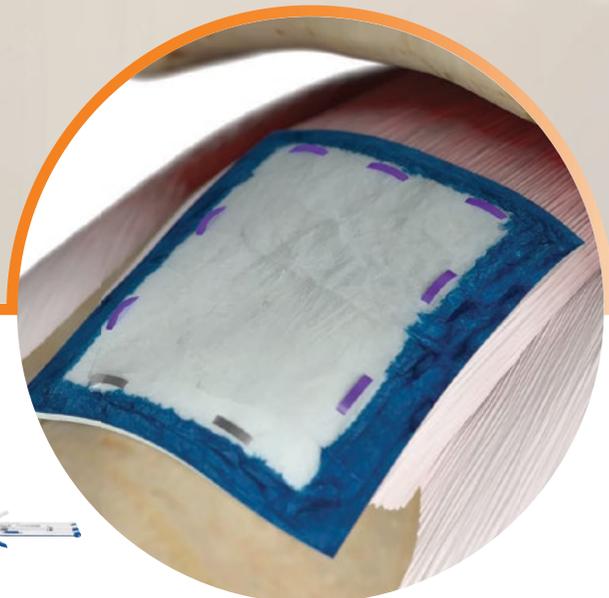
www.sigascot.com

Make your Course an...

ISAKOS
Approved-Course

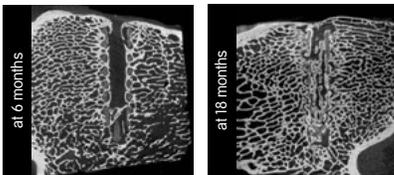
isakos.com/meetings

Life Unlimited



References 1. Data on file at Smith & Nephew, report 15000897, 2012. 2. Costantino PD, Friedman CD. Synthetic bone graft substitutes. *Otolaryngol Clin North Am.* 1994;27:1037-1074

REGENESORB® Material
Replaced by bone within 24 months.¹



Comparisons of absorption, measured via μ CT, at 6 and 18 months.²

**HEALICOIL®
REGENESORB
Suture Anchor**



**REGENETEN®
Bioinductive Implant**

Rotator Cuff Repair

Advancing Healing Solutions

Come and learn more at AAOS 2019 Annual Meeting, **booth #3421.**



International Society of Arthroscopy,
Knee Surgery and Orthopaedic Sports Medicine
2410 Camino Ramon, Suite 215
San Ramon, CA 94583-4318 USA

Telephone: +1 925 807-1197
Fax: +1 925 807-1199
isakos@isakos.com
www.isakos.com



12TH Biennial

ISAKOS
CONGRESS 2019

Cancun, Mexico • May 12-16, 2019



SAVE THE DATE

13TH Biennial

ISAKOS
CONGRESS 2021

#ISAKOS2021

Cape Town, South Africa | May 23 - 27, 2021