# ISAKOS

ISAKOS NEWSLETTER 2024 • VOLUME I

Current Perspectives on Arthroscopy, Knee Surgery & Orthopaedic Sports Medicine

ISAKOS CONGRESS 2025 | MUNICH GERMANY June 8–11

PG. 9 | CALL FOR ABSTRACTS **NOW OPEN!**

INTERNATIONAL SOCIETY OF ARTHROSCOPY, KNEE SURGERY & ORTHOPAEDIC SPORTS MEDICINE • 1995 •

## Register Today!

ISAKOS KNEE ARTHROPLASTY FORUM | KYOTO, JAPAN 2024 OCTOBER 31 – NOVEMBER 1

INSIDE

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International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine

isakos@isakos.com

# **At this "interim" year, coming off our 2023 ISAKOS Congress in Boston, USA,** and looking forward to our 2025 ISAKOS Congress in Munich, Germany

ISAKOS leadership is tirelessly working to disseminate cutting-edge knowledge on orthopaedic sports medicine throughout its diverse, international platforms. Please find the time to devote to these unique platforms and use them to advance your own knowledge and career. I will mention, here, just a few.

To those of you who made the **2023 Congress** a huge international success and to those who were unable to make it, we encourage you to access the Congress recordings available on ISAKOS Global Link and enjoy sessions you were unable to attend.

ISAKOS CONGRESS 2023 Boston Massachusetts June 18–June 21

This is an ocean of knowledge you should all benefit from as your schedule allows. In addition, we suggest you find the time to browse the OrthoEvidence summaries, which you are all entitled to as ISAKOS members, as these will effectively enable you to improve your evidence-based clinical judgement. Access to OrthoEvidence and other ISAKOS publications can be found at isakos.com/myISAKOS. Another platform we hope you are all able to enjoy are the ISAKOS webinars. ISAKOS leaders are continuously including the top-experts in our field in these webinars—another invaluable resource to help aid you with the issues and controversies we are all dealing with every day. View the schedule for upcoming ISAKOS webinars at isakos.com/webinars. We also invite you to take note of the upcoming ISAKOS collaborative courses and workshops, as these provide the best hands-on and knowledge sharing experience for attendees. Last, but certainly not least, for those of you who are seeking platforms to publish your studies, we encourage you to consider submitting to the *Journal of ISAKOS* (jisakos.com). This peer-reviewed journal recently received its first impact factor—a direct result of the editorial board's hard work and scientific quality of its articles. The journal, headed by Dr. Olufemi R. Ayeni as Editor in Chief and Dr. Vikas Khanduja as Associate Editor in Chief, is well on its way to becoming one of the world's leading sports medicine journals. Submitting your research to *JISAKOS*, a prestigious open-access publication, will contribute to the growth of both your career and our society.

I hope you will find this volume of the ISAKOS Newsletter insightful and valuable as a guide for planning your 2024 sports medicine year.

As we are all looking forward to our next ISAKOS Biennial Congress in Munich in 2025, please note that abstract submission is now open at isakos.com/2025congress. We invite you to submit your abstracts and apply for a multitude of ISAKOS awards.

Sincerely yours,

IH

**Iftach Hetsroni, MD, Associate Prof.**

Interim Editor, ISAKOS Newsletter Editorial Board
ISRAEL

**David A. Parker, MBBS, BMedSc, FRACS**
ISAKOS President, 2023–2025
AUSTRALIA

Dear Friends,

It seems like yesterday that we were all together in Boston, but a lot has happened in the ISAKOS world since then. As we continue to find even more ways to achieve our mission of global education in the area of arthroscopy, knee surgery and orthopaedic sports medicine, our office staff and our hundreds of committee members are doing an incredible job for our organization. I would like to start by personally thanking everyone who is giving up their time and expertise to help us in continuing this important mission. Our biennial Congress is of course our flagship event, but there is no time for rest between these meetings as we provide a continuous program of educational events and resources for our members.

Since Boston, we continue to engage with our partner societies around the world. In June, a week after our Boston meeting, we officially welcomed our first national partner society, the Japanese Sports Orthopaedic Association, at their inaugural meeting in Hiroshima, in what was a very memorable ceremony. We had an excellent symposium on Patellofemoral Pathology at the AOSSM meeting in Washington, DC in July. We have had webinars with APKASS, SLARD, IAS, ICRS, ISHA and ESSKA, and have more planned throughout 2024, including with JSOA. In the first half of the new year, we are very excited to be contributing symposia to the SLARD and ESSKA meetings, and partnering with AANA on a Specialty Day course at the AAOS meeting in San Francisco.

> **"** We have had many **educational activities around the world."**

In September, we joined with the Aspetar clinic in Qatar to run a cadaveric skills lab in arthroscopic knee and ankle surgery. The course was sold out and had 30 surgeon attendees from 18 countries. A big thanks to Dr. Pieter D'Hooghe and his team at Aspetar for helping to put together a great experience for the attendees. In October, we joined with AOSSM to run a teaching lab on Osteotomy around the knee, at the Orthopaedic Learning Center in Chicago. This course was also sold out, attracting 50 surgeons from 17 different countries, and the feedback from the attendees at both courses was overwhelmingly positive. For the first half of 2024, ISAKOS lab courses include the IAS-IEAAF Workshop Chennai held this past January and the ISAKOS & AANA Surgical Skills Lab to be held in Miami in April.

I have personally been busy representing ISAKOS at various meetings around the world, starting with the Canadian Orthopaedic Association meeting in Calgary immediately after the Boston meeting. Since then, I attended the JSOA meeting in Hiroshima, the IFOSMA meeting in Chongqing, China, the Hong Kong Orthopaedic Association meeting, and the Australian Orthopaedic Association and Australian Knee Society meetings. It has been an absolute pleasure to participate in so many meetings around the world and catch up with so many friends and colleagues. The coming year looks like it will be equally busy, and it is always an absolute honor to represent ISAKOS.

ISAKOS continues its commitment to enhance our focus on knee arthroplasty, and plans are well underway for the second ISAKOS Knee Arthroplasty Forum (IKAF) in Kyoto, Japan in October of this year. Program chairs, Shuichi Matsuda and Sebastien Lustig, have put together a fantastic innovative program, featuring an amazing faculty of international experts as well as arthroplasty leaders from within Japan and the surrounding regions.

It will be a fantastic educational event in a wonderful historic location, and I encourage anyone with an interest in knee arthroplasty to register and join us in Kyoto.

Planning is also well underway for our biennial Congress in Munich in June of 2025. Abstract submission is now open and we encourage you to submit early at isakos.com/2025congress. All of our committee members have been working hard to provide suggestions for content at the meeting, and the Program Committee will soon be working to pick the best suggestions to create the most innovative educational experience we have ever seen. Drs. Al Getgood and Pietro Randelli are leading the Program Committee, and I am looking forward to joining Al, along with our office staff, in Munich in May (prior to the ESSKA meeting in Milan) to visit the site and connect with local partners to ensure we have the best possible experience at our meeting.

I would again like to thank all our wonderful ISAKOS committee chairs and members for their hard work to make ISAKOS the organization it is, and to our incredibly dedicated office staff who work tirelessly to keep everything running smoothly. ISAKOS exists for our members, so please send in any feedback you may have about how we can continue to make our society better.

## I hope the New Year is off **TO A ROUSING START!**

# 2023 ISAKOS by the Numbers

## Congress

**2023 ISAKOS Congress**

**1,000+** **ePosters** and **Posters** Presentations

**36** ICLs

**55** Symposia

**643** Faculty & Scientific Paper Presenters from **48 Countries**

**110** In-person **posters**

**20+** Surgical **Demos**

**11** Meet the Experts Sessions

**62%** of Registrants were **under 50 years of age**

**375+** Scientific Session Faculty representing **50+ Countries**

**450** **Paper** Presentations

**283** Live **Sessions**

## ISAKOS Publications

### *Journal of ISAKOS*

**278** articles submitted from **43 Countries**

**92** Papers **Published**

**213** Unique **Authors**

**251** Unique **Reviewers**

### ISAKOS Biannual Newsletter

2023 Vol 1:

**2904** Total **Views**

**1600** **Unique** Views

2023 Vol 2:

**2081** Total **Views**

**1212** **Unique** Views

**ISAKOS Books**

**40** Books Published **to Date**

**2** Books published

# Society

## ISAKOS Membership

**89%**
Member **Retention**

**110**
Countries **Represented**

## ISAKOS Committees

**65** **Meetings** Held

**32** Total **Committees**

**262** Committee **Members**

# ISAKOS Education

2 Lab Courses in 2023

**80+** **Participants**

## ISAKOS Webinars

**3,983**
Unique People

**10**
Live Webinars

**6,823**
Registrations

Participants from **129** **Countries**

## ISAKOS Global Link

**176**
Surgical Videos

**1161**
Unique Surgical Demo Views

**43**
Micro-Learning Videos

**1299**
Congress Media Content Added

**89**
Non-Congress Items Added

**52**
Webinar Recordings to date

## Research Grants

**8** Scientific Research Grants **awarded in 2021–2023**

**$158,250**
Funded in **2021–2023**

## Awards, Fellowships, & Scholarships

**122** Applications submitted for **nine 2023 Congress Awards**

**166** Applications submitted for **six fellowships in 2021–2023**

International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine

Thank you for helping ISAKOS continue to provide excellence in research and education.

**isakos.com**

## *JISAKOS* EDITOR IN CHIEF'S MESSAGE

**Olufemi R. Ayeni, MD, PhD, MSc, FRCSC**
CANADA
Editor in Chief, *JISAKOS*
chiefeditor@jisakos.com

In June 2023, the *JISAKOS* impact factor was released at an impressive 1.6 (Journal Citation Reports® Clarivate Analytics, 2023). Since then, we are already seeing an increase in submissions, and I have been fortunate to witness the alignment of our editorial interests and talents as we continue to propel this journal forward as one of the leading sources of information in sports medicine.

Since taking on the position of Editor in Chief a few months ago, I have recognized and have begun to implement several worthwhile pursuits to advance the impact of *JISAKOS*. These include promoting excellence in peer review, dedication to evidence-based principles and methodology, and open access, as well as implementing other programs, to allow for a global reach.

In an effort to promote excellence in peer review, we have created the 'Elite Reviewer' role. An 'Elite Reviewer' is a content expert with high-level research and peer-review experience identified by the Editors. Each Elite Reviewer has agreed to review at least 20 manuscripts per year and return their review within 2 weeks of accepting an invitation. Elite Reviewers have been selected from across all continents to ensure manuscripts receive a global perspective.

In an attempt to improve transparency and objectivity, we have initiated a standard scoring system to evaluate all reviews of submitted manuscripts. Over time, scoring reviews will assist Associate Editors with finding reviewers that typically provide comprehensive and insightful comments. Where previous scoring was completed based on individual opinion, we hope more objective criteria will promote more consistent and accurate review practices.

> "We will continue to seek impactful research **that affects care across the globe.**"

Finally, we recently launched a global initiative for Excellence in Authorship with a goal to build capacity with researchers in low-to middle-income countries (LMICs) to promote diversity, inclusion, and global perspectives for papers submitted and published with the journal. This program will provide training and learning opportunities for researchers in LMICs in terms of writing high-level manuscripts, navigating the peer-review process, and ultimately, publishing their work. Successful applicants will be provided a waiver for a *JISAKOS* open access fee; participate in a research and publishing webinar with expert researchers and *JISAKOS* Editorial Board members; and have access to statistician, research manager, and surgeon-scientist advisor(s) to assist with the statistical analysis, logistical implications, and methodology of their project and final manuscript.

Of course, none of these initiatives would be possible without our *JISAKOS* team. Dr. Vikas Khanduja is the new Associate Editor in Chief. He brings a tremendous amount of knowledge, expertise and innovation to the journal, having served as a leader in several organizations including past President of the British Hip Society and President Elect of SICOT. Ms. Nicole Simunovic (new Managing Editor) has an extensive publication and administrative leadership record relating to clinical trials and health research methodology. The Editorial Board and Associate Editors consist of a group of leading, exceptional experts in their respective fields and editorial content. Their administration and input have been invaluable to the editorial process and our success as a stand-alone journal.

I look forward to what 2024 can bring as we get fully immersed in our roles. We will continue to seek impactful research that affects care across the globe.

# ISAKOS KNEE ARTHROPLASTY FORUM

KYOTO, JAPAN 2024

OCTOBER 31 – NOVEMBER 1

# Register Today!

As the world's only truly global knee society, ISAKOS is proud to once again host an international meeting dedicated entirely to Knee Arthroplasty.

Through symposia, debates, surgical demonstrations and interactive case-based discussion, world-renowned experts will offer insights into clinical challenges and research advancements.

## Featuring an Innovative and Interactive Meeting Format

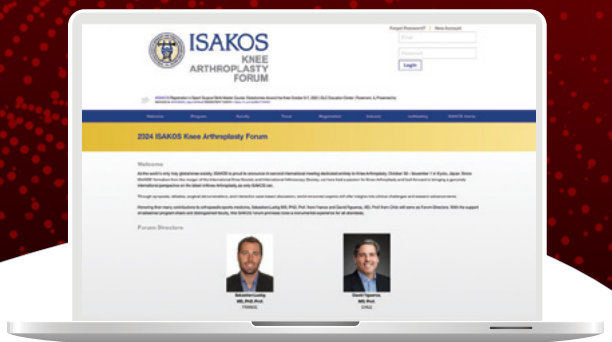
- Controversial Topics
- New Technology
- Debates
- Consensus

Cutting-edge, international knowledge you can take home!

## Forum Directors

Sebastien Lustig, MD, PhD, Prof.
FRANCE

Shuichi Matsuda, MD, PhD
JAPAN




**isakos.com/IKAF2024**

**David A. Parker, MBBS, BMedSc, FRACS AUSTRALIA**

President 2023-2025

**Alan Getgood, MD, FRCS(Tr&Orth), DipSEM CANADA**

Program Chair 2023-2025

# WELCOME!

We cordially invite you to the 15th Biennial ISAKOS Congress in Munich, Germany. The ISAKOS Congress continues to be considered the premier international meeting, providing a unique opportunity for attendees to share, discuss and learn the latest advancements in arthroscopy, knee surgery and sports medicine.

The four-day ISAKOS Congress includes 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.

We hope you will plan to participate in the international experience that is the ISAKOS Congress!

## PROGRAM COMMITTEE

Nasef Mohamed N. Abdellatif, MD, PhD EGYPT

Claudia Arias, MD PERU

Olufemi R. Ayeni, MD, PhD, MSc, FRCSC CANADA

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Stefano Zaffagnini, MD, Prof. ITALY

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ISAKOS CONGRESS 2025 | MUNICH GERMANY June 8–11

# CALL FOR ABSTRACTS **OPEN!**

## ONLINE ABSTRACT SUBMISSION INSTRUCTIONS

1. Log-in using the presenting author's email and password for ISAKOS. If a record does not exist for the presenting author, you will be prompted to create a new record.
2. You must then create or update your Financial Disclosure Statement with AAOS to be current within 24 months. Upon completion, you will be returned to the abstract submission portal at ISAKOS.
3. Complete contact information for the presenting and other authors, including the institution of research. It is helpful to have the ISAKOS ID numbers for as many authors as possible. You may email **isakos@isakos.com** to obtain an author's ISAKOS ID number—**please do not make duplicate records.**
4. Complete the American Food and Drug Administration (FDA) Statement and Copyright License Agreement on behalf of all authors.
5. Provide the abstract title in proper title case for publishing.
6. Enter the plain abstract text in the provided text box. Please note, graphics and tables are not accepted.
7. Once the abstract is submitted by the presenting author, any other authors will be notified to complete their disclosures through AAOS. Abstracts will not be considered until all disclosures are completed. Please ensure that the same email is used for both ISAKOS and AAOS accounts.
8. Author Warranty: Authors must read and abide by the Abstract Submission Guidelines to be considered for presentation.

SUBMIT TODAY! **ISAKOS.COM/2025**

ABSTRACT SUBMISSION DEADLINE:
**SEPTEMBER 1, 2024**

# AWARDS & FELLOWSHIPS

## AWARDS
**isakos.com/awards**

**SUBMIT YOUR ABSTRACTS AND APPLY FOR THESE PRESTIGIOUS ISAKOS AWARDS!**

### AWARDS

**Freddie Fu Lifetime Achievement Award**
*Sponsored by Smith+Nephew*

In honor of renowned orthopaedic surgeon, ISAKOS Past President and inspirational leader, the Freddie Fu Lifetime Achievement Award is the highest pinnacle of honor bestowed by ISAKOS—established to recognize an ISAKOS Member for their distinguished service to the Society, plus their significant contributions to the field(s) of arthroscopy, knee surgery and orthopaedic sports medicine.

**John J. Joyce Award**

In 1981, Dr. John J. Joyce, III, offered a monetary prize for the best arthroscopy paper read by an orthopaedic surgery resident or fellow during the Scientific Program of the 4th Congress of the International Arthroscopy Association in Rio de Janeiro. With characteristic generosity, he endowed a prize to be awarded at every IAA Congress thereafter. John Joyce created the award with the intention to stimulate and reward younger members who contribute high-quality data and presentations.

**Richard B. Caspari Award**

Beginning at the 2003 ISAKOS Congress in Auckland, New Zealand, a monetary prize in honor of Richard B. Caspari was awarded to the best upper extremity paper read at the scientific program of the Congress. The Richard B. Caspari award was established with the intention of stimulating and rewarding upper extremity focused abstracts and presentations.

**Jan I. Gillquist Scientific Research Award**

Beginning at the 2007 ISAKOS Congress in Florence, Italy, a monetary prize was awarded to the best scientific paper presented during the scientific program of the Congress. ISAKOS will remember Jan Gillquist with a Research Award, created with the intention to stimulate and reward abstracts and presentations in the subject of Scientific Research

**Gary G. Poehling Award**

Former ISAKOS President, Gary G. Poehling, is an innovator, teacher and leader in the field of Arthroscopy-specializing in the elbow, wrist and hand. Beginning at the 2017 ISAKOS Congress in Shanghai, China, a monetary prize in honor of Dr. Poehling is to be awarded to the best Elbow, Wrist and Hand paper read during the scientific program of the ISAKOS Congress.

**Albert Trillat Young Investigator's Award**
*Sponsored by Innovate Ortho*

In 1989, The International Society of the Knee established a Young Investigator's Research Award in memory of Professor Albert Trillat. Past President and founder of the International Society of the Knee. Trillat was a pioneer in knee surgery and sports traumatology. This award provides recognition for a young researcher who has done outstanding clinical laboratory research contributing to the understanding, care or prevention of injuries to the knee.

**Achilles Orthopaedic Sports Medicine Research Award**
*Sponsored by Enovis*

The Achilles Orthopaedic Sports Medicine Research Award was created in 1995 to recognize the researchers(s) who have performed the most outstanding clinical or laboratory research in the field of sports medicine, such as the care and prevention of injuries.

**Paolo Aglietti Award**
*Sponsored by Nicolaas C. Budhiparama, Jr. & Inge Widjaja*

*Nicolaas Institute of Constructive Orthopaedic Research & Education Foundation for Arthroplasty & Sports Medicine*

ISAKOS is pleased to announce the Paolo Aglietti Award for Knee Arthroplasty. This award is in recognition of Professor Aglietti's numerous contributions to knee surgery as a prolific researcher, teacher and surgeon. Professor Aglietti served as Chairman of the ISAKOS Knee Committee and was ISAKOS President from 2007-2009.

**Patellofemoral Research Excellence Award**
*Sponsored by The Patellofemoral Foundation, Inc.*

The Patellofemoral Research Excellence Award was conceived in 2005 by the Patellofemoral Foundation and ISAKOS to encourage outstanding research leading to improved understanding, prevention and treatment of patellofemoral pain or instability.

## FELLOWSHIPS

**isakos.com/fellowships**

**2023-2025 FELLOWSHIP RECIPIENTS HAVE BEEN SELECTED!**

## FELLOWSHIPS

**ISAKOS Global Traveling Fellowship**

Coordinated by the ISAKOS Traveling Fellowship Committee, the fellowship will provide the opportunity for orthopaedic surgeons from five regions to travel with an ISAKOS Godfather to the region of the 2025 ISAKOS Congress. Fellows will have the opportunity to observe sports orthopaedic surgeries performed by highly respected surgeons, discuss the surgical procedures and all aspects of patient management and to discuss and share research experience.

**ISAKOS Knee Arthroplasty Traveling Fellowship**
*Sponsored by Nicolaas C. Budhiparama & Inge Widjaja*

*Nicolaas Institute of Constructive Orthopaedic Research & Education Foundation for Arthroplasty & Sports Medicine*

Coordinated by the ISAKOS Knee Arthroplasty Committee, the fellowship will provide the opportunity for selected young orthopaedic surgeons, currently working in developing countries, to travel to various medical sites around the world to learn more about knee arthroplasty and to be exposed to the techniques of well-respected expert surgeons. At each site, the fellow will participate in knee arthroplasty surgical procedures, patient management or cadaver dissections in order to broaden their knowledge of the procedure.

**Patellofemoral Traveling Fellowships**
*Sponsored by The Patellofemoral Foundation, Inc.*

The Patellofemoral Traveling Fellowship was established in 2005 by the Patellofemoral Foundation and ISAKOS to promote better understanding and communication around the world regarding Patellofemoral pain. The Patellofemoral Traveling Fellowship is available on a competitive basis to an orthopaedic surgeon interested in the study and advancement of understanding of the Patellofemoral joint.

**ISAKOS Young Investigator's Scholarship and Research Mentoring Program**

The ISAKOS Young Investigator's Scholarship and Research Mentoring Program was developed by the ISAKOS Scientific Committee as a mentor-mentee program for young investigators with a specific focus on developing countries. The program seeks to stimulate research and education in developing countries, foster international collaboration, and promote academic excellence in arthroscopy, knee surgery and orthopaedic sports medicine.

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# The Use of Ortho-Biologics in Sports Medicine: An ISAKOS Survey Report

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*Osaka, JAPAN*

David A. Parker, MBBS, BMedSc, FRACS
*Sydney Orthopaedic Research Institute*
*Sydney, AUSTRALIA*

John G. Lane, MD
*Musculoskeletal and Joint Research Foundation*
*San Diego, CA, USA*

Alberto Gobbi, MD, FRACS
*Orthopaedic Arthroscopic Surgery International (OASI) Bioresearch Foundation Gobbi NPO*
*Milan, ITALY*

- Scientific literature and previous experience with biologics were the most indicated reasons for utilizing biologics
- PRP is the most popularly used biologic
- Platelet concentration was considered the most important factor in effectiveness of PRP injections
- The most popular indications for PRP were muscle injury, partial Achilles tendon rupture and rotator cuff tears
- An ICRS Grade IV lesion of **>2 cm² microfracture** with collagen/HA membrane was the most preferred treatment, followed by microfracture alone
- The most reported side effects to biologics were local inflammation, hematoma, and infection. 40% of respondents had never noted a complication
- Standardization of biologics and well-designed clinical trials are imperative to defining clinical indications and outcomes for biologic therapies. Most therapies lack results and clear guidelines for use

## Introduction

Biologic therapies have generated considerable interest and have experienced exponential growth over the last two decades. Translational research has focused on the development of novel, effective biologic therapies for the treatment of musculoskeletal injuries. Early pre-clinical data have been the driving force for commercial markets, and, unfortunately, long-term data and rigorous clinical trials have yet to be reported for most therapies. Commonly used biologics include platelet-rich plasma (PRP), micro-fragmented adipose tissue (MAT), bone marrow aspirate (BMA), and bone marrow aspirate concentrate (BMAC), among others. The ethical implications of biologics, particularly treatments based on stem cells, remain controversial. Biologics have some known complications, such as tumorigenicity, and ethical concerns have been raised regarding the source of stem cells; these concerns have been addressed by the formation of governing bodies to ensure ethical and legal medical practices[1]. These institutions have struggled to define and classify biologics because, unlike traditional drug treatments, these medications are a blend of complex active substances. The primary issues have been the autogenic or allogenic makeup of the biologic source, the tissue source itself, and, most importantly, the reasons for its use. Many of these concerns are still a matter of opinion rather than consensus, and therefore we thought that a targeted global survey could offer a useful perspective on the way that these biologicals are currently used in health care environments around the world.

## Survey: Methods and Results

The ISAKOS Biologics Task Force conducted an online survey to assess the use of biologics in clinical practice. This 46-question survey was sent to all members in the ISAKOS database via email between August 2022 and October 2022. The survey was completed by a total of 721 responders, of whom 514 indicated that they used biologics in their practice. Table 1 summarizes the responses from each geographical region and the users of biologic therapies from each region.

**Table 1. Responses According to Geographic Region**

| Geographic Region | Percentage of Responders According to Region N=721 | Percentage of Responders from Each Region Who Used Biologics N=514 |
|---|---|---|
| Latin America | 209 (29%) | 160 (31%) |
| Asia-Pacific | 198 (27%) | 133 (26%) |
| Europe | 178 (25%) | 129 (25%) |
| North America | 72 (10%) | 51 (10%) |
| Africa-Middle East | 64 (9%) | 41 (8%) |

## Utilization

Individuals who confirmed using biologics were further questioned about the particulars of their use. When asked to specify the primary rationale for their use of biologics, 35% of respondents cited the scientific literature, 32% cited their own previous experience with biologic therapies, 11% cited information from presentations, and the remaining 22% indicated failure of other treatments or other reasoning. The most common biologic therapy option was PRP, followed by bone marrow products and injections made from adipose tissue. The survey also included several additional treatments such as exosomes, umbilical cord stem cells, prolotherapy, and scaffolds, but these options were not chosen. Tendon and cartilage injuries were the most typical reasons for the use of biologics by health care professionals who treated sports-related injuries. The most common administration technique, used by roughly 50% of the responders, was ultrasound-guided injection. Overall, 59.8% of respondents indicated that they started using biologic therapies between 2010 and 2020; 23.3%, before 2010; and 16.9%, after 2020. Table 2 summarizes the use of biologics across the respondents as well as their indications and mode of delivery.

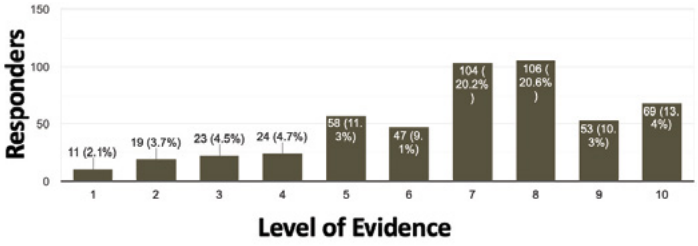
**Table 2. Biologics Used, Indications, Mode of Delivery, and Ultrasound Guidance**

| Questionnaire Item | Percentage of Respondents |
|---|---|
| **Biologic used** | |
| PRP | 93.6% |
| MAT | 16.1% |
| BMA | 35.1% |
| BMAC | 33.8% |
| Amniotic stem cell | 5.2% |
| **Use of biologics for sports injuries** | |
| Yes | 91.3% |
| No | 8.7% |
| **Tissue injury indication** | |
| Tendon | 79.4% |
| Muscle | 46.6% |
| Ligament | 51.1% |
| Meniscus | 40.4% |
| Cartilage | 74.4% |
| Joint disease | 60.8% |
| Others | 2.8% |
| **Delivery method** | |
| Joint injection | 87.8% |
| Tissue injection | 59.4% |
| Adjunct to scaffold | 30.7% |
| Joint injection/tissue injection/ adjunct to scaffold | 36.5% |
| **Ultrasound guidance for injection** | |
| Yes | 52.1% |
| No | 47.9% |

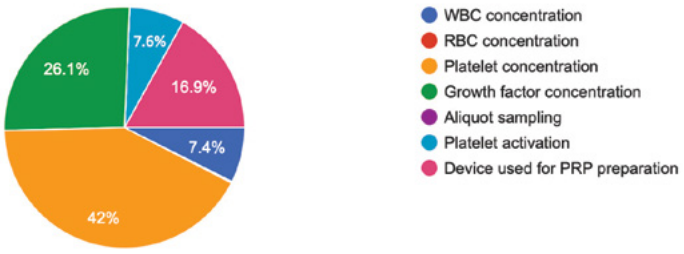
## PRP

PRP was the most popular biologic utilized, with 93.6% of respondents reporting that they routinely used it in their clinical practice. The survey also included questions regarding the rationale for using PRP, PRP preparation methods, and indications for using PRP.

Responders were asked their opinion on the current level of evidence for the use of PRP in their daily clinical practice, with 1 indicating "not at all" and 10 indicating "very much"; the most popular choices were 7 and 8 (Fig. 1). Further questioning revealed that users regarded platelet concentration to be the most important factor responsible for the effectiveness of PRP, followed by growth factor concentration and the preparatory device (Fig. 2).




01 Bar chart summarizing the responses regarding the level of user confidence in the scientific support for using PRP.




02 Pie chart summarizing the responses regarding the most important factor in the effectiveness of PRP as a treatment.

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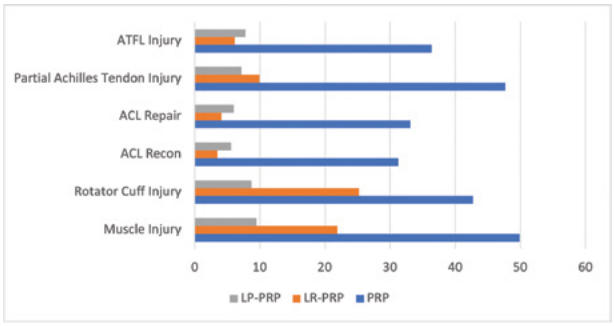
# The Use of Ortho-Biologics in Sports Medicine: An ISAKOS Survey Report

## Clinical Indications and PRP

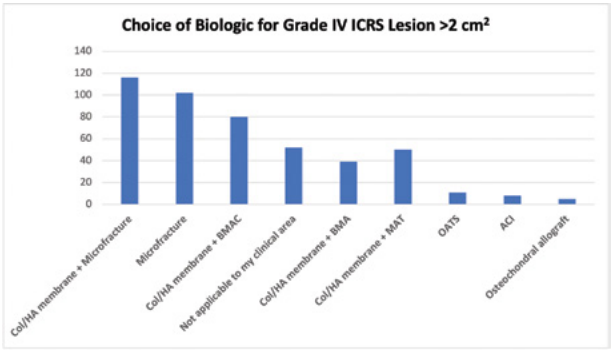
The survey further examined the indications for PRP to broadly determine what clinical scenarios had applicability for PRP. The use of PRP and its components were assessed in the setting of muscle injury, ACL injury, rotator cuff injury, partial Achilles tendon rupture, and ATFL injury. PRP was the most popular biologic for the treatment of all of the aforementioned injuries. Leucocyte-rich PRP (LR-PRP) was preferred for the treatment of muscle, rotator cuff, and partial Achilles tendon injuries, whereas leucocyte-poor PRP (LP-PRP) was preferred for use in ACL surgery. Fig. 3 summarizes the use of PRP and type in each indication.




03 Bar chart summarizing the preferred use of PRP, LP-PRP, LR-PRP for the treatment of various injuries.

## Biologics in Cartilage Injury

The survey included two questions related to the treatment of chondral injury. The first question asked whether the respondent would use a biologic to treat a chondral lesion, and the second asked the respondent about their choice of treatment for an ICRS grade-IV chondral lesion measuring >2 $cm^2$ in size. On the first question, 83.1% of respondents revealed that they would use a biologic to treat chondral injuries. Responses to the second question indicated most surgeons preferred a collagen/hyaluronan patch augmented with microfracture or microfracture alone (Fig. 4). Microfracture alone was most frequently chosen by responders from Latin America, followed by Europe and the Asia-Pacific region.



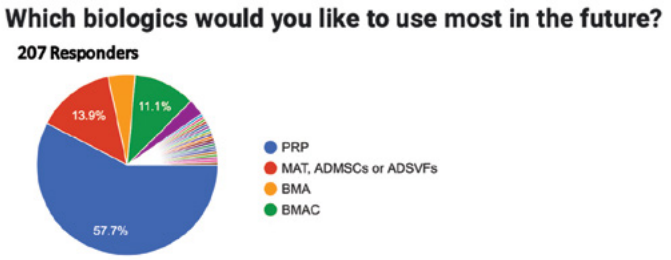

04 Bar graph summarizing the use of biologics for the treatment of a chondral lesion measuring >2$cm^2$.

## Adverse Reactions

The survey also inquired about complications associated with the use of biologics. The most common complications were local inflammation at the injection site (reported by 289 of the 514 respondents), hematoma (60 respondents), and infection (16 respondents). In addition, 205 of the 514 respondents indicated that they had not encountered any complications in association with the use of biologics.

## Non-Users of Biologics

The 40% of participants who indicated that they did not use biologics answered a set of questions that the users of biologics did not. Interestingly, 88.1% of non-users revealed that they were interested in using biologics in the future. PRP was the biologic that was most likely to be incorporated by these responders (Fig. 5).




05 Pie chart summarizing the biologics most likely to be used by current non-users of biologics.

## Discussion

This ISAKOS Biologics Task Force survey aimed to summarize a global perspective on the use of biologic therapies among professionals treating musculoskeletal injuries in athletes. Standardized recommendations for the use of biologics have not been achieved at this stage, with significant variability among responses to the survey. Most governing bodies remain equivocal in their recommendations on the use of biologics. Despite the lack of evidence, the commercial growth of such therapies has been immense. Biologic therapies have been popularized as a less-invasive method of treating common sports injuries as well as an adjunct to other surgical procedures involving ligaments and joints. Many of these therapies are autologous, allowing them to undergo less-stringent certification. Furthermore, as shown by the results of our survey, the prevalence of adverse reactions is low and most adverse reactions are mild. The use of biologics has increased over the last two decades in association with the commercial growth of such products, but this growth is also likely a result of pressure from the athletic community on sports physicians to provide options for less-invasive treatments with a speedier return to sport.

The survey revealed that PRP was the most preferred biologic for sporting injuries. This finding is indicative of an evidence-based approach to the use of biologics, as PRP is reported to have moderate clinical benefit in selected clinical scenarios.

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Other biologics have not reported with reasonable levels of evidence for use, which explains why they are not as popular for use. However, literature regarding PRP does have some shortcomings. Most studies have not defined the constituents of the PRP that was used. According to recent literature, the most important aspects in establishing well-defined clinical results with PRP usage are categorization and standardization of PRP production procedures. High irregularity and improper reporting of these variables in studies have been prohibitive in defining the exact indications and outcomes of PRP. However, there is consensus that PRP has a low complication rate and is a relatively safe treatment[2].

Standard PRP was still the most preferred treatment across the spectrum of muscle, rotator cuff, ATFL, and partial Achilles injury. In the setting of muscle injuries, reports in the literature have demonstrated both significantly reduced time to return to sport as well as no difference. No study has demonstrated improvement in terms of pain, muscle function, or healing. Muscle injuries are common in the athletic population, in which return to sport is the priority. Despite ambiguous results after the failure to achieve symptomatic relief with rehabilitation and physiotherapy, both clinicians and athletes prefer a less-invasive option such as PRP injection for the benefits that it may provide. LP-PRP was favored for intra-articular scenarios such as ACL reconstruction and repair. Recent literature has shown no significant clinical benefit in association with the use of PRP alongside ACL reconstruction surgery[3]. It may be that PRP should be reserved mainly for conservative treatment of soft-tissue injuries and should not be used as an adjunct to intra-articular surgery.

On the topic of chondral injury, the survey asked one question regarding the use of biologics for the treatment of ICRS Grade-IV lesions measuring >2cm$^2$. The most popular choice was collagen/hyaluronan-augmented microfracture, followed by microfracture alone. The literature has been clear that the results of microfracture are inferior for lesions measuring >2cm$^2$ in size[4]. Despite these results, the main reason for use in the sporting population is the swifter rehabilitation protocol. Treatments such as osteochondral autograft, ACI, and osteochondral allograft were the least popular, probably because of the need for extended rehabilitation.

Musculoskeletal treatment strategies for sports-related injuries are very different from those for non-sports-related injuries. The main governing factors appear to be time off the field and postoperative recovery. Despite the lack of uniformity in PRP preparation in the available literature, PRP is used in view of its safety rather than its proven clinical benefit. Stem cell therapies have been less popular because of regulatory concerns. In the athletic population, any possible benefit of less-invasive treatment is preferable. Less time away from sporting activities remains the primary objective even when surgery is unavoidable.

Our survey revealed that biologics are a popular strategy for treating sports injuries. It is encouraging to see that most advocates of PRP utilized this biologic because of its moderate clinical evidence. However, with non-uniformity of PRP being a critical issue in the available literature, users should now aim to perform clinical trials with strictly defined PRP protocols and formulations. It is an exciting time for biologic therapies, and, because of their complex composition, it is vital that data are collected in a homogenous fashion, with the therapeutic method being clearly defined and controlled. This will lead to better outcomes, which can then be used to govern clear clinical guidelines. Communities resembling ISAKOS have the responsibility of achieving this.

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# Recent Development of Arthroscopic Repair of the Ankle Lateral Ligament

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## Introduction

Symptomatic chronic lateral ankle instability (CLAI) develops in approximately 20% of patients after the failure of nonoperative treatment of a lateral ligament rupture. Persistent CLAI may cause osteochondral lesions of the talar dome and subsequently may result in osteoarthritis of the ankle. Furthermore, CLAI negatively affects not only the plantar flexion of the ankle but also the extensor strength of the hip and knee by affecting sensorimotor control at both the spinal and supraspinal levels, resulting in decreased athletic performance. Therefore, if non-surgical treatment fails and lateral instability of the ankle persists, then surgical repair or reconstruction should be performed in order to maintain the lateral stability of the ankle and to prevent subsequent disorders such as osteochondral lesions of the talar dome and osteoarthritis of the ankle.

The direct anatomical repair of lateral ligaments of the ankle was originally described by Broström in 1966, and this popular technique has remained the gold standard to this day. While arthroscopic surgery of other joints evolved quickly after the development of suture anchors, the procedure for suturing the residual ankle lateral ligament arthroscopically has been developed by top surgeons in this field.

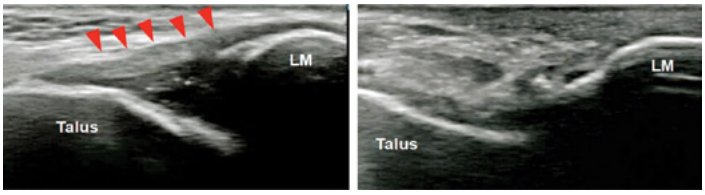
## Preoperative Imaging Assists in Choosing the Appropriate Procedure

Stress radiography was once regarded as the gold standard for diagnosing CLAI. On the other hand, the normal range of stress radiography is as large as 3 to 10 mm for anterior drawer of the talus and 0° to 23° for talar tilt. Because the accuracy is low as compared with that of 3D analysis, stress radiography is regarded much less accurate than previously believed.

Because of the invasiveness of the procedure itself, stress radiography is now considered to be unnecessary for the diagnosis of CLAI.

Ultrasonography (US) has become the mainstay of diagnostic imaging in recent years. A systematic review and meta-analysis of the accuracy of imaging for the diagnosis of CLAI showed that US demonstrated a high diagnostic accuracy for both anterior talofibular ligament (ATFL) and calcaneofibular ligament (CFL) injuries. The ATFL and CFL can be easily visualized with use of US, and the modality is useful for assessing the quality of these ligaments.

Surgery for CLAI can be roughly divided into ligament repair with use of the remnant and ligament reconstruction with use of a graft, and the choice of a surgical procedure should be determined by evaluating the quality of the residual ligament. If the quality of the remnant is sufficient, a repair technique to suture the remnant to its fibular attachment is indicated. Reconstruction is chosen if the quality of the remnant is insufficient. Morvan et al. compared the results of preoperative MRI (including axial T2-weighted imaging) with those of arthroscopic evaluation. The correlations between MRI and arthroscopy were 90.9% for Observer 1 and 86.4% for Observer 2, and the authors concluded that preoperative MRI of the ATFL is a reliable and valid decisional tool for choosing the surgical technique for the stabilization of CLAI. The quality of the remnant depends on the type of major collagen. Type-I collagen comprises 90% of the normal ligament and is primarily responsible for stiffness of the ligament. Takao et al.[3] compared the results of staining and gene expression of type-I collagen by RT-PCR and the arthroscopic evaluation of the ATFL remnant. As a result, gene expression of type-I collagen was found in all cases undergoing type-I collagen staining of the remnant using RT-PCR. Significant correlation was found between type-I collagen staining and arthroscopic evaluation results. Accordingly, arthroscopy can serve as a tool to accurately assess the quality of the remnant. The results of arthroscopic evaluation were compared with the results of stress radiography, MRI, and stress US. Only stress US showed a significant correlation with arthroscopic evaluation. Accordingly, repair surgery was recommended for cases in which ligament fibers are found and reconstruction was recommended for cases in which regiment fibers are not found on preoperative stress US examination (Fig. 1). The operative procedure is finally determined by intraoperative arthroscopic evaluation.




01 Preoperative stress US. The left image shows ATFL ligament fibers (arrowheads), but the right image shows no ligament fibers. LM = lateral malleolus

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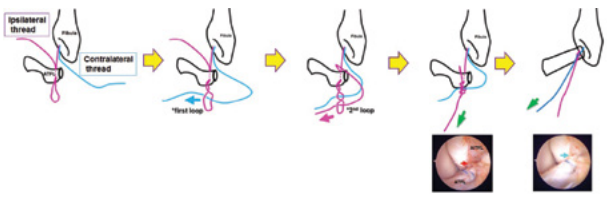
## History of Arthroscopic Ankle Lateral Ligament Repair

In 1987, Hawkins initially described an arthroscopic repair procedure to fix the remnant of the ATFL with a staple to the talus. Arthroscopic repair using suture anchor technique was first reported by Kashuk et al. in 1994 with the development of a suture anchor that was adapted for manipulation in a small working space and insertion into narrow bone. Corte-Real and Moreira[1] reported a simpler and more reproducible procedure using suture anchors in 2009, and various procedures for arthroscopic ligament repair using suture anchors have been reported since that time.

## Recent Developments and Remaining Problems Related to Arthroscopic Ankle Lateral Ligament Repair

Arthroscopic lateral ankle ligament repair typically involves three steps: (1) placement of a suture anchor at the ATFL attachment to the lateral malleolus, (2) securing the suture anchor to the remnant, and (3) knotting. Arthroscopic repair procedures can be classified into two types according to the process of securing the suture anchor to the remnant: (1) arthroscopic repair with a percutaneous procedure and (2) all-inside arthroscopic repair. Arthroscopic repair with a percutaneous procedure was first reported by Corte-Real and Moreira[1] in 2009 and has since been further developed by several surgeons. Placement of the suture anchor is performed arthroscopically through the portal. Securing the suture anchor to the remnant is performed with a percutaneously inserted needle under arthroscopic visualization. The percutaneous procedure is less invasive than the arthroscopy-assisted mini-open procedure and also has the advantage of being able to apply sutures to the CFL as well as the ATFL. On the other hand, it is difficult to apply a suture to the ligament alone, and the percutaneous procedure is not anatomic because the ligament, capsule, and the inferior extensor retinaculum are sutured together with the same suture anchor. In addition, the knotting is performed through a small incision and subcutaneously guided to the portal with an additional invasive procedure. The simultaneous knotting of the peroneus tertius tendon and a branch of the superficial peroneal nerve may also introduce risk of complications.

The all-inside arthroscopic procedure using a knotless anchor was first reported by Vega in 2013.[2] Takao reported a suture anchor procedure with a lasso-loop stitch technique in 2016 and later developed the modified lasso-loop stitch technique.[3] The all-inside technique is the least invasive procedure because all 3 steps are performed arthroscopically through one portal (Fig. 2).




02 Modified lasso-loop stitch technique

Since the all-inside arthroscopic procedure enables the ligament to be sutured in a direct arthroscopic view, it can be performed anatomically. On the other hand, since only the ATFL can be observed with arthroscopy, it is impossible to apply a suture directly to the CFL. Guillo et al.[4,5] described an all-inside endoscopic technique. That technique has the advantage of directly suturing the ATFL and CFL to their respective attachments, but it is technically demanding. Because the CFL is an extra-articular ligament that requires a soft-tissue resection to approach its fibular attachment, the procedure is also slightly invasive comparing with other all-inside arthroscopic procedures. In most cases of chronic lateral ligament rupture, the ATFL and CFL are connected with the lateral talocalcaneal ligament and are detached at the fibular attachment as one unit. Therefore, the ATFL is sutured to a normal footprint, the stump of the CFL. Biological research using cadaveric models of ATFL and CFL ruptures revealed that suturing only the ATFL also exerted some tension on the CFL, but the tension pattern was not always normal. Although there is a theory that the function of CFL can be restored automatically only with ATFL sutures, the need for suturing the CFL and the method of how to suture the CFL remain unsolved problems.

Another remaining problem is the debridement around the pilot hole to expose the cancellous bone. Some reports have recommended debridement of the contact surface of the ATFL with the fibula to expose the cancellous bone and to induce bleeding to promote fixation of the stump to the bone. An animal study on the biological bonding of bone and tendon grafts showed that the strongest bonding occurred between the graft and the periosteum in the initial period up to 6 weeks and between the graft and the bone marrow within the bone tunnel after 12 weeks. Exposing the bone marrow by debridement of the bone surface simultaneously removes the periosteum. As a result, the initial strength is impaired for up to 6 weeks after surgery, which may interfere with accelerated rehabilitation. Bleeding is essential for tissue repair, but some surgeons consider bleeding from the pilot hole to be sufficient and do not perform debridement of the bone surface. The necessity of debridement around the pilot hole requires further discussion.

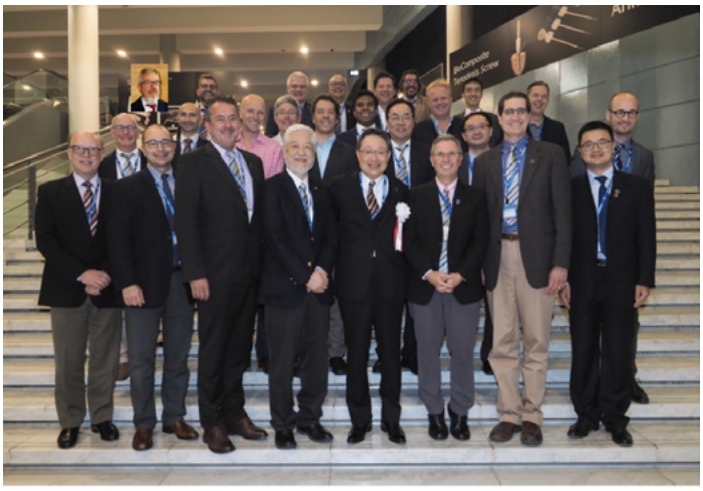
## Activities of the Ankle Instability Group (AIG)

The Ankle Instability Group (AIG) was established in 2013 as a research group specializing in ankle instability by top surgeons in this field who responded to Dr. Guillo's invitation. The group consists of core members from Argentina, Belgium, Brazil, Canada, China, France, Japan, Korea, Portugal, Spain, United Kingdom, and the United States. The aims of the AIG are (1) to facilitate the most scientifically rigorous international discussion for ankle instability (completely independent of scientific societies and commercial companies), (2) to invite the greatest number of experts around the world, and (3) to support young foot and ankle surgeons who will further develop the field in the future.

## Recent Development of Arthroscopic Repair of the Ankle Lateral Ligament

The AIG group has dedicated a vast number of resources to address the shortcomings of current treatment in lateral ankle instability, which has led to seven major publications on the topic in specialist journals around the world.

The first AIG annual conference was held in Bordeaux with Dr. Guillo (France) as president, the second conference was held in Chicago in 2014 with Dr. James Stone (USA) as president, the third conference was held in Seoul in 2015 with Dr. Jin Woo Lee (Korea) as president, the fourth conference was held in Bordeaux in 2017 with Dr. Guillo as a returning president, and the fifth meeting was held in 2018 in Kisarazu, with Dr. Ozeki and Dr. Takao (Japan) as co-chairs (Fig. 3).



03 Photograph from the fifth AIG meeting in 2018.

The number of participants at the AIG conference increased with each event, and, as of 2022, the number of faculty members was 33. In addition, AIG has published >10 papers in the English language and has contributed to the development of this field (https://sites.google.com/view/aig-global/home). Although suspended because of the COVID-19 global pandemic, the sixth meeting is tentatively scheduled to be held in Asheville with Dr. Peter Mangone (USA) as president.

### Conclusion

Surgical methods for lateral ankle instability have rapidly developed in recent years, coinciding with the establishment of AIG. On the other hand, many problems remain unresolved. Further development is desirable to improve the clinical outcomes of patients with CLAI.

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# Adding Lateral Extra-Articular Procedures to Augment ACL Repair may Help to Mitigate Concerns Regarding Failure Rates

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## Introduction

Anterior cruciate ligament (ACL) repair (as an alternative to ACL reconstruction) is currently enjoying something of a renaissance. In a recent letter to the JISAKOS editor, many surgeons from across the world shared the collective opinion that "the modern-day ACL surgeon's armamentarium should include multiple surgical approaches including primary repair, augmentation, and reconstruction".[1]

## A Brief History of ACL Repair

The re-emergence of ACL repair as a useful and potentially advantageous treatment option for carefully selected patients with ACL injury is reflected in the 2022 bibliometric analysis by Li et al.[2] The authors reported that the literature demonstrates two eras of increasing publication frequency with respect to ACL repair. The first era, from 1980 to 1993. was followed by a period of declining interest (likely secondary to inferior outcomes of ACL repair at that time, when compared to reconstruction). A second rise in publication frequency began in 2010 and continues to the present day2, likely reflecting advances in surgical technology which may lead to better outcomes, and a consequent re-emerging interest in the potential advantages of ACL repair (including quicker rehabilitation, reduced operative time, the avoidance of donor-site morbidity, and the ease of revision to ACL reconstruction if the repair fails).

In a 2020 systematic review focusing only on the contemporary literature, Kandhari et al. identified 19 eligible studies (including 5 comparative studies).[3] None of the comparative studies showed any significant differences between the repair and reconstruction groups with respect to International Knee Documentation Committee (IKDC) scores, Lysholm scores, Tegner scores, side-to-side laxity differences, knee stability, or graft rupture rates. Four non-comparative, intermediate to long-term studies (with mean follow-up periods ranging from 43.3 to 79 months) demonstrated mean Lysholm scores ranging from 85.3 to 100, mean IKDC subjective scores ranging from 87.3 to 100, and mean Tegner activity scores ranging from 5 to 7. Despite these promising findings (suggesting non-inferiority of repair with respect to these outcomes), the authors cautioned that the literature had major weaknesses and limitations (particularly small study populations), and that further high-quality comparative studies were needed in order to better understand the clinical outcomes of ACL repair.

## Concerns Regarding Failure Rates of ACL Repair versus ACL Reconstruction

A long-standing concern regarding ACL repair has been the potentially higher rates of ipsilateral second ACL injury when compared with ACL reconstruction. This concern has historically been blamed on poor patient selection and surgical technique, but it is not clear that the issue has been solved in contemporary practice, even with particular attention being paid to these aspects of treatment. Despite the recent increase in enthusiasm for ACL repair (especially in some centres), this concern is likely the main factor that has limited widespread adoption. These concerns were recently re-demonstrated by Ferreira et al.[4] In that study, patients undergoing ACL repair were propensity matched (based on demographic characteristics, time between injury and surgery, knee laxity parameters, the presence of meniscal lesions, pre-operative activity level, and sports participation), in a 1:1 ratio, to those undergoing ACL reconstruction (n = 75 in each group). The authors reported a significant difference in the rate of ACL re-rupture after a mean duration of follow-up of 30 months (5.3% in the repair group, compared with 0% in the reconstruction group; $p = 0.045$). Patients who had failure of the ACL repair were significantly younger than those who did not, and, in fact, there were no significant differences between the groups in terms of rupture rates when only patients older than 21 years of age were considered (2.9% vs. 0.0%, respectively; $p = 0.157$). Despite these findings, repair was also associated with some advantages, including significantly better mean hamstring muscle strength at 6 months compared with the reconstruction group (1.7% ± 12.2% vs. -10.0% ± 12.8%, respectively; $p < 0.0001$), which seems logical given the avoidance of graft harvest and donor-site morbidity, and empirically less arthrogenic muscle inhibition. The repair group also had significantly better mean Forgotten Joint Scores (FJS-12) compared with the reconstruction group (82.0 ± 15.1 vs. 74.2 ± 21.7, respectively; $p = .017$). No significant differences were found in terms of other functional outcomes, return to sport metrics, or knee laxity parameters.[4] However, it is not clear that the observed advantages outweigh the impact of the observed increased risks of failure.

## Adding Lateral Extraarticular Procedures to ACL Repair: A Potential Solution?

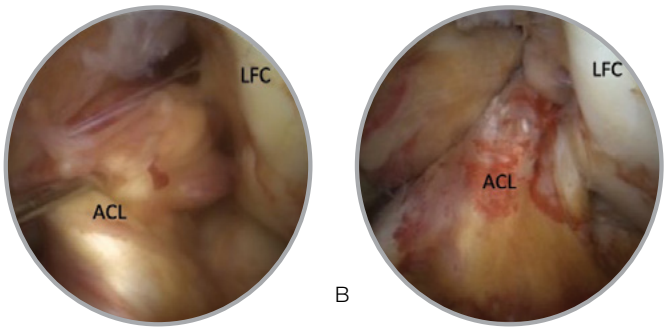
A potential solution to concerns about failure rates could be the addition of lateral extra-articular procedures (LEAPs). Numerous comparative studies have shown that LEAPs are highly effective for reducing graft rupture rates after ACL reconstruction, and it is logical to believe that they would also be similarly effective in the ACL repair setting because of their biomechanical benefits (load-sharing with the ACL and more reliable restoration of knee kinematics).

In a recent prospective comparative non-randomized study, Ferretti et al. compared the clinical outcomes of ACL reconstruction with a LEAP (ACLR+LEAP) with those of ACL repair with concomitant repair of the anterolateral structures (ACL+AL repair).[5] The attached figures depict examples of the technique used. Fig. 1A shows an example of a femoral sided avulsion of the ACL (Sherman 1 type tear). This is a tear pattern that is amenable to repair. Fig. 1B shows the repair achieved. Fig. 2 shows the appearance of a repaired ACL at second look arthroscopy 2-years post-operatively. Fig. 3 shows a lateral exploration and repair of the anterolateral structures. In their study, Ferretti et al. evaluated 100 consecutive patients after a mean follow-up of 25.2 months. There were no significant differences between the groups with respect to ipsilateral second ACL injury rates, which were low overall (3.8% for the ACL+AL repair group and 2.1% for the ACLR+LET group, p = 0.63). At the time of the latest follow-up, differences between the groups with respect to the IKDC score, anteroposterior side-to-side laxity difference, and signal-to-noise quotient (SNQ) did not exceed non-inferiority thresholds. However, ACL+AL repair was associated with some advantages, including a shorter time to return to the pre-injury level of sport (mean, 9.5 months for the ACLR+LET group and 6.4 months for the ACL+AL repair group; p < 0.001), better FJS-12 scores (mean, 97.4 for the ACLR+LET group, compared with 91.4 months for the ACL+AL repair group; p = 0.04), and a higher proportion of patients achieving a patient acceptable symptom state (PASS) for KOOS subdomains (symptoms, 88.2% vs. 67.4%, p = 0.005; sport and recreational function, 94.1% vs. 67.4%, p < .001; quality of life, 92.2% vs. 73.9%, p = 0.01).

## Conclusion and Future Directions

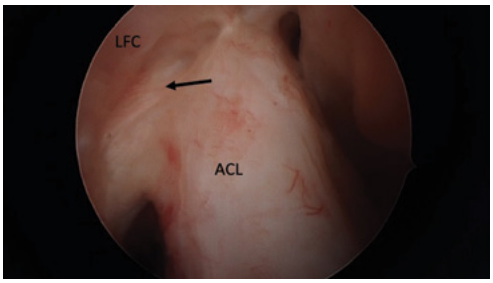
In conclusion, although recent comparative studies demonstrate some significant advantages of ACL repair over ACL reconstruction, it is our opinion that a cautious approach must be adopted. Even in carefully selected patients, especially those younger than 21 years of age, there is a concern that ipsilateral re-injury rates are higher following ACL repair than they are after ACL reconstruction. The work by Ferretti et al.[5] is promising in that it indicates that repair of the anterolateral structures is helpful for mitigating this risk. However, further large comparative studies (preferably randomized controlled studies) with longer-term follow-up are needed.

Such studies are clearly justified based on this existing work and the potentially important advantages of ACL repair demonstrated in the cited (and other recent) comparative studies.

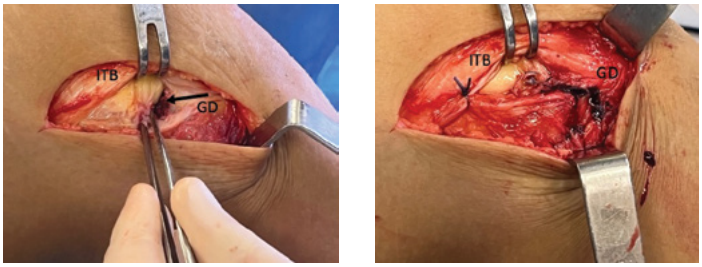



A B

01 Sherman type-1 ACL tear in a left knee before treatment (left panel) and after repair with a suture pull-out technique (right panel). ACL: anterior cruciate ligament. LFC: lateral femoral condyle




02 Second-look arthroscopy showing the appearance at 2 years following ACL repair in a right knee. ACL: anterior cruciate ligament. LFC: lateral femoral condyle. The arrow indicates the femoral insertion of the repaired ACL.




03 Left panel: Lateral exploration performed in a right knee concomitant to ACL repair. In this example, there is a Segond fracture (distal anterolateral ligament avulsion). Right panel: Repair of the injured anterolateral structures (including the Segond fracture), performed concomitantly with the acute ACL repair. ITB: iliotbial band. GD: Gerdy's tubercle. The arrow indicates the Segond fracture at the level of the lateral tibial plateau.

## Adding Lateral Extra-Articular Procedures to Augment ACL Repair may Help to Mitigate Concerns Regarding Failure Rates

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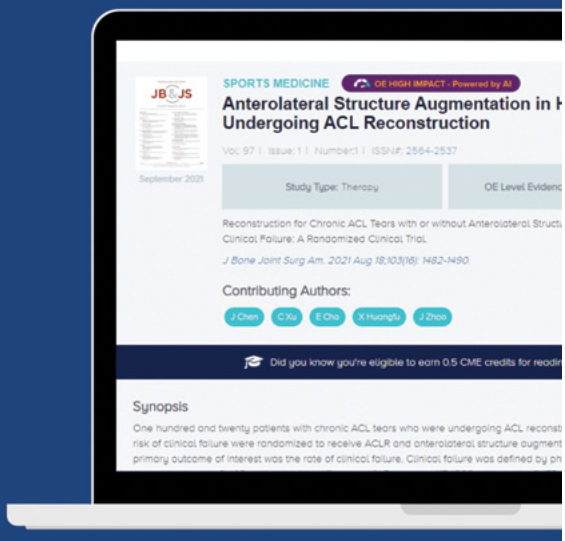

# Dream Crazier: The Impact of the Women's World Cup on the World of Women's Sports

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ISAKOS Gender & Diversity Task Force

## Introduction

In the wake of the electrifying 2023 FIFA Women's World Cup, hosted by Australia and New Zealand, the world witnessed a remarkable surge in the prominence of women's sports media coverage. The tournament, held on a global stage, not only showcased the exceptional talent and determination of female athletes but also sparked a revolutionary change in how women's sports are perceived and covered by the media. As the final whistle echoed across stadiums and television screens, it became evident that a seismic shift was underway, propelling women's sports into the limelight like never before.

In the aftermath of the World Cup, the rise in women's sports media became an integral part of this transformative journey, breaking barriers, challenging stereotypes, and celebrating the achievements of female athletes on a scale previously unimagined. This newfound momentum ushered in an era in which women athletes are not just athletes; they are icons inspiring generations, and their stories are now being told, heard, and celebrated across diverse media platforms. This surge in women's sports media after the FIFA Women's World Cup 2023 marked a pivotal moment in the history of sports journalism, emphasizing the importance of gender equality and providing a powerful impetus for further progress in the realm of women's sports.

## Where We have Come From and Where We are Today

It is important to note that while women's soccer has been gaining ground in closing the gender gap, men's soccer still receives more media attention and higher viewership numbers due to historical, social, and cultural factors.

Certain aspects contribute to this difference in popularity, including investment discrepancies and perceptions of stereotypes, which continue to align with traditional gender roles, pay discrepancy, visibility, cultural norms, and fanbase traditions. With the recent resurgence in the attention paid to female athletes, there has been a concerted effort to support closing this gender gap via increased media coverage, efforts to equalize pay, promoting women's leagues and tournaments, and challenging gender stereotypes through various advertising campaigns such as:

Nike's "**Dream Crazier**" featuring Serena Williams

https://bit.ly/47Pdl3W

"**What are Girls Made Of?**"

https://bit.ly/3Uk1zMd

**France's Women's World Cup Team**

https://bit.ly/3OEBDY3

France's Women's World Cup Team video used video editing to showcase how its female athletes were just as spectacular and talented as their male athletes **(all readers are encouraged to watch)**.

The 2023 FIFA Women's World Cup was a blueprint for narrowing this gap. Spain was victorious, defeating England, with Sweden taking Bronze and Australia with their best finish yet in fourth. Over 1.9 million tickets were sold, an increase compared with the 1.13 million tickets that were sold in 2019. The first match of the tournament (New Zealand vs. Norway) had 42,137 fans in attendance, a record for both men's and women's soccer attendance in New Zealand. This record was subsequently broken at the 41st match of the tournament (USA vs. Portugal), with 42,958 in attendance.[1,4] The semi-final match between England and the Australian women's team, the Matildas (who beat France to make the semi-finals for the first time), became the most watched television broadcast in Australian history with an average viewership of 7.13 million and peak viewership of 11.3 million viewers.[2]

At the previous FIFA Women's World Cup in France, 10 matches across the entire tournament attracted >25,000 spectators. By comparison, during the 2023 FIFA Women's World Cup Group Stage, 21 matches surpassed the 25,000 mark. As for viewership across the globe, the digital streaming number for the entire 2019 World Cup tournament was surpassed by Day 14 of the 2023 tournament, welcoming 22 million unique users in that time span.[1] This significant trend in increased viewership has been steadily rising over the past 4 years. In 2019, a total of 1.12 billion people globally watched the matches, and the final match attracted 82.18 million viewers, setting a new FIFA Women's World Cup record, surpassing the 2015 final hosted in Canada.[3]

In the United States, women's sports have made significant strides. When analyzing the men's and women's soccer teams in the United States, the women's team has been consistently more successful than the men's team. The USA Women's National Team (USWNT) has won four of the nine total FIFA Women's World Cup tournaments. On the contrary, the USA Men's National Team has yet to win a World Cup and has gone as far as the semi-finals just once, in 1930. Since 1999, the USA Women's National Team has been ripe with household names, including Mia Hamm, Julie Foudy, Brandi Chastain, Abby Wambach, Carli Lloyd, Megan Rapinoe, Alex Morgan, just to name a few.

No article reporting a rise in women's sports attention would be complete without acknowledgement of and respect directed toward the 1999 USA Women's Soccer Team, known as the "99ers," who made a profound influence not only on women's soccer but on all women's sports. The 99ers increased visibility of women's sports, inspired a generation, highlighted the gender disparities in sports, attracted record-breaking attendance and viewership, and lead to the first professional women's soccer league in the USA. The 1999 USA Women's Soccer Team's triumph not only transformed women's soccer but also had a lasting impact on women's sports, inspiring generations of athletes and contributing to the ongoing progress of gender equality in sports.

In 2019, the USWNT filed a lawsuit against US Soccer for gender discrimination in the workplace and unequal pay; the unequal pay claim was dismissed by the federal judge in 2020, but claims of discriminatory workplace were considered. For reference, at that time, the US Men's National Team received $5 million for losing in Round 16 at the World Cup; on the contrary, the Women placed 2nd in the World Cup the same year and were awarded just $1.8 million.[3] The USWNT appealed the decision in 2022 and the dispute came to an end when US Soccer agreed to a settlement to guarantee equal pay to the men's team in all friendlies and tournaments. Notably, this discrepancy is not observed in all sports in America. This year's US Open celebrated 50 years of equal pay for its female and male athletes, achieved by the fierce dedication of Billie Jean King in 1973.

## What Still Needs to Be Done and How Can We Achieve This?

Despite this rise in popularity, there remains ample room for growth and increased support of women's sports nationally and globally. Here are several strategies that can be employed to further promote women's sports (Fig. 1):


01 Strategies to Promote Women's Sports

1. **Increased Media Coverage:** Media outlets can play a crucial role in promoting women's sports. Networks and publications should provide **consistent** and comprehensive coverage of women's sports, including broadcasting games, sharing athlete profiles, and reporting on women's sports achievements. This should not occur every 3 or 4 years, conveniently surrounding the World Cup or Olympic Games; instead, this coverage should remain consistent, mirroring that of men's sports coverage.
2. **Equal Pay:** Ensuring that female athletes receive equal pay for their accomplishments is vital. This effort requires not only support from sports organizations and sponsors, but also a shift in societal attitudes toward women's sports. We must continue to build on the foundational work started by the great Billie Jean King.
3. **Investment in Marketing and Promotion:** Sports organizations and sponsors should invest in marketing and promoting women's sports events and athletes. This effort should include advertising campaigns, endorsements, and partnerships with popular brands to increase visibility and reach a wider audience. While societal and cultural norms have historically implied that women are not interested in watching sports, perhaps the narrative is that women do not see many athletes in advertisements who look like them and are thus relatable.
4. **Youth Development Programs:** Investing in youth development programs for girls, including school sports, clubs, and community initiatives, can foster interest and talent from an early age. Providing opportunities for girls to participate in sports helps in building a strong foundation for women's sports in the future.

## Dream Crazier: The Impact of the Women's World Cup on the World of Women's Sports

5. **Role Models and Mentorship:** Highlighting successful female athletes as role models can inspire younger generations. Mentorship programs, in which experienced female athletes guide and support aspiring athletes, can provide valuable encouragement and advice.
6. **Accessible Facilities:** Ensuring that girls and women have access to quality sports facilities, including both school facilities and community sports centers, is crucial. Accessible facilities promote participation and skill development.
7. **Education and Awareness:** Promoting awareness about women's sports and their importance in fostering teamwork, leadership, and confidence is essential. Educational programs in schools can help to challenge gender stereotypes and encourage support for women's sports.
8. **Fan Engagement:** Creating an engaging fan experience, both in stadiums and online, can enhance the spectatorship of women's sports. Fan events, interactive experiences, and social media campaigns can help build a passionate fan base.
9. **Collaboration with Corporate Partners:** Partnering with corporations that support gender equality and women's empowerment can bring additional resources and visibility to women's sports initiatives.
10. **Policy Advocacy:** Advocacy for policies that support women's sports, such as Title IX and equal opportunities in education, can create a more conducive environment for female athletes at all levels.

By implementing these strategies and fostering a culture that values and supports women's sports, the global community can continue to promote growth and garner increased support for female athletes and sports organizations.

### Conclusion

The trend of increased viewership and media coverage for women's soccer has been on the rise in recent years, and several factors suggest that this trend is likely to continue. The aforementioned strategies to support women's sports also will continue to grow viewership and media coverage. While challenges and disparities still exist, the overall trajectory suggests that the momentum for women's soccer will likely continue and transcend across other women's sports. This will also positively impact our ability as physicians and surgeons to provide access to state-of-the-art care for these female athletes. If there is sustained effort from governing bodies, media outlets, sponsors, and fans to support and promote women's soccer, it is probable that the trend of increased viewership and media coverage for women's sports will persist in the coming years. Stay tuned for an updated report in the coming years!

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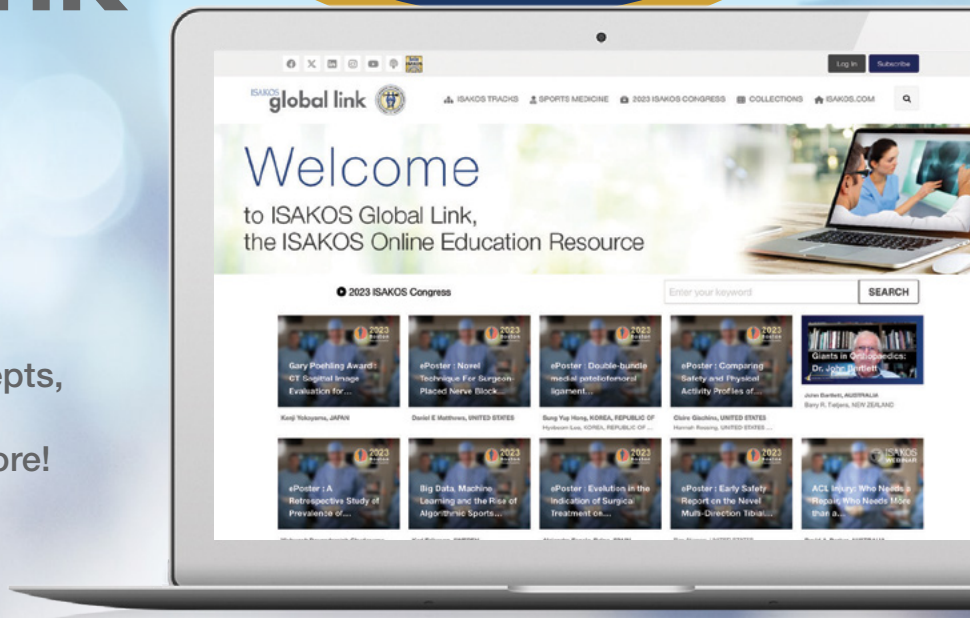


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# The Impact of Artificial Intelligence on Total Knee Arthroplasty: Revolutionizing Patient Care and Surgical Outcomes

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## Introduction

Artificial intelligence (AI) has emerged as a transformative technology in various fields, and orthopaedic surgery is no exception. With the ability to analyze vast amounts of data, detect patterns, and provide real-time decision support, AI has revolutionized the practice of orthopaedic surgery in terms of preoperative planning, intraoperative assistance, postoperative rehabilitation, and outcome prediction (1).

The integration of AI technologies has the potential to augment the ability of orthopaedic surgeons enabling them to make data-driven decisions and optimize patient care.

Potential applications to knee arthroplasty practice include:

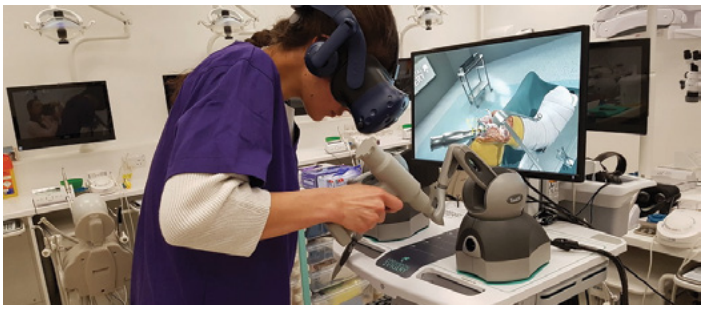
- Surgical education, which can be improved by virtual reality (VR) and augmented reality (AR).
- Preoperative planning using medical imaging (e.g., CT scanning) can accurately identify specific patient anatomy. This allows the surgeon to visualize the patient's 3D anatomy, to understand deformities, to improve implant selection and placement, and, potentially, to manufacture personalized surgical instrumentation (PSI).
- Computer-assisted surgery (robotic-assisted surgery or AR) provides real-time assistance. Visual algorithms can track surgical instruments and anatomical landmarks, enabling precise implant positioning. Computer assistance enhances dexterity, precision, and reliability, resulting in improved surgical outcomes.
- After TKA, postoperative rehabilitation with sensor-based devices analyzes real-time monitoring of patients' exercises and progress. These devices provide personalized feedback and motivate patients to adhere to their rehabilitation protocol. Algorithms can analyze data to tailor rehabilitation and predict patient outcomes.
- Large databases and machine-learning techniques can predict surgical outcomes, complications, and risk factors.
- The integration of AI into existing health care systems requires careful planning, training, and collaboration between surgeons, engineers, and data scientists. Data quality, privacy, and security concerns, as well as algorithmic bias, are important considerations to optimize surgical techniques and personalize patient care plans, enhance surgical precision, and improve overall patient outcomes.

## Virtual and Augmented Realities

These cutting-edge applications exist at the boundary between everyday life and science fiction. These technologies are especially useful in education and are progressively being applied in knee arthroplasty surgery (e.g., robotics).

### Virtual Reality

Virtual reality (VR) simulates the physical presence of a participant in a computer-made fictive environment. Immersion inside this digital world is achieved with use of an image that is projected in front of the user's eyes through a 3D stereoscopic headset that completely isolates them from reality. A position tracking system in the room and a sensor in the participant's hand (in the form of a glove or joystick) allows the participant to move and interact with this virtual world. Virtual reality provides a full sensory immersion experience involving sight, sound, and touch (with haptic technology providing tactile feedback) (Fig. 1). Thus, the participant moves and interacts in the digital world.

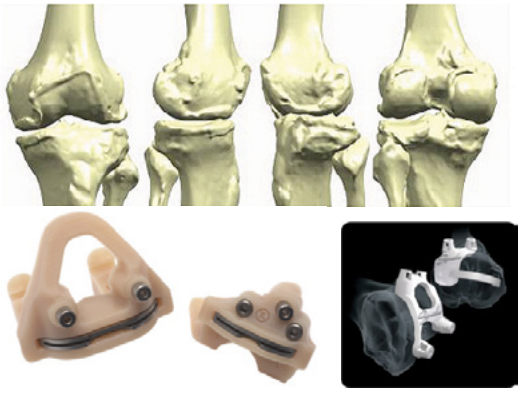


01 Virtual Reality. The operator is immerged in a virtual world where he/she can interact

VR is commonly used in video games, real estate tours, and visits of cultural sites and allows the user to navigate within impressive 3D reconstructions. In medicine, reproducing the human body organ per organ is a high-quality educational tool. Classical surgical training can be enriched by VR as it allows different points of observation and a better understanding of the gestures to be performed.

VR also allows surgical interventions to be simulated realistically in step-by-step fashion, repeatedly, and at the trainee's own pace. It also allows for the testing of several procedures on a 3D digital twin of the knee anatomy before the final surgical procedure. Although it is not currently possible to create a virtual world that is identical to the real world, VR allows surgical trainees to develop their surgical skills with efficiency in a safe environment. Application to TKA is not finalized but is in progress.

The creation of a 3D printed guiding tool (PSI) using software that analyzes the patient's CT scan is a VR (Fig. 2). Unique custom-made instrumentation for use during surgery could contribute to a more accurate implantation that is adapted to the patient.



02 Personalized System Instrumentation mold on a CT model

Finally, VR also can be used to minimize patients' stress by immersing them in the operating room before the procedure.

### Augmented Reality

Augmented reality (AR) superimposes digital images in real time onto real space through connected glasses. The virtual objects are movable in real time with use of a position tracking system, a display system, and system-controlling software. The ability to save progress facilitates the illusion of a persistent experience, possibly shared by several users.

In orthopaedics, AR can be used to illustrate a patient's anatomy. Preoperative imaging allows the surgeon to map out the patient's skin, skeleton, vessels, and nerves, which are not readily visible. It is also possible to trial digitally made instruments or implants. It is then possible to overlay a hologram of the patient or instrument on the real view at the time of surgery with use of tracking sensors.

In terms of education, AR is useful for helping to improve surgical accuracy and reproducibility. AR can be adapted to different skill levels with an option to assist at each stage, and detailed performance indicators can be accessed by activating an immediate feedback option. The surgeon can also perform the entire procedure without guides and choose to review the analyses at the end of the operation. Ha et al. recently noted that AR has the potential to be a great educational supplement in the current state of duty-hour restrictions and decreased resident autonomy in the operating room.

The use of AR in the operating theatre is a recent development. In 2017, AR was used during a spinal procedure in Montpellier and a reverse shoulder replacement in Paris.

The glasses allow a surgeon to insert the virtual implant superimposed on his surroundings. He can position and modify its size as needed (Fig. 3). This technology is quite tricky and has a significant learning curve.

03 Augmented Reality. A virtual image is superimposed within the real field of view

Several companies have developed AR systems for use in TKA. New technologies for TKA, including smartphone applications that display superimposed images of the target angles of axis and slope of the tibia for real-time adjustments by the surgeon, are being developed rapidly.

## Robotic-Assisted TKA

### Introduction

In the field of surgery, robots have been developed to reduce human error and enhance surgical precision. In the setting of TKA, all robotic systems employ dynamic referencing to evaluate knee stability, alignment, and range of motion during surgery, while simultaneously adjusting bone resection, ligament balance, and prosthesis placement (Fig. 4).

04 Robotic arm assisted TKA

## The Impact of Artificial Intelligence on Total Knee Arthroplasty: Revolutionizing Patient Care and Surgical Outcomes

Robotic-assisted surgery platforms can be categorized as either "fully active" or "semiactive," depending on how bone resections are performed. With fully active systems, a robotic arm autonomously executes preprogrammed bone resections. With semiactive systems, the surgeon performs bone resections within a predefined zone established in the preoperative plan, with the benefit of receiving intraoperative feedback. These systems typically include a haptic interface that provides the surgeon with information about the forces and stress applied to articular surfaces, allowing for real-time adjustments. Preoperative imaging is used to generate a virtual 3D model of the patient's specific anatomy. This model aids in planning cuts, implant sizing, and positioning, and is subsequently mapped to the patient's anatomy during surgery using navigational trackers.

Another type of semiactive system involves handheld robotic burrs that the surgeon manually controls. In this case, the robot follows the burring tool's trajectory in the navigation field, with the tool's speed and exposure being controlled to prevent inadvertent ligament injuries. Unlike haptic systems, this semiactive system does not rely on imaging and is compatible with a wide range of prosthetic implants.

Each robotic device comes with its own set of advantages and limitations (Table 1). Although semiactive systems are currently the most commonly used, the emergence of second-generation fully active systems might yield even more encouraging results in the near future.

**Table 1. Benefits and Limitations of Different Fully and Semiactive Robotic-Assisted Surgery Platforms**

| Robotics systems | | Benefits | Limitations |
|---|---|---|---|
| Active | ROBODOC*<br>CASPAR*<br>TSolution One | • Improved mechanical axis alignment in comparison to conventional TKA with first-generation systems | • Higher operation times in comparison to conventional TKA in the case of first-generation systems |
| | | • Minimal deviation in implant positioning compared to preoperative planning with second-generation systems | • Very few studies assessing the accuracy of second-generation systems |
| | | • No complications associated with this type of technology (eg, infections, neurovascular or ligament injuries) | • Limited data on improving gap balance in comparison to conventional TKA |
| | | • Wider range of implant choices | • Limited data on second-generation systems improving early functional outcome scores |
| Semi-active | MAKO<br>NAVIO<br>ROSA<br>OMNIBotics | • Better implant positioning and limb alignment in comparison to conventional TKA | • Limited implant choice as they are frequently closed platforms |
| | | • High accuracy of bone cuts according to the surgical plan | • Increased surgical times compared with conventional TKA (controversial) |
| | | • High accuracy in predicting postoperative gap profile before femoral resection | • Increased time in preoperative planning |
| | | • Reduced rate of iatrogenic soft-tissue injuries (eg, PCL) in comparison with conventional TKA | • Increased radiation exposure if patient's CT scans are required (image-dependent systems) but no evidence to date to be detrimental to patient |
| | | • Improved early functional recovery and greater ROM compared to conventional TKA | • Learning curve between 7 and 20 cases without negative impact on accuracy of implant positioning |

Table 01 *First-generation system.
PCL = posterior cruciate ligament, ROM = range of motion, TKA = total knee arthroplasty.
Source: St Mart JP, Goh EL. The current state of robotics in total knee arthroplasty. *EFORT Open Rev.* 2021 Apr;6(4):270–279.

### Clinical and Functional Outcomes of Robotic-Assisted TKA

There is a widely accepted belief in the superiority of robotic-assisted TKA (raTKA) over conventional TKA with regard to improving implant positioning and lower-limb alignment. However, some systematic reviews have presented conflicting results.

Batailler et al. (2) in a review of the functional outcomes from 14 studies that utilized the MAKO system, found that the raTKA group had reduced postoperative pain and shorter hospital stays when compared with the conventional TKA group. Additionally, patient-reported functional scores were either equal or slightly better in the raTKA group at 1 year postoperatively. Nevertheless, the degree of improvement declined over time. In the intermediate term, raTKA and conventional TKA appeared to result in similar functional outcomes, a trend that has also been observed with other robotic-assisted systems.

A recent meta-analysis by Zhang et al. (3) revealed nearly identical complication rates for raTKA and conventional TKA.

### The Promising Clinical Outcomes of Functionally Aligned TKA

Ongoing randomized clinical trials continue to compare functionally aligned (FA) and mechanically aligned (MA) TKAs. Most of the current evidence regarding the clinical outcomes of FA TKA is derived from a limited number of studies. For instance, in a series of 110 consecutive TKA procedures, Shatrov et al. found that kinematically aligned TKA (KA TKA) failed to restore a balanced knee in 65.7% of cases for the extension gap and 49.1% of cases for the flexion gap during surgery. Better alignment and reduced bony resection were achieved when FA principles were applied. Comparison of MA, FA, and KA TKA revealed that a kinematically placed femoral component led to positioning that was considered unsafe in >13% of cases, in contrast to a functionally placed femoral component, which more closely restored trochlear depth in all three positions of flexion.

The superiority of FA over KA in achieving excellent functional outcomes was further supported by Clark et al. In a study of 650 raTKA procedures, the authors observed minimal deviations from the desired alignment targets. Patients who were treated with FA experienced significant improvements in knee range of motion and pain at 2 years of follow-up. However, it is important to note that this technique is not without complications; following the 650 procedures, the authors reported >40 complications, although most of them were minor in nature.

Long-term studies are needed to assess the clinical outcomes and implant survivorship associated with FA to establish whether this technique is superior to conventional TKA.

### Is raTKA Cost-Effective?

The currently employed semiactive robotic systems provide surgeons with a higher degree of technical reliability compared with manual TKA. However, this enhanced performance comes with a significant financial investment. The major expenses associated with raTKA, in addition to equipment acquisition and maintenance, stem from preoperative imaging, implants, and intraoperative consumables. Chen et al. (4) recently reported that the use of raTKA increased the total surgical expenses by 6.1% to 12% when compared with conventional arthroplasty.

Conversely, a recent economic analysis of patients <65 years old indicated that the average cost at 90 days after surgery was twice as high following conventional TKA as compared with raTKA. This difference was attributed to the lower rate of postoperative visits to skilled nursing facilities for patients in the raTKA group. This raises the question of why raTKA was not initially considered to be cost-effective.

When addressing this issue, experts emphasize that when evaluating the costs of raTKA, it is essential to consider not only the price of the equipment but also the benefits in terms of reduced hospitalization costs, fewer complications, and fewer surgical revisions. Therefore, only long-term studies that take into account these parameters can provide a comprehensive assessment of whether raTKA is cost-effective.

### Conclusions and Future Perspectives

Robotic-assisted surgical platforms are increasing in popularity. The era of one-size-fits-all solutions is coming to a close, and the utilization of patient-specific arthroplasty is currently on the rise. With the assistance of robotic-assisted surgical platforms, surgeons can offer patients enhanced limb alignment and prosthesis positioning while minimizing the risk of inadvertent ligament injuries.

The promising short-term results observed with raTKA, if they prove to be consistent in the long term, along with the use of customized implants, are paving the way for personalized knee arthroplasty in the future. This marks a significant advancement in the field of orthopedics, offering patients the potential for more tailored and effective treatment.

## The Use of Technological Aides and AI Outside of the Operating Room

Some of the most exciting advances in the application of modern technological aides to arthroplasty practice have occurred outside of the operating room during the diagnostic, preoperative, and rehabilitative phases of the patient's journey.

### Technology as a Diagnostic Aide

Image processing is one of the most promising areas of AI research. The ability to process hundreds of images rapidly and accurately may yield improvements in diagnostic performance.

Olsson et al. described the use of AI to diagnose and grade osteoarthritis from radiographs. The investigators used a database of radiographs to train a convolutional neural network (CNN) to identify and classify radiographic appearances of knee osteoarthritis according to the Kellgren-Lawrence scale. The CNN was then able to attribute the correct grade with an area under the curve of 0.95, representing excellent accuracy. CNNs are a type of neural network comprising nodes. Data are entered into an input layer, which then connects to one or more processing layers of nodes. Depending on the selected threshold, each node will either activate and pass data on to the next layer, or not. Ultimately, the data exit the output layer after being filtered and distilled by the intervening processes. This type of network can be trained to identify objects in images, such as the appearance of osteoarthritis on radiographs.

Tingrun et al. used a different approach involving the use of machine-learning (ML) models to diagnose knee osteoarthritis from MRI images and reported excellent performance of the resultant algorithms.

Bonnin et al. recently described the use of an AI tool to evaluate postoperative radiographs following TKA. In addition to having a similar performance to surgeons in the measurement of implant angles, the AI tool was able to boost surgeon performance by 12% in the detection of interface anomalies. This finding supports the notion of an AI tool and human surgeon combining to improve the performance of each alone. While the tool detects anomalies, the human eye can interpret these anomalies and determine their significance.

Patel et al. used a neural network approach to identify implant type on the basis of postoperative radiographs. In a head-to-head comparison with senior orthopaedic surgeons, the AI tool outperformed the human surgeons, correctly identifying 178 of 180 implants as compared with 137 of 180 implants.

### Technological Aides in Rehabilitation Following Surgery

Rehabilitation following surgery can be arduous and resource-intensive. The ability to harness technology to improve the effectiveness of rehabilitation interventions is therefore of great interest to arthroplasty clinicians.

Two types of robotic aides have been assessed in rehabilitation settings: exoskeletons and end-effector robots. The former have joints mirroring the limb to which they are applied and are thus able to both exert force and measure movement across a number of joints simultaneously. The latter apply force to the end of a limb and thus have less control of the movements of the joints above.

## The Impact of Artificial Intelligence on Total Knee Arthroplasty: Revolutionizing Patient Care and Surgical Outcomes

Cai et al. (4) tested a robotic-assisted postoperative protocol against a standard, manual therapy regimen. They found improvements in terms of active range of motion ($p < 0.001$), passive range of motion ($p = 0.001$), Hospital for Special Surgery Knee-Rating Score ($p < 0.001$), and modified Barthel Index score ($p = 0.004$) in the robot-assisted rehabilitation group.

Yoo et al., in a meta-analysis of 9 studies with a total of 230 patients, found that hybrid assistive limb training provided benefits in terms of both pain control and self-selected walking speed when compared with standard rehabilitation.

In addition to robotic-assisted rehabilitation, wearable technology can be combined with machine-learning algorithms to evaluate postoperative performance and to provide standardized feedback. Ramkumar et al. validated a remote patient-monitoring system with regard to mobility, knee range of motion, patient-reported outcome measures (PROMs), opioid use, and home exercise program (HEP) compliance. The wealth of data that were gathered emphasizes the role of automated data processing in allowing meaningful patient-level interpretation.

### The Future of Patient Information

Large-language models (LLMs) are having an impact on all fields of human endeavor, and orthopaedics is no exception. The most established of these models, ChatGPT, is used by an ever-increasing number of people to distil information from the enormous body of online information. Patients are now turning to these creative engines to obtain information about their conditions and treatment options.

Dubin et al. (5) used a novel approach, searching for websites pertaining to joint arthroplasty and obtaining the 10 most frequently asked questions. These questions were then used to search for answers both through a Google web search and ChatGPT, and the responses were analyzed for accuracy. ChatGPT was not found to be as reliable a source of information. This caveat should be attached to any LLM-generated text, and clinicians should be aware that patients may well be finding erroneous information via these routes, further emphasizing the value of clinician-patient direct communication.

### Conclusion

Technological aides are increasingly going to permeate a patient's journey from initial diagnosis to postoperative rehabilitation. In addition, AI allows the analysis of enormous datasets generated by these devices, with the ultimate goal of improving outcomes. Care should be taken when LLMs are used to generate patient information, and clinicians should be aware that, although useful, these tools can cause confusion if used in an unfiltered manner.

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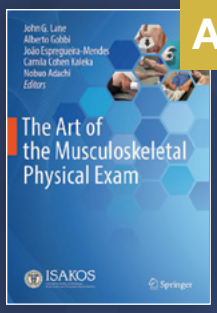


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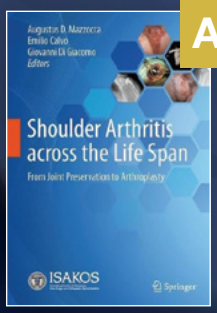


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# AOSSM & ISAKOS Masters Course: Osteotomies Around the Knee Course Recap

Elizabeth A. Arendt, MD
*ISAKOS Board Member at Large*
*University of Minnesota*
*Minneapolis, MN, USA*

On October 6-7, 2023, ISAKOS and AOSSM collaborated to offer a Masters course entitled "Osteotomies Around the Knee," chaired by Drs. Elizabeth Arendt, Alan Getgood, and Robert LaPrade, at the Orthopedic Learning Center in Rosemont, Illinois.

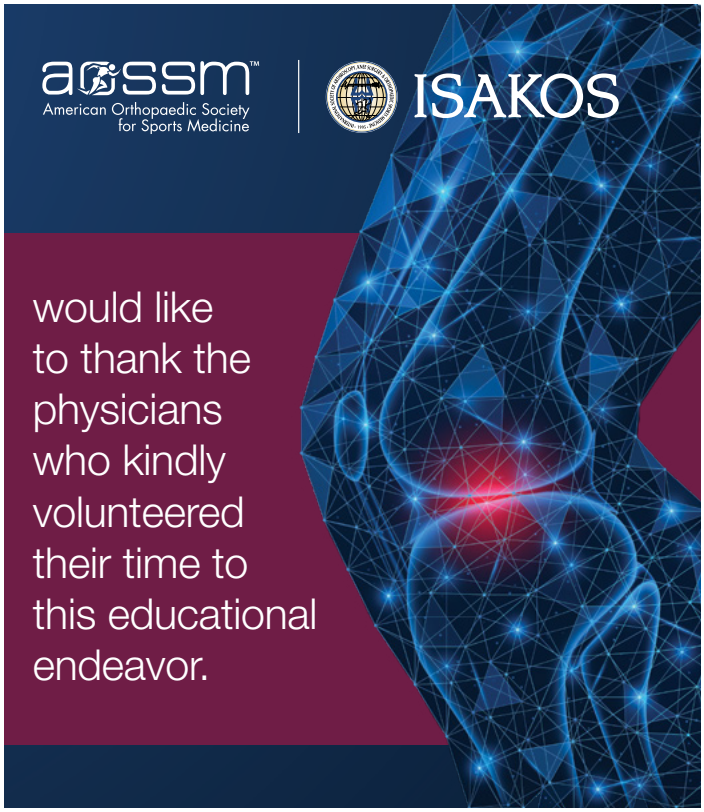
This two-day course featured an international faculty representing four regions: David Parker, MBBS, BMedSc, FRACS (current ISAKOS president/Australia); and Rodrigo Maestu, MD; and Maria Tuca, MD (South America); sponsored by ISAKOS, as well as Kristian Kley, MD; and Matthieu Ollivier, MD (Europe); supported by an industry educational grant, and nine North American faculty including Annunziato Amendola, MD; Andrew S. Bernhardson, MD; Jorge Chahla, MD, PhD; Henry B. Ellis, MD; Rachel M. Frank, MD; Andrew Geeslin, MD; Volker Musahl, MD; Anil Ranawat, MD; and Seth L. Sherman, MD.

The course was divided into a day of didactics that included both video and live cadaveric demonstrations, and a second all day hands-on cadaveric experience in the lab. The course covered all things around the knee, including coronal, sagittal and axial plane abnormalities, as well as femoral, tibial, and tibial tubercle osteotomies. Clinical cases including ligament deficiencies, uni-compartment osteoarthritis, and anterior knee pain.

The course began with presentation and discussion about osteotomy basics, as well as deformity analysis using current software applications. Questions tackled included the role of joint line obliquity, and whether patient specific instrumentation and navigation is necessary to achieve optimal outcomes.

Both opening and closing wedge osteotomies of the femur and tibia were discussed and the pros and cons of their use in clinical practice. The emerging role of biplanar correction and correction on both sides of the joint was demonstrated through case-based discussions and applications.

Sagittal plane tibial slope correction for ligament deficiency for both ACL and PCL was discussed and their related clinical application was discussed in a lively roundtable case based format, involving both faculty and audience.




The first day proceeded into the evening with a pizza and beer dinner, with an engaging faculty complications corner on "my worst complication and how to avoid it."

The course participants exceeded the number of spots available with applicants from 14 countries and approximately 60% from the United States. One participant, Dr. Gen Lin Foo from Singapore, cleverly combined this two-day course with the Chicago marathon, which he completed the following day. The Chicago weather providing a great setting for this autumn weekend.

This Masters course was a great learning opportunity for participants and faculty alike. Throughout the course, faculty and participants intermingled at breakfasts, lunches, and breaks, where all those present had an opportunity to network and ask questions, renew friendships, and establish new ones.

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