



BIG SKY

SPORTS MEDICINE CONFERENCE

January 11th—15th, 2026

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Go BIG at Big SKY!

2026 BSSMC Program Highlights

Sunday 1.11 2:30 pm Registration Opens
3:00 pm Opening Remarks, Jeffrey S Monroe
6:00 pm DJ/Enovis with SamSport NFL Playoffs Welcome Reception, Brian Moore and George Lewis Hosts. Families and friends welcome.

Monday 1.12 7:00 am Scientific Presentations
9:00 am MSK Ultrasound Workshop I
11:00 am MSK Ultrasound Workshop II
3:00 pm Concussion Day Programming
6:00 pm Vendors Reception

Tuesday 1.13 7:00 am Concussion Day Presentations
3:00 pm Concussion Day Cont'd

Wednesday 1.14 7:00 am Ortho Day Presentations
4:00 pm Ortho Day Cont'd

Thursday 1.5 7:00 am Ortho Day Cont'd
10:00 am End of Conference





CONTINUING MEDICAL EDUCATION INFORMATION

Activity Name: Big Sky Sports Medicine Conference

Date: January 11-15, 2026

Location: Big Sky, Montana

Activity Code:

Target Audience: The conference is designed to provide education on the latest advancements in sports medicine, injury prevention, treatment techniques, and rehabilitation. It is designed for individuals looking to enhance their knowledge and skills in managing athletic injuries and optimizing performance in athletes.

Accreditation Statements:

Michigan State University College of Osteopathic Medicine is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians. MSUCOM designates this live activity for a maximum of *24 AMA PRA Category 1 Credit(s)*TM. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Credit subject to change based on any program changes

Completion of each of these steps is required to earn CME/CE credit.

- Attest to your time in attendance by scanning the QR code below.
- Enter your email and password to log into the system, when prompted.
- Fill out the evaluation.
- Attest to your time in attendance and your corresponding credit type (DO, MD, other) and follow the screen instructions to print your certificate. Make sure your computer is set to allow pop-ups from the site, or the certificate will not show.
- The evaluation/claiming credit process will close 30 days after the activity. **You will not be able to claim credit after this date.**



Continuing Education Instructions

Big Sky Sports Medicine Conference

January 11 – 15, 2026

Sunday, January 11



CME\CE Sign-In

Scan the QR code above to register your attendance. You will use the same credentials used for registration.

**You only need to sign in once
Do not sign in daily**

Michigan State University College of Osteopathic Medicine is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

MSUCOM designates this live activity for a maximum of *24.0 AMA PRA Category 1 Credit(s)*TM. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Michigan State University College of Osteopathic Medicine (BOC AP#P2555) is approved by the Board of Certification, Inc. to offer continuing education to Certified Athletic Trainers. ATs should claim only those hours actually spent in the educational program.

Having trouble? Email:

cme@com.msu.edu

Thursday, January 15



Claim Your CME/CE Certificate

Scan the QR code above to access the conference evaluation. Once complete, you will be able to print your CME certificate

**The evaluation will not open until
the conference has concluded**

Welcome to the 2025 Big Sky Sports Medicine Conference

Celebrating Education, Collaboration, and Community

Conference Overview

The Big Sky Sports Medicine Conference traces its roots back to a winter ski trip in 1986, which blossomed into a series of meetings initially attended by just eight people. Since 1995, our gathering has evolved and grown, becoming a hallmark event in sports medicine education. The 2025 Big Sky Sports Medicine Conference proudly continues this tradition, building on the foundation laid by pioneers like Denny Miller of Purdue, Randy Cohen of Arizona, and Jeff Monroe of Michigan State.

Gratitude to Our Sponsors

This meeting could not take place without the profound generosity of our sponsors. The unrestricted funds pledged by sponsors go directly to covering essential meeting expenses, making the event possible. We are committed to keeping our sponsors actively engaged in the conference by promoting sponsored functions for all attendees. This involvement fosters congeniality and meaningful connections between attendees and sponsors.

We encourage all participants to visit our sponsors in the Exhibit Hall, share feedback about their products and services, and engage in productive dialogue about how you use these resources in your work.

Attendee Participation and Prizes

All registered attendees will receive duplicate tickets. You can leave one ticket with each vendor you visit in the Exhibit Hall. On Monday, January 12th at 6:30 PM, a drawing will be held during the Sponsors Reception (which begins at 6:00 PM) for five \$100 Big Sky Resort Vouchers. These vouchers are valid for any purchase made at the Resort. Please note: you must be present to win!

Special Thanks

Appreciation is extended to Kip Smith of Indiana, Denny Miller of Purdue, Paul Schmidt of Michigan and Randy Cohen of Arizona for their dedicated work in overseeing registration and help with our sponsors.

A Message from the Executive Director

We hope you enjoy your stay and make the most of your time in Big Sky Country. Let's have some fun, learn together, and continue building the legacy of this remarkable conference.

Jeffrey S. Monroe, Executive Director



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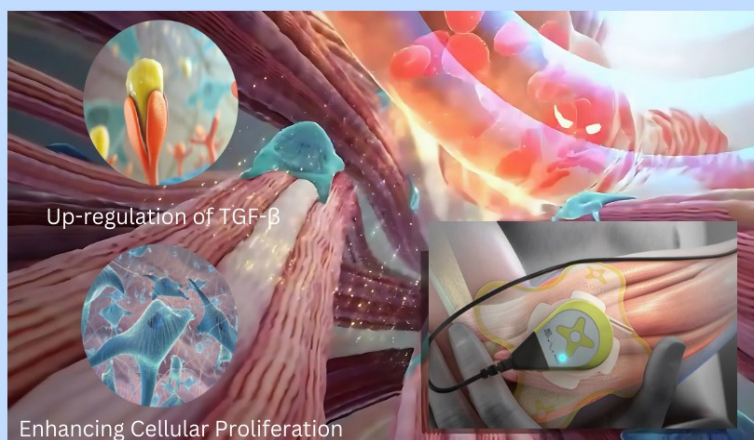
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- Plantar fasciitis.
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Sunday Afternoon, January 11th, Opening Program

2:30 pm **Registration Opens, Please check-in at Registration Desk**

3:00 pm **Opening remarks:** Jeffrey S Monroe, BSSMC Executive Director, Michigan State University Emeritus

3:00 pm **"Prehospital Care of the Spine Injured Athlete"** Erik Swartz, PhD, ATC, FNATA, Professor & Director, Hawaii Concussion Awareness Management Program (HCAMP), University of Hawaii

3:20 pm **"You Can't Build a Rocketship on a Paper Airplane: Why Foot Strength is the Best-Kept Secret in Sport Performance"** Milica McDowell, PT Bozeman, MT

3:40 pm **"Why All the Shaking? Vibration Therapy and its Clinical Effects"** Cindy Trowbridge PhD, LAT, ATC, CSCS, University of Texas at Arlington

4:00 pm **"Explore Core Aspects of Sport Psychology Including, Self-Confidence, Fear of Failure, and Communication in Relation to How Clinicians' Interact with Athletes, Supervisees, and Co-Workers"** Ryan Pittsinger AT PhD, Texas A & M University

4:30 pm **"Beyond the Injury: Considerations for Sports Medicine Care for Athletes with IDD Across the Lifespan"** April Felton RN, PhD; Kathleen Tenreiro RN, PhD; Ellen Donald DPT; Faculty Members of Florida Gulf Coast University

5:00 pm **"Injury Prevention, A Different Perspective: The Blind Screen"** Dave Hancock, 35 year veteran in Professional Sports (NFL, NBA, EPL, MLB)

5:30 pm **"Latest Advances in Sustained Acoustic Medicine for Transdermal Drug Delivery"** George Lewis PhD Biomedical Engineering • NIH/VHA/DOD Research Counsel Reviewer

6:00 pm **NFL Wild Card Weekend Playoff Welcome Reception, Hosted by Enovis and SamSport, Jefferson and Madison Ballrooms, Families and Friends Invited**

Notes:



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Monday Morning, January 12th, Scientific Presentations (Breakfast Provided, 6:30 am to 8:00 am)

7:00 am Opening remarks: Jeffrey S Monroe, Executive Director

7:00 am **“Prohibiting Injury From Entering the Athlete’s Physical Reality”** Simon Iden DPT

7:25 am **“PolarCap®: An Acute-Stage Concussion Treatment Using Selective Head and Neck Cooling — Clinical Results and Use Cases from the EU.”** Jamie Bache, University of Durham, UK Indiba

7:50 am **“Unlocking Athletic Potential: The Role of Dry Needling”** Keri Maywhort DPT, OCS, Advanced Functional Dry Needling Specialist, Program Director, Functional Dry Needling Certification Lead Instructor, Evidence in Motion, University of Colorado and Regis University; Mia Ramsey DPT, Colorado State University

8:15 am Exhibit Hall Break

8:30 am **“Beyond Rest and Rehabilitation: Hyperbaric Oxygen and Photobiomodulation In Sports Performance Injury Recovery”** Zayd Ratansi, ND (Neuropathic Doctor)

8:55 am **“Clinical Applications of Photobiomodulation: A Revolution in Wearable Technology”** Gina Myers PhD, Bio-engineering, Director of Research and Product Development, Incrediwear

9:20 am **“Using Closed Kinetic Chain Isokinetics in the High-Performance Setting”** Erik Meria DPT, Owner Black Diamond Physical Therapy

9:45 am **“Improving Tendinopathy Outcomes with Shockwave and Laser Technology”** Mark Callanen DPT, Enovis/Chattanooga, Marymount University

10:15 am End of Monday AM Session

Notes:



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Point of Care Muscular Skeletal Ultrasound Workshops:

7:00- 9:00 am, Monday Morning, One of two concurrent sessions, Lamar Gibbon Rm:

(Attendee must have preregistered online during registration)

Musculoskeletal Ultrasound Imaging

Shawn Felton EdD, AT, Dean- Marieb College of Health and Human Services, Florida Gulf Coast University, Arie van Duijn PT, MScPT, EdD, Professor of Physical Therapy at FGCU and Jacqueline van Duijn, Clinical Professor and Director of Clinical Education at the Doctoral Physical Therapy Program at FGCU

Musculoskeletal ultrasound imaging (MSKUI) is an extremely powerful tool for clinicians aiding in the assessment of tendons, ligaments and other musculoskeletal injuries. The use of MSKUI has been developing rapidly over the past 25 years. This session will describe the use of MSKUI in clinical settings, including the examination of musculoskeletal injuries for diagnostic and rehabilitative purposes. Participants will have the opportunity to practice MSKUI applications for selected structures during the laboratory component of the session.

At the conclusion of the of the program, participants will be able to:

1. Gain an understanding of technical aspects of MSKUSI
2. Learn basic concepts of interpreting ultrasound images, including tissue signatures
3. Discuss the use of Point of Care Ultrasound in clinical settings

9:00-11:00 am Second of two concurrent sessions, Lamar Gibbon Rm:

Musculoskeletal Ultrasound Imaging (Attendee must have Preregisterd online during registration)

“Hands on Introduction to Musculo-Skeletal Ultrasound on Common Body Parts”

1. Identify normal presentation and common pathologies of tendons, muscles, and joints through MSKUI.
2. Evaluate the use of MSKUI in enhancing the clinical orthopedic examination and rehabilitation.
3. Discuss key findings from MSKUI.

Notes:

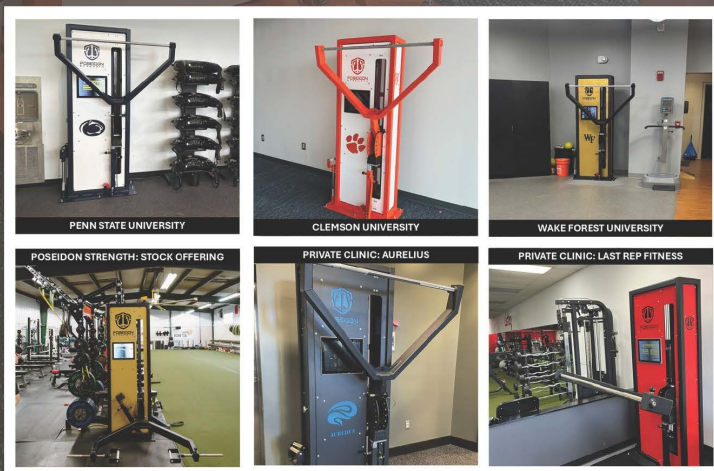


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Brad Curran: bcurran@poseidonstrength.com | 717-315-6729

Monday Afternoon, January 12th, Concussion Day

3:00 pm – Opening remarks, Jeffrey Kutcher MD, Director, Kutcher Clinic for Sports Neurology, Park City, UT/Ann Arbor, MI

3:15 pm **“The Evolving Landscape of Concussion Research,”** Christopher Giza, MD, UCLA BrainSport, Los Angeles, CA

4:00 pm **“Reviewing the Clinical Utility of Brain Cooling in Concussion Treatment,”** Ryan Pelo, DPT, Kutcher Clinic for Sports Neurology, Park City, UT

4:30 pm Exhibit Break

4:50 pm **“Concussion Mechanism of Injury as a Predictor of Symptom Type and Duration in Elite Athletes,”** Michael Hutchison, PhD, University of Toronto, Toronto, Ontario, Canada

5:30 pm **“Concussions: Those We Have Left Behind,”** Douglas McKeag, MD, Emeritus, University of Indiana School of Medicine

6:00 pm **Vendor Reception and Raffle Drawing, Poster Awards, Adult Refreshments in Exhibit Hall**

Notes:

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Tuesday Morning, January 13th, Concussion Day

7:00 am **“Behind the Curtain: Creating Clinical Guidelines to Support University-Level Performing Arts students after Concussion,”** Randall Dick, MS, FACSM

7:30 am **“Bending Over Backwards: Yoga for Concussion,”** Kate Essad, MD, Aurora Health Care, Milwaukee, WI

8:00 am **“The Effect of Concussion on the Pupillary Light Reflex,”** Nicholas Port, Ph.D. School of Optometry, Indiana University, Bloomington, IN

8:30 am **Exhibit Break**

8:45 am **“Using Hybrid Realty to Assess Neuro-Athleticism,”** Jake Carpenter-Thompson, MD, PhD, Kutcher Clinic for Sports Neurology, Ann Arbor, Michigan

9:15 am **“Application of AI Infused Accelerometer Technology for Performance, Safety, and Situational Awareness,”** Jeffrey Kutcher MD, Director, Kutcher Clinic for Sports Neurology, Park City, UT/Ann Arbor, MI

9:45 am **“Failing Exertional Testing Prior to Return to Sport: Insights From Neuroimaging,”** Kyla Pyndiura, PhD, University of Toronto, Toronto, Ontario, Canada

10:30 am **End Morning Session**

Notes:



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1. Garras, D.N., Scott, R.T., Particulate Umbilical Cord/Amniotic Membrane for the Treatment of Plantar Fasciitis. *Foot Ankle Orthop.* 2017;2(3):2473011417S00017. 2. Hanselman, A.E., Tidwell, J.E., Santrock, R.D., Cryopreserved human amniotic membrane injection for plantar fasciitis: a randomized, controlled, double-blind pilot study. *Foot Ankle Int.* 2015;Feb 36(2):151-158. 3. Duru, N., Williams, G. Jr., Assid, E. et al. Comparative, Controlled, Retrospective Study of Patient-Reported Outcomes After Meniscectomy With Adjunctive Use of Platelet-Rich Plasma or Amniotic Cord Tissue. *Ochsner Journal* 2024; March 24(1):6-13. 4. Castellanos, R., Tighe, S. Injectable Amniotic Membrane/Umbilical Cord Particulate for Knee Osteoarthritis: A Prospective, Single-Center Pilot Study. *Pain Med.* 2019; Nov 1:20(11):2283-2291.

US-CL-0003 11/25

Tuesday Afternoon, January 13th, Concussion Day

3:00 pm **“Controversies & Ethical Issues in Sports Medicine,”** David Klossner, PhD, National Football League Players’ Association, Washington, DC

3:45 pm **“Poster Presentation Recognition”** Christopher Giza MD, UCLA BrainSport, Los Angeles, CA

4:00 pm **Exhibit Break**

4:15 pm **“Neurological Disorders and Clinical Progression in Boxers from the 20th Century,”** Rudy Castellani, MD, Northwestern Feinberg School of Medicine, Chicago, IL

4:45 pm **“When Symptoms Collide: Depression and Concussion in Athletic Populations”** Lindsay Keenan PhD, LAT, ATC, West Chester University Pennsylvania

5:15 pm **Panel Discussion: Advancements, Challenges and Predictions** led by Jake Thompson MD, and Meeryo Choe, MD, All Concussion Faculty

6:00 pm **End of Afternoon Session**

Notes:



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1. Garras D, Scott R. AOFAS Annual Meeting 2017. 2. Hanselman AE, Tidwell J, Santrock R. *Foot Ankle Int.* 2015 Feb;36(2):151-8. 3. Duru N, Williams G Jr, et. al. *Ochsner J.* 2024;24(1):6-13. 4. Castellanos R, Tighe S. *Pain Medicine.* 2019;20(11):2283-2291.

Wednesday Morning, January 14th, Ortho Day

7:00 AM Opening remarks, Geoffrey Baer MD, University of Wisconsin Team Physician

7:00 am **“Management of the Spinal Cord Injury: Ambulance to Return to Sport”** Seth Williams MD, University of Wisconsin

7:15 am **“Stress Fractures of the Foot and Ankle: Why do they occur and what should be do about them?”** Katie Williams MD, University of Wisconsin

7:30 am **“Management of Acute Hand Injuries and Return to Sport”** Jonathan Tueting MD, Rush Medical Center

7:45 am **“The Science and Clinical Application of Regenerative Medicine in Sports Injuries”** Jason Krystofiak MD, Team Physician, Rutgers

8:00 am **Clavicle Injuries – What and When**

“Management of AC joint injuries” (15min) Winston Gwathmey MD, University of Virginia

“Clavicle Fractures” (15min) Seth Gamradt MD, University of Southern California

“Sternal Clavicular Joint Injuries” (15min) James Carpenter MD, University of Michigan

Questions?

8:50 am **Shoulder Instability – When to Fix and How**

“Management of the First Time Shoulder Dislocation” (10min) Keith Kenter MD, University of Missouri

“Arthroscopic Bankart Repair” (10min) Alexandria Chrumka MD, University of Wisconsin

“When to Add Remplissage to Your Labral Repair” (10min) Emma Klosterman MD, University of Michigan

“Management of Bone Loss with Shoulder Instability” (10min) Brian Werner MD, University of Virginia

Questions?

9:35 am **Management of the Collision Sport Athlete – Thoughts of the Experts**

Geoff Baer MD, University of Wisconsin

Chris Kaeding MD, The Ohio State University

Brian Werner MD, University of Virginia

Seth Gamradt MD, University of Southern California

David Mcallister MD, University of California Los Angeles

Matt Smith MD, Washinton University, St Louis Blues of the NHL

Matt Matava MD, Washington University, St Louis Blues of the NHL

Allison Brooks MD, University of Wisconsin

Molly Day MD, University of Wisconsin

10:30 am – End of Morning Session

Notes:

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*Neuropsychological tests including: Trail Making Test Part A (TMT-A), Trail Making Test Part B (TMT-B), Purdue Pegboard Test (PPT), Rey Auditory Verbal Learning Test (RAVLT), Stroop Color and Word Test, Digit Symbol Substitution Test (DSST).

References: 1. Andrefsky J, et al. *Neurol Sci Neurosurg* 2020;2(1):114. 2. Galvin JE, et al. *J Alzheimers Dis* 2024;100(2):509–523. 3. Ma F, et al. *Neurol Sci Neurosurg* 2021;2(2):116. 4. Cahn-Hidalgo D, et al. *World J Psychiatry* 2020;10(1):1–11.

Disclaimer: Cognivue Clarity[®] is indicated for use as adjunctive tool for evaluating cognitive function. It is not a stand-alone diagnostic tool and does not identify the presence or absence of clinical diagnoses. The device results are to be interpreted by a licensed clinician. Cognivue and Cognivue Clarity are trademarks of Cognivue, in the US and/or other countries. ©2025 Cognivue. All rights reserved. CGC-1060 (11_2025)

Wednesday Afternoon, January 14th, Ortho Day

3:00 pm **“Leveraging Collaborative Research To Drive Change in Youth Sports”** Drew Watson MD, University of Wisconsin

3:15 pm **“Mountain Bike Injuries-Management to Get Back to the Trail”** Grant Jones MD, The Ohio State University

3:30 pm **Anterior Cruciate Ligament Injury: Repair and Reconstruction Options**

“Hamstring Tendon Graft” (10min) Geoffrey Baer MD, PhD, University of Wisconsin

“Patellar Tendon Graft” (10min) David Mcallister MD, UCLA

“Quadriceps Tendon Graft” (10min) Molly Day MD, University of Wisconsin

“Anterior Cruciate Repair with BEAR Technique” (10min) Chris Kaeding MD, The Ohio State University

Questions?

4:20 pm **Patella Instability**

“Initial Evaluation of Patella Instability” (10min) Brendon Ronna MD, University of Wisconsin

“Medial Patellofemoral Ligament (MPFL) and Tibial Tubercle Osteotomy (TTO) for the Management of Patella Instability” (15min) Molly Day MD, University of Wisconsin

“Patella Instability: When is MPFL and TTO Not Enough” (15min) David Diduch MD, University of Virginia

Questions?

5:05 pm **Hip Pain Management in the Athlete**

“Things Every Sports’ Medicine Specialist Should Know about Hip Pain” (12min) Haley Smith MD, University of Wisconsin

“Cartilage Injuries to the Hip-Repair and Management” (12min) Brian Walczak DO, Rush Medical Center

“When is a Labral Repair not Enough?” (12min) Justin Greiner MD, University of Omaha Nebraska

Questions?

5:50 pm **Injuries in the Overhead and Non-Collision Athlete – Thoughts of the Experts**

Geoffrey Baer MD, PhD, University of Wisconsin

Grant Jones MD, The Ohio State University

Justin Greiner MD, University Nebraska Omaha

Haley Smith MD, University of Wisconsin

Matt Matava MD, Washington University, St Louis Blues

Keith Kenter MD, University of Missouri

Drew Watson MD, University of Wisconsin

Winston Gwathmey MD, University of Virginia

6:30pm – End of Afternoon Session

Notes:

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Pain Reduction
Reduce pain by accelerating the body's natural repair process.



Wound Healing
Help wounds heal faster and boost blood flow to reduce swelling.



Podiatry
Painlessly and effectively accelerates natural recovery for various foot alignments.



Soft Tissue Injuries
Accelerate the resolution of oedemas in acute injuries and stabilize hematomas.



Neuropathy
Reduce pain and swelling due to injuries, and/or chronic conditions.

Thursday Morning, January 15th, Ortho Day

7:00 am Introduction – Geoffrey Baer MD, PhD University of Wisconsin

7:00 am **“Durable Medical Equipment (DME) Working within the Medicare Rules”** BJ Maack ATC, Little Rock, Arkansas

7:25 am **“Practical Applications of Extracorporeal Shockwave Therapy in Sports Medicine: Enhancing Recovery and Return to Play”** Stephen Eddy MD, Akron University

7:50 am **“The Science and Clinical Application of Regenerative Medicine in Sports Injuries”** Jason Krystofiak MD, Team Physician, Rutgers University

8:15 am **“Managing the College and Professional Athlete – How things change in the Time of NIL, Agents and Advisors”** Matt Matava MD, Washington University, St Louis Blues

8:40 am **“Management of the Arthritic Shoulder Return to Sport Following Shoulder Replacement”** Eric Cotter MD, University of Wisconsin

9:05 am **“Management of Common Dermatologic Conditions in Sports”** Lisa Cotter MD, University of Wisconsin

9:30 am **Scientific Talks – ACL**

“Isokinetic Strength Recovery Following ACL Reconstruction: Patellar Tendon Versus Quadriceps Tendon Auto-grafts” (10min) Collin Nguyen, Sports Medicine Research Fellow, University of Wisconsin

“Single-Leg Vertical Hop Deficits in D1 Athletes Following ACL Reconstruction” (10min) Michael Baer, Miami University, Badger Athletic Performance, University of Wisconsin

“Protecting the Pivot: Are ACL Injury Prevention Programs Failing to Reach High School Athletes in Metro Detroit” (10min) Isabella Stricker BA, Oakland University William Beaumont School of Medicine

Questions?

10:00 am **“Comparing On-Site Wet Bulb Glove Temperature Measurements with Phone Application Estimates and the Influence on High School Sports Activity Modification”** Bud Cooper, PhD, ATC, University of Georgia

10:25 am End of Conference

Notes:



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Poster Abstracts Sponsored by MioTech

Traumatic Crush Injury in Polo: A Case Report of Acute Management and Recovery Following a High-Impact Sports Accident

Authors: Maguire E. Anuszewski¹, Dylan M. Bush¹, Thomas Germano², Tareq Kheirbek³

Institutions:

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³ The Warren Alpert Medical School of Brown University, Department of Surgery - Division of Trauma and Critical Care Brown University, Providence, RI, United States;

Background: Equine polo is a contact sport with significant injury risk—particularly crush injuries. Although played in more than 77 countries worldwide, limited research exists on polo-related injuries.

Methods: Chart review, patient and provider interviews, and follow-up physical exams were performed to present a 21-year-old female polo player who was stepped on by her horse during a match.

Results: The patient was ambulatory upon presentation to a community hospital but reported severe left calf pain and was transferred to a level I trauma center for concern of compartment syndrome. Laboratory results showed an elevated total creatine kinase (951 U/L, Ref: 20-165) and leukocytosis ($14.1 \times 10^9/L$, Ref: 3.5-11), with increased segmented neutrophils and monocytes. Compartment pressure measurements confirmed lateral, superficial posterior, and deep posterior compartment syndrome. A 4-compartment fasciotomy was performed with a Jacob's ladder closure. On postoperative day 5, fasciotomy extension was required to verify nerve integrity. The wound was closed 10 days after the initial intervention, and the patient was subsequently discharged home. At 6-month follow-up, the patient had resumed horseback riding with improved mobility and ambulation, though mild left foot drop persisted. At 8 years post-injury, examination revealed decreased light touch sensation and two-point discrimination over the left lateral calf. Inversion strength was reduced and mild foot drop persisted, with otherwise normal plantar flexion, dorsiflexion, and eversion.

Conclusion: Prompt surgical intervention likely preserved motor and sensory outcomes in this case. Greater awareness of polo injury patterns may improve care—additional research is needed to further characterize incidence and optimal management.

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Validity of lumbar spine and lower-extremity kinematics and kinetics during the squat and lift of a box using markerless motion capture: clinical implications

Authors: Richard Boergers PhD, ATC, Manfred Minimair, PhD, Hsin-Yi Lin, PhD, Elizabeth Clark, BS, Juan Abando

Institutions/Departments: Seton Hall University, School of Health and Medical Sciences

Background: Low back pain is recognized globally as the leading orthopedic cause of missed work. According to the U.S. Bureau of Labor Statistics from 2021-22, back and shoulder injuries made up approximately 51% of workplace injuries leading to lost work time, many of which are associated with flawed lifting mechanics. Previous injuries may have a detrimental effect on the kinetic chain resulting in flawed mechanics that negatively affect low back torque. 3D motion capture studies are sometimes used to provide valuable insight on kinematic and kinetic data throughout the kinetic chain. Fortunately, a free markerless motion capture system (OpenCap) is available, which may provide clinicians and patients with insights into mechanics while lifting. The purpose of this study was to determine the validity of OpenCap markerless motion capture kinematic and kinetic data compared to the Vicon motion capture system.

Methods: Twelve healthy adults [male: N=6, female: N=6; age: 32.30 ± 10.57 (yrs); height: 1.71 ± 0.08 (m); weight: 73.59 ± 18.12 (kg)] participated. Simultaneous motion capture data was collected with a marker-based system (Vicon with Bertec force plate) and a markerless system (OpenCap). Subjects performed three trials each of a squat-bend lift of a 4.54kg plastic box positioned (1) directly in front of their feet, (2) 45° angle off the left foot, (3) 45° angle off the right foot. The peak values for kinematic and kinetic outcomes was averaged for the three trials of each condition. Both systems use a static calibration pose in addition to the subject's height and weight to help build a biomechanical model (standard plug-in gait model for Vicon; Lai-Ulrich full body model for OpenCap). Kinetic data were processed for both systems using inverse dynamics to calculate joint forces up the kinetic chain. Pearson's r was used to determine concurrent validity of peak kinematic and kinetic variables in the lumbar spine and lower extremity, as well as three-dimensional peak force plate values. Pearson's correlation was interpreted as: poor (<0.40), modest (0.40-0.74), or excellent (>0.75). All alpha levels were set at 0.05 a priori.

Results: Peak angles in the sagittal (flx/ext) and frontal (add/abd) planes were significantly modestly or excellently related (sagittal range: 0.470-0.935; frontal range: 0.437-0.616). Peak angles in the transverse plane showed no significant correlation. Only peak torques for spine flexion ($r=0.798$, $p=0.001$), spine lateral flexion ($r=0.606$, $p=0.001$), left hip flexion ($r=0.677$, $p=0.001$), left ankle flexion ($r=0.534$, $p=0.001$) had significant relationship that was modest to excellent. For the forceplate data, peak force in the forward shear was modestly significantly related ($r=0.580$, $p=0.001$) and downward force had significant excellent relationship ($r=0.960$, $p=0.001$).

Conclusions: During a slow squat-bend lift with a weighted box, lower extremity and spine kinematic data (angles) from the OpenCap are valid in both the sagittal and frontal planes (11/11 variables). Kinetic data (joint torques) were less valid (only a total of 4/11 variables). Fortunately, spinal flexion and lateral flexion torques data had significant relationship between the Vicon and OpenCap systems. However, caution must be used making comparisons between subjects as the OpenCap system reported much higher spinal flexion torque (OpenCap= 145 ± 45.70 N, Vicon= 118.80 ± 53.34), which we suspect is likely due to reporting lower knee flexion angles, which would affect the estimated center of gravity. Combined with clinical judgement, OpenCap markerless motion capture may have utility in the rehabilitation clinic setting for assisting clients/patients with proper lifting form.



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Title: Adapting Baseball Pitching Limits to Golf Swing Guidelines: A Biomechanical Approach to Preventing Overuse Injury in Youth Golfers

Authors: Ryan Browne, Medical Student at Elson S. Floyd College of Medicine at Washington State University

Objective: To propose golf swing count guidelines adapted from baseball's Pitch Smart pitching count recommendations to mitigate overuse injuries in youth golfers.

Background: Baseball's Pitch Smart guidelines reduce shoulder and elbow injury rates by 20-50% through age-specific pitch limits (e.g., 50-95 per game), mandatory rest periods, and holistic monitoring, based on longitudinal studies. Golf, involving repetitive rotational swings with similar biomechanical mechanisms to the throwing motion, similarly risks overuse injuries like low back pain (up to 34% prevalence), medial epicondylitis, and rotator cuff tendinitis. Yet, golf lacks structure swing volume protocols.

Methods: Drawing from biomechanical similarities between pitching and golf swings, we propose preliminary guidelines informed by baseball's evidence base and golf injury literature. Recommendations include age- and experience-based swing limits (e.g., 50-75 daily swings for youth under 12, 100-200 for adults), rest periods (1-4 days post-high-volume sessions), and monitoring for fatigue or poor mechanics to minimize cumulative microtrauma. These align with sports medicine principles emphasizing tissue recovery and conditioning.

Proposal: The proposed guidelines aim to prevent overuse injuries by moderating swing volume and incorporating appropriate recovery periods, mirroring baseball's approach. For instance, capping weekly swings at 500-700 for amateurs, adjusted for intensity, reflects pitching data linking high volumes to elevated injury risk.

Conclusion: The golf swing count and recovery period guidelines offer a preliminary preventive approach for reducing overuse injuries. It is recommended that prospective, golf-specific research is conducted to establish more precise swing thresholds, recovery periods, and tailor recommendations to the diverse golfer populations.



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TITLE: Establishing Normative Neuromuscular and Functional Profiles in Collegiate Baseball Pitchers

AUTHORS: Deric Grohowski¹, Michael Cohen¹, Patrick Horvath^{1,1} King’s College, Wilkes-Barre, PA, USA

PURPOSE: To establish normative neuromuscular, strength, and functional movement profiles in collegiate baseball pitchers using tensiomyography (TMG), handgrip dynamometry, and the Functional Movement Screen (FMS).

METHODS: Seven male collegiate pitchers (18–25 years) completed a single pre-season laboratory session. TMG assessed delay time (Td), contraction time (Tc), maximal displacement (Dm), and relaxation time (Tr) in the biceps brachii, pectoralis major, anterior deltoid, posterior deltoid, and middle trapezius using a TMG Science for Body Evolution device. Three trials per muscle were averaged. Bilateral isometric grip strength was measured using a hydraulic dynamometer, and shoulder mobility was evaluated using the FMS Shoulder Mobility Test. Inter-limb differences were analyzed via Wilcoxon matched-pairs tests ($p \leq 0.05$). ChatGPT was used solely for formatting and editing in accordance with NSCA guidelines.

RESULTS: Significant dominant-side adaptations were observed. Tc was shorter in the anterior deltoid ($p = 0.034$) and posterior deltoid ($p = 0.016$). Tr was shorter in the biceps brachii ($p = 0.012$), anterior deltoid ($p = 0.005$), and middle trapezius ($p = 0.008$). Dm was lower in the dominant posterior deltoid ($p = 0.048$), indicating increased stiffness. FMS shoulder mobility trended lower on the dominant side ($p = 0.051$). Grip strength showed no asymmetry.

CONCLUSIONS: Collegiate pitchers exhibit sport-specific neuromuscular adaptations characterized by faster contractile properties and increased dominant-side stiffness. Functional mobility showed mild asymmetry without strength deficits.

PRACTICAL APPLICATIONS: These data provide normative references to identify asymmetries, guide interventions, and support

Parameter	Muscle	Direction	p-value
Tc	Anterior Deltoid	Dominant < Non-dominant	0.034*
Tc	Posterior Deltoid	Dominant < Non-dominant	0.016*
Tr	Biceps Brachialis	Dominant < Non-dominant	0.012*
Tr	Anterior Deltoid	Dominant < Non-dominant	0.005**
Tr	Middle Trapezius	Dominant < Non-dominant	0.008**
Dm	Posterior Deltoid	Dominant < Non-dominant	0.048*

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Title: Establishing the feasibility of a first population-based case-control study of traumatic brain injury as a risk for chronic traumatic encephalopathy (CTE) and other neuropathologies

Authors: Douglas Wiebe PhD, Rafael Torres Fajardo MD, Julia Brake MS, Abigail Bretzin PhD ATC, Andrew Lieberman MD PhD, Matthew Perkins BS, Sami Barmada MD PhD

Institutions/Departments: University of Michigan; Atrium Health, Charlotte NC; Wake Forest University; Michigan Gift of Life

Background: Chronic traumatic encephalopathy (CTE) has been reported primarily in case series of former collision sport athletes and widely publicized, leading to widespread public belief that repetitive head impacts and traumatic brain injury (TBI) cause CTE. However, current evidence is derived from highly selected samples and cross-sectional study designs that cannot determine causation. The field lacks population-based approaches that can estimate the prevalence of CTE or evaluate TBI as a risk factor. In response to calls from the 6th International Consensus Statement on Concussion in Sport for stronger epidemiologic study designs, we developed the first population-based case-control strategy capable of testing whether lifetime TBI exposure is associated with CTE and Alzheimer's disease/related dementias (AD/ADRD).

Methods: We partnered with a Level I trauma center and an organ procurement organization (OPO) to identify adults who sustain acute fatal injuries from road traffic crashes and other unintentional events. Next-of-kin consent is obtained for a follow-back interview and organ donation. Immediately after circulatory death, the brain is preserved and transferred to our academic medical center's brain bank for neuropathological evaluation. Cases are defined as individuals with neuropathologically confirmed CTE or AD/ADRD; controls are individuals without either condition. The follow-back interview captures lifetime TBI exposure—including contact sports participation, military service, interpersonal violence, and unintentional injury—using NINDS Common Data Elements, along with demographic characteristics and potential confounders. The population-based recruitment strategy emulates random sampling of community-dwelling adults who would be alive absent the index event. Logistic regression will estimate adjusted odds ratios for associations between TBI and each neuropathology. Power calculations indicate that with 1,700 enrolled participants, the study will achieve $\geq 80\%$ power to detect meaningful associations across plausible prevalence scenarios.

Results: One (N=1) study participant/decedent has been enrolled to date. Recruitment infrastructure, brain extraction and processing procedures, and data collection workflows are being established with the goal of enrolling 5 to 10 participants in this initial feasibility. Once our protocol is established we will apply for R01 funding to complete the study at scale with a planned 10 sites recruiting in parallel. Projected deliverables include generating the first population-based prevalence estimates of CTE and AD/ADRD within the catchment region and evaluating TBI history as a potential risk factor.

Conclusions: This study introduces a feasible, population-based epidemiologic design to investigate whether TBI contributes to the development of CTE and related neuropathologies. By reducing selection bias, collecting detailed lifetime exposure histories, and incorporating appropriate controls, this approach addresses long-standing limitations of prior CTE research. The design also enables expansion to multiple trauma centers and supports data sharing through the FITBIR informatics system, improving sample diversity and accelerating scientific progress in understanding TBI-related neurodegeneration. Having enrolled N=1 within months of study launch, we are initially optimistic about the feasibility of this innovative protocol.

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Title: Effect of targeted neck strengthening exercise on cervical muscle size, strength, and neuromuscular activation, as well as head accelerations during simulated impact events

Authors: James T. Eckner MD MS, Hogene Kim PhD, Yumeng Wang PhD, Benjamin Wojtas MS, Neddie Byron, Thomas Paul, Mark Peterson PhD, Mike Favre MS, Xuming He PhD, Jon Jacobson MD, Corrie M. Yablon MD, Ingrid K Ichescio MD, Steven Broglio PhD, Anita Vasavada PhD, James A. Ashton-Miller PhD

Background: Neck strengthening exercise represents a promising concussion prevention strategy in athletes. However, relatively few studies have directly investigated the effect of neck strengthening exercise on concussion risk, with mixed results.

Purpose: To determine the effect of a 12-week manual resistance-based neck strengthening exercise program on cervical muscle size, strength, and neuromuscular activation, as well as head accelerations during standardized lab-based loading tasks in male and female high school athletes.

Design: Randomized clinical trial.

Methods: 40 high school soccer athletes (15.5 ± 1.4 years; 37% females) were randomized to an experimental group participating in a 12-week whole-body resistance training program including targeted neck strengthening exercises ($n=19$) vs. an otherwise identical control program not targeting the neck ($n=21$). Participants completed 4 identical assessments at baseline and after 4-, 8-, and 12-weeks. Each lab-based assessment measured neck size (circumference, sternocleidomastoid cross-sectional area [SCM-CSA], total cervical muscle volume [CMV]), strength (isometric maximum voluntary contraction [MVC], rate of force/torque development [RFTD]), and neuromuscular activation (during maximum voluntary isometric co-contraction [VIC]), as well as head kinematics (primary outcomes: linear and angular areas under the acceleration vs. time curves, LinAccAUC and AngAccAUC) during 3 standardized loading tasks: multidirectional direct force application to the head with/without anticipatory bracing (primary), simulated body checking with/without anticipatory bracing, and simulated soccer heading. Linear mixed models compared changes in head kinematics over time between groups. Pearson correlations also evaluated relationships between pre-/post-changes in each cervical measure and changes in head kinematics during direct force application to the head.

Results: A significant group-time interaction effect was present for MVC, with greater increases in the experimental group compared to controls ($p=0.038$). Significant time and group-time interaction effects were present for VIC ($p=0.017$, $p=0.027$, respectively), with an increase over time in both groups that was greater in the experimental group. LinAccAUC and AngAccAUC decreased over time in both groups following direct force application to the head (primary loading condition), with lower LinAccAUC and AngAccAUC magnitudes and smaller decreases over time in the experimental group. There were no significant time, group, or group-time interaction effects for LinAccAUC nor AngAccAUC during the secondary simulated checking or soccer heading tasks. Changes in VIC were inversely associated with small changes in LinAccAUC and AngAccAUC (both $p<0.001$).

Discussion/Conclusions: Targeted neck strengthening exercise was associated with greater neck strength increases, primarily attributable to greater cervical neuromuscular activation. However, head accelerations following direct force application significantly decreased in both study groups over 12 weeks of resistance training, regardless of inclusion of targeted manual resistance-based neck strengthening exercises, and no measurable effects were observed on linear nor angular head accelerations during either secondary loading condition. The manual resistance-based neck strengthening exercise program may have begun to influence head accelerations through early strength gains attributable to neuromuscular adaptation. Future research should consider a longer duration of exercise or alternative, more dynamic forms of targeted neck strengthening exercise. The optimal application of neck strengthening exercise as a concussion risk reduction strategy in athletes remains uncertain.

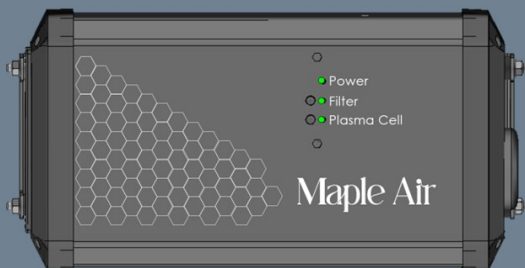
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Psychological Readiness Affects Return-to-Play Outcomes and Mental Health in Collegiate Ice Hockey Athletes Following Soft-Tissue Injury

Author(s): Nicholas Koumontzis, MS¹; Stephen Williams, BS¹; Rhett White, BS¹

Institution(s): 1. West Virginia University School of Medicine

Background: Post-operative return-to-play (RTP) protocols traditionally emphasize physical recovery, but sport-specific psychological readiness is gaining awareness for its role in postoperative confidence and performance. Hockey athletes, in particular, face substantial mental and physical stressors due to the sport's contact demands, rapid pace, and competitive intensity. This study compared mental-health indicators in surgically treated collegiate hockey players versus uninjured teammates using a novel Return-to-Play Mental Health 15-item scale (RTP-MH-15) and validated mental health instruments.

Methods: 31 collegiate hockey athletes with 36 surgically treated shoulder labrum, rotator cuff, or hip labrum repairs were retrospectively assessed following return to full participation. Participants were ≥ 18 -year-old men and women from the NCAA Division 1 and Division 3 levels with the intent to return to play within program. Athletes who sustained fractures with their injury, received mobility-restrictive hardware, had received a diagnosis with limitations in eventual return to play, or withdrew from sport completely were excluded. All participants completed the RTP-MH-15 (reflecting mental readiness two weeks prior to clearance), the Generalized Anxiety Disorder-7 (GAD-7), and the Patient Health Questionnaire-9 (PHQ-9). A reference group of 20 uninjured athletes competing at the same level completed these questionnaires. RTP-MH-15 scores were analyzed as a function of injury type and mental-health measures.

Results: Preliminary analysis demonstrated significantly lower RTP readiness as indicated by RTP-MH-15 scores in injured athletes compared with uninjured controls (71.4 ± 11.2 vs 83.6 ± 7.5 ; $p < 0.01$). Injured athletes reported higher levels of anxiety compared to controls ($p < 0.01$, 95% CI = 1.82 to 3.79), while depressive symptoms between groups showed no statistical significance ($p = 0.10$, 95% CI = -0.18 to 1.78). Despite this, RTP-MH-15 scores displayed a negative correlation with both anxiety and depression within the injured cohort, indicating that greater psychological burden was associated with lower individual RTP readiness.

Conclusions: Collegiate hockey players returning from common soft-tissue surgery exhibit measurable deficits in psychological readiness and higher rates of subclinical anxiety compared with uninjured teammates. This study underscores the importance of dual physical and psychological clearance in post-surgical athletes. Integrating structured mental-health screening such as the RTP-MH-15, alongside GAD-7 and PHQ-9, provide actionable metrics to identify at-risk athletes, personalize rehabilitation, and optimize

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Title: Anti-Gravity Treadmill Versus Traditional Gait Training and Strengthening Effect in Lower Extremity Osteoarthritis, Original Research

Authors: Dr. Beth Marschner

Institutions/Departments: Minot State University, Department of Science

Background: Osteoarthritis is associated with pain in weight-bearing and contributes to weakness and loss of function. The purpose of this study was to examine the effect of gait training and strengthening using an anti-gravity treadmill versus traditional gait training and strengthening on pain, range of motion, speed of gait and lower extremity endurance.

Methods: This study utilized a convenience sample (N=30) consisting of volunteer participants using a snowball effect in recruiting. Each participant was randomly assigned to either the anti-gravity treadmill group or the traditional hallway walking group. Participants completed a medical history questionnaire, PAR-Q+, painful joint range of motion testing using a goniometer, 20-meter walk test, and 30 second sit to stand test at pre-test, and the measures were repeated at the end of their twelfth session (two times per week for six weeks).

Results: Data was analyzed using SPSS to determine descriptive and parametric statistics. Independent Samples T Test was used to see if groups differed at the beginning of the study. Results indicated that there was no significant difference between the treatment groups at baseline except for weight. Paired Samples T Test was used to determine if either treatment made a difference. The results indicate there was a significance difference in pre-test and post-test measures for pain, 20-meter walk test and 30 second sit to stand test for both groups, $p < 0.001$.

Conclusions: Results support that an anti-gravity treadmill is as effective as traditional physical therapy. Further research with a shorter treatment period would be appropriate.

Support: This work was supported by awards from: North Dakota Economic Diversification Research Fund (EDRF) and Minot State University Faculty Small Research Grant.

Title: Effects of Instrument Assisted Soft Tissue Mobilization (IASTM) on Range of Motion and Grip Strength, Original Research

Authors: Dr. Beth Marschner, Conner Meldrim

Institutions/Departments: Minot State University, Department of Science

Background: Limited tissue mobility and loss of range of motion (ROM) contribute to changes in movement patterns, strength and function. The purpose of the study was to determine the effect of instrument assisted soft tissue mobilization (IASTM) on tissue mobility and grip strength.

Methods: This study utilized a convenience sample (N=72) from an accredited regional university consisting of students, faculty, and staff. Each participant served as their own control using a crossover study design with test and re-test measures. Individuals were pre-tested for ROM using a goniometer and grip strength using a JAMAR hand dynamometer in three different shoulder and elbow combinations. Individuals either received IASTM treatment on bilateral upper extremities with HawkGrips or did nothing during the session. Post-tests were completed after each session.

Results: Repeated measures results showed a significant difference for bilateral elbow flexion and extension, forearm pronation and supination, wrist flexion and extension, wrist radial and ulnar deviation, finger flexion, and thumb extension and abduction ROM between pre-and-posttest IASTM treatment. There was not a statistically significant difference in bilateral grip strength between pre-test IASTM and post-test IASTM.

Conclusions: The findings of this study indicate that IASTM improves ROM but does not immediately increase strength of grip. The effects on grip strength may be further investigated by assessing a delayed period of measurement versus immediate measurement after treatment. This study supports further research using IASTM to treat other conditions with limited ROM contributing to the pathology or effect of the pathology.



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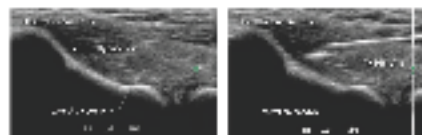
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¹Stulman C, et al. Orthopedics 2016;39(6):e0028-e0035. ²Various. See Citation 1 at: <https://tricemedical.com/references/>
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Title: Effects of Instrument Assisted Soft Tissue Mobilization (IASTM) on Range of Motion and Lower Extremity Power, Original Research

Authors: Dr. Beth Marschner, Brady Schock

Institutions/Departments: Minot State University, Department of Science

Background: Limited tissue mobility and loss of range of motion (ROM) contribute to changes in movement patterns, power and function. The purpose of the study was to determine the effect of instrument assisted soft tissue mobilization (IASTM) on tissue mobility and lower extremity power.

Methods: This study utilized a convenience sample (N=50) from an accredited regional university consisting of students, faculty, and staff. Each participant served as their own control using a crossover study design with test and re-test measures. Individual's ROM was pretested using a goniometer, and lower extremity power was tested using horizontal and vertical jump measures. Individuals either received IASTM treatment on bilateral lower extremities with HawkGrips or did nothing during the treatment session. Post-tests were completed after each session.

Results: Repeated measures results showed a significant difference for bilateral ankle dorsiflexion and plantarflexion, knee flexion, hip abduction, hip extension, and hip internal rotation. Single side significant difference was observed with right ankle eversion, left hip flexion, and left hip external rotation between pre-and-posttest IASTM treatment. Significant side-to-side balance (symmetry) effects were noted after treatment. There was a statistically significant difference on horizontal jump and vertical jump after further analysis.

Conclusions: The findings of this study indicate that IASTM improves ROM and lower extremity power. The effects of lower extremity power need further examination. This study shows support for further research using IASTM to treat conditions with limited ROM and functional limitations such as decreased power or speed of movement.

Title: Evaluation of Next-Generation Sustained Acoustic Medicine (SAM) Technology: From Young Adults to Geriatrics

Authors: Nikhil G. Menon, PhD, Jason Krystofiak, MD, CAQSM, Stephanie C. Petterson, MPT, PhD, Thomas M. Best, MD, PhD, FACSM

Background: Arthritis is a musculoskeletal disease causing joint pain and inflammation. Patients with arthritis have difficulty performing tasks involving physical strength. Sustained Acoustic Medicine (SAM), a medical device approved by the FDA to provide long-duration continuous ultrasound, reduces arthritis-associated pain. This study examined a new single-peel patch (SPP) for usability by young and old, healthy and arthritic subjects.

Methods: 30 healthy subjects (aged 19-78) used the SAM device with the SPP, assisted by trained professionals, and were given surveys on their experience. Later, subjects took the device home, used it normally three times, and filled out a separate survey. 8 subjects (aged 25-66) with moderate to extreme arthritis used the device with the SPP. They rated ease of use and pain during various setup, usage, and storage steps.

Results: Most healthy subjects found it easy to attach the applicator (93.3%) and remove the SPP liner (96.4%) with assistance in the office. These percentages changed during the at-home sessions to 94.0% and 88.1%, respectively. In all sessions, all patients were able to successfully apply and remove the device. Arthritis subjects gave each step an average ease of use rating between 4 and 5, with an overall average of 4.6 out of 5. They also experienced no pain during any of the usage steps.

Conclusions: SAM and the SPP are easy to use for healthy and arthritic subjects, receiving the Arthritis Foundation Ease of Use certification and making SAM an effective treatment option for athletes suffering from arthritis.

ACUTE EFFECTS OF BODY TEMPERING ON BIOMECHANICAL TISSUE CHARACTERISTICS IN THE LOWER BACK

Authors: Danielle Alley; Kayla Elias; Gabe Pancratz; Jeff Williams PhD, LAT, ATC; Butler University Department of Health Sciences

Objective: Body tempering (BT) is a novel, myofascial release technique that is growing in popularity among sports medicine and performance practitioners. No studies have explored its effects on biomechanical tissue characteristics or its influence on perceived disablement within the thoracolumbar spine region.

PURPOSE: To examine the acute effects of BT on soft-tissue characteristics and perceived disablement in the thoracolumbar spine.

METHODS: A randomized controlled trial was used to study 22 young adults (10 males, 12 females, age=21.1±0.68 years, height=170.6±11.8 cm, mass=65.2±14.2 kg). Treatment group participants received a 1-minute BT treatment to the soft-tissues of their thoracolumbar spine. Control group participants received no treatment. Pretest and posttest measurements of tissue characteristics (tone, stiffness, elasticity, relaxation, and creep) were performed on both groups inside a human performance lab by a single blinded examiner using a MyotonPRO. Levels of perceived lower back disablement were also examined using the Oswestry Disability Index (ODI). Independent t-tests were used to analyze changes in tissue characteristics and ODI scores from pre- to post-treatment with p-values set a priori at 0.05.

RESULTS: No statistically significant changes in tissue tone, stiffness, elasticity, relaxation, creep, or ODI scores were observed between groups ($p > .17$).

CONCLUSION: A single BT treatment did not acutely change characteristics of the soft-tissues within the thoracolumbar spine region. BT also did not cause acute changes in perceived lower back disablement. The efficacy of BT as a therapeutic technique remains questionable. Clinicians may benefit from employing other evidence-based therapies as myofascial release techniques.

Effectiveness of a Standardized, Seasonally Adjusted Vitamin D Supplementation Protocol in Collegiate Track and Field Athletes: A Retrospective Cohort Study

Authors: Madeline Block, MCA; Tyler Slayman, MD; Mederic Hall, MD; Timothy Thomsen, MD; Douglas West, PhD, ATC

Abstract: Background: Vitamin D plays a key role in bone health, muscle function, and immune regulation. Despite this, vitamin D insufficiency and deficiency remain common in athletes, particularly during winter months and in indoor sports. Standardized supplementation protocols in collegiate athletics are limited.

Purpose: To evaluate the efficacy of our NCAA Division 1 Track and Field Vitamin D Supplementation Protocol Vitamin D Supplementation Protocol in improving serum 25-hydroxyvitamin D (25(OH)D) levels in track and field athletes.

Study Design: Retrospective cohort study.

Methods: Track and field athletes (n=320, 50.3% female) participating in routine vitamin D screening from January 2018 to May 2024 were included. Serum 25(OH)D levels were measured at 1,278 clinical visits. Supplementation was provided according to protocol thresholds, which were seasonally adjusted post-June 2020. Logistic regression using generalized estimating equations assessed predictors of achieving serum 25(OH)D ≥ 50 ng/mL at the next visit. Repeated measures analysis evaluated dose-response relationships.

Results: At baseline, 226 athletes (75.4%) had 25(OH)D levels below the treatment threshold, with 6.3% deficient (<20 ng/mL) and 32.2% insufficient ($20\text{--}30$ ng/mL). Supplementation was indicated at 964 visits (75.4%) and administered at 958 visits (74.9%). Among 693 treated visits with follow-up, 138 (19.9%) achieved ≥ 50 ng/mL at the subsequent visit. Logistic regression identified season of follow-up (spring/summer vs. fall/winter: OR 2.36, 95% CI 1.52–3.67), supplement dose (per unit increase: OR 1.54, 95% CI 1.02–2.31), and baseline 25(OH)D level (per ng/mL increase: OR 1.11, 95% CI 1.07–1.16) as significant predictors of treatment success. Dose-response analysis revealed higher weekly supplementation doses were associated with greater increases in serum 25(OH)D ($p<0.001$). Untreated athletes consistently experienced declines in 25(OH)D, while treated athletes showed stabilization or modest improvement.

Conclusion: A structured, seasonally adjusted vitamin D supplementation protocol modestly improved 25(OH)D levels in NCAA Division 1 Collegiate track and field athletes, with a clear dose-response effect. Overall success in achieving target thresholds was limited, highlighting the need for individualized dosing and ongoing monitoring. These findings support standardized, evidence-based vitamin D management to optimize athlete health, recovery, and performance.

Title: Six-Month Effectiveness of Sustained Acoustic Medicine for Knee Osteoarthritis: A Randomized, Placebo-Controlled, Double-Blind, Crossover Clinical Study

Authors: Stephanie C. Petterson, MPT, PhD, Cameron Whitacre, Kevin D. Plancher, MD, MPH, FAOA, FAAOS, Thomas M. Best, MD, PhD, FACS, Sam Phillips, PhD, Jemy Delikat, MOT, OTR/L, CDP

Institutions/Departments: Orthopedic Foundation, James A Haley Veterans Hospital, University of Miami, University of South Carolina, Albert Einstein University

Background: Osteoarthritis (OA) is the most common musculoskeletal disease, characterized by degeneration of articular cartilage and bone. Sustained Acoustic Medicine (SAM) is an FDA-approved medical device that provides long-duration continuous ultrasound, slowing OA progression and mitigating OA-associated pain. This study examined the six-month efficacy of SAM in treating pain and improving function of knee OA patients.

Methods: Forty-four non-diabetic patients with knee OA and chronic knee pain began treatment with SAM or placebo, 4 hours/day, 5 days/week for 6 weeks. Participants then crossed over to the alternate treatment arm. After 6 weeks, all participants continued with active SAM treatment for 12 weeks. Pain on the Numeric Rating Scale (NRS) and function on the Western Ontario McMaster (WOMAC) Osteoarthritis Questionnaire were measured at baseline, 6-week, 12-week, and 6-month timepoints.

Results: There were no differences in demographics between the two study groups, and no adverse events were reported. All 44 subjects completed the 12-week crossover, and 34 subjects completed 24 weeks of treatment. SAM-treated patients demonstrated a significant reduction in knee pain (NRS score) at 6 weeks (1.89 ± 1.47 vs. 0.59 ± 1.45 , $p < 0.0001$), 12 weeks (2.42 ± 1.60 vs. 0.86 ± 1.48 , $p < 0.0001$), and 24 weeks (2.51 ± 2.10 vs. 0.91 ± 1.55 , $p < 0.0001$). Similarly, WOMAC score improved in the SAM-treated group at 6 weeks (10.2 ± 16.4 vs. -6.1 ± 18.1 , $p < 0.0001$), 12 weeks (17.8 ± 9.4 vs. 1.5 ± 9.6 , $p < 0.0001$), and 24 weeks (17.1 ± 14.2 vs. -1.32 ± 16.6 , $p < 0.0001$).

Conclusions: SAM significantly reduced joint pain and improved joint function in patients with knee OA with no adverse events, making SAM a non-invasive, conservative treatment option for knee OA patients.

Title: Equine Polo-related Trauma Injuries: A comprehensive review of data from the National Electronic Injury Surveillance System

Authors: Dylan M. Bush¹, Maguire E. Anuszewski¹, Thomas G. Germano²

Institutions/Departments: ¹Division of Biology & Medicine, The Warren Alpert Medical School of Brown University ²Emergency Medicine, The Warren Alpert Medical School of Brown University

Background: Polo is an equine sport that involves horseback riding, physical contact, and wooden mallets, with significant injury potential. No research has examined the incidence or nature of polo-related injuries in the United States.

Methods: Researchers reviewed 20 years of National Electronic Injury Surveillance System (NEISS) data. Injuries were categorized based on narratives, and analyzed for demographics, diagnoses, and outcomes. Univariate analysis assessed differences in diagnosis, fracture incidence, and hospitalization between polo and other equine injuries.

Results: Among 27,645 equestrian injuries, 41 were polo-related. Most patients (61.0%, N=25) were male. The median age was 22 (range: 8-65). Mechanisms included impact (N=34), laceration (N=3), and crush (N=4). Mechanistically, the most concerning injuries involved a horse falling on top of its rider (N=2). Head (N=8, 19.5%), shoulder (N=6, 14.6%), and lower trunk (N=5, 12.2%) were the most frequently injured structures. Contusions (N=11, 26.8%) and fractures (N=10, 24.4%) were the most frequently reported diagnoses. Most patients (N=34, 82.9%) were discharged from the emergency department, although a minority required admission (N=3, 7.3%) or transfer (N=2, 4.9%). Univariate analysis revealed no significant differences in diagnoses between polo and non-polo equine injuries ($p = 0.1145$). Fracture ($p = 0.3514$) and hospitalization incidence ($p = 0.9381$) did not significantly differ either.

Conclusions: Provider failure to specifically mention “polo” likely leads to undercounting. Despite potential undercounting, findings show traumatic mechanisms and frequent head injury—highlighting the need for further research.

From Yeast Cells to ACLs: Investigating the Use of Recombinant Type I Collagen in Compensatory Synthetic Ligaments

Authors: Lead Author: Eniola Soetan; Faculty Advisors: Dr. Samantha Hettiarachchi, Professor Trevor Hann; Research Assistants: Samuel Stillings, Maxx Lee, Tia Madriga, Hudson Atkinson

Institutions/Departments: Dickinson State University School of Applied Sciences and Exercise Science Program

Background: Tears to the anterior cruciate ligament (ACL) are seemingly on the rise, with the current best way to address these injuries being through reconstruction surgery. However, the use of autografts to reconstruct the ACL introduces donor site morbidity, particularly in individuals who have experienced multiple ACL tears. This research contributes to bioengineered ligament and tissue graft development, potentially improving structural integrity and mechanical function in individuals with collagen-related genetic disorders, particularly in cases of ligament repair and reconstruction. These findings could also improve ligament reconstruction strategies broadly, even for individuals without genetic disorders, by eliminating the need for autograft harvesting, thereby reducing surgical morbidity and improving patient outcomes.

Methods: Collagen was synthesized using *Komagataella pastoris* induced with plasmids encoding normal and mutated collagen genes. The mutated genes used were mutations that coded for Type 1 Osteogenesis Imperfecta as well as Arthrochalasia Ehlers-Danlos syndrome. Synthesized collagen will undergo fibrillation and characterization via Fourier Transform Infrared Spectroscopy (FTIR). The remaining soluble collagen will be molded into mock Anterior Cruciate Ligament (ACL) grafts under different crosslinking agent and scaffolding treatments, followed by mechanical testing of tensile strength and elasticity

Results: Results are currently pending! Grafts are currently being put together before they are then freeze-dried and used for mechanical testing.

Conclusions: No formal conclusion yet as results are still pending. The hypothesis is that the grafts with mutated collagen will show significantly weaker mechanical properties than grafts with normal collagen. However, we also expect that crosslinker treatment will improve the mechanical strength of the grafts with mutated collagen, perhaps more significantly than it will for grafts with normal collagen.

Descriptive Bibliometric Analysis of the 100 Most-Cited Articles on Medial Tibial Stress Syndrome

Authors: Brian S. Tao, BA,¹ Mudassir Khan BS,² Hailey B. Hulse BS,² Kevin A. Hao, MD,³ Antonio; Cusano, MD,⁴ Robert L. Parisien, MD,⁵ Richard Ma, MD,⁶ Xinning Li, MD¹;

Background: Medial tibial stress syndrome (MTSS), commonly known as shin splints, is a frequent overuse injury characterized by pain along the posteromedial tibial border. Despite its prevalence among athletes, the research landscape surrounding MTSS has not been well defined. Understanding the most influential studies can help identify knowledge gaps and guide future clinical and research priorities.

Methods: A bibliometric analysis was conducted using Web of Science with search terms “shin splint*” OR “medial tibial stress syndrome.” Articles primarily focused on MTSS were included; studies addressing unrelated leg pathologies were excluded. The top 100 most-cited articles were identified and analyzed for publication year, citation count, level of evidence, study design, country of origin, author affiliation, and keyword networks. Descriptive analyses and keyword mapping were performed using Python 3.10.0.

Results: The top 100 MTSS articles accumulated 4,913 total citations (mean 49). Citation volume increased steadily from 1990 and peaked in 2017. One article exceeded 401 citations, while two others had more than 175 citations. Most publications appeared in a limited number of orthopaedic and sports medicine journals. The United States produced the largest share (n = 40), followed by the Netherlands (n = 13) and the United Kingdom (n = 8). Clinical studies dominated (n = 92), largely retrospective or observational, with Level 4 evidence being most common (n = 25). Higher levels of evidence did not correlate with increased citation counts. Keywords with the strongest centrality included MTSS, shin splints, tibia, running, overuse, diagnosis, and shoe inserts.

Conclusions: MTSS research has evolved from broad descriptive work to more refined studies addressing diagnosis, risk factors, and treatment. The most frequently cited article introduced an influential MRI-based grading system for tibial stress injuries. Increasing citation trends reflect rising clinical recognition and expanding research interest. Citation patterns were not significantly associated with level of evidence or journal prestige. These findings can guide future research priorities and support more evidence-based clinical decision-making in MTSS management.

Title: Comparison of Rapid Pistoning Versus In Situ Dry Needling of the Triceps Surae: A Critically Appraised Topic

Authors: Stanek, JM, Smith, J

Institution/Departments: Illinois State University, College of Applied Science and Technology, School of Kinesiology & Recreation

Background:

Dry needling (DN) is increasingly used by allied health professionals to treat myofascial trigger points (MTrPs), yet standardized dosing methods remain unclear. Two common DN techniques include rapid “pistoning” of the needle for short durations (15 sec–1 min) and maintaining needle insertion in situ for longer periods (8–30 min). To date, no studies have directly compared the efficacy of these two different methods. This critically appraised topic aimed to compare the effectiveness of these two DN techniques applied to the triceps surae on foot and ankle outcomes in the physically active population.

Methods:

A literature search was conducted in PubMed, Medline, the Cochrane Database, and Google Scholar for studies examining DN of the triceps surae using either the pistoning or in situ technique. Five studies met inclusion criteria.

Results:

Three studies investigated pistoning and two examined the in situ technique. Outcome measures included tissue perfusion, myotonometry, pain pressure threshold (PPT), muscle power, range of motion, plantar pressure, and the Foot Function Index. In 2 of the 3 pistoning studies, at least one outcome measure was positive for the dry needling group. In both in situ studies, at least one outcome measure was positive.

Conclusions:

Current evidence comparing DN techniques is limited, but both methods are generally supported for DN therapy. Further research is needed to clarify how dosing parameters influence outcomes.

Title: The Effect of Instrument Assisted Soft Tissue Mobilization on Knee Joint Stiffness

Authors: Wade LD*, Ricard MD*, Loghmani MT[£], Hwang CL*, Wolfram S[¥], Trowbridge CA*: The University of Texas at Arlington; [£] Indiana University – Indianapolis; [¥]Northumbria University

Introduction: Hamstring tightness is associated with knee joint stiffness. Instrument Assisted Soft Tissue Manipulation (IASTM) relieves tightness, but the amount of force application is usually subjective and unquantified.

Purpose: The purpose of this study was to investigate the short-term effect of individualized IASTM with two different force applications on knee joint stiffness and perceived hamstring muscle tightness.

Methods: We used a randomized controlled design (group x time). Volunteers included 24 healthy individuals (15 men, 9 women; age=22±4 years). Groups were control group, an individualized 5-minute high force (HF) IASTM (40-50% of dynamic pressure threshold (DPT)), or an individualized 5-minute low force (LF) IASTM (20-30% of DPT). Treatment occurred at medial hamstring muscles. Before and immediately after each treatment, knee joint stiffness was assessed by using a damped oscillation technique with a knee perturbation and subjective tissue tightness was assessed with a functional test using the global rating of change (GROC) scale.

Results: No significant differences were recorded but knee joint stiffness increased in control group by 1.5 Nm/rad, while it decreased by 1 Nm/rad in LF group and by 0.6 Nm/rad in HF group. Both LF and HF groups reported significantly improved GROC scores (p<0.05) for hamstring tightness with ratings around “a quite a bit better” whereas the control group reported tightness as “slightly worse or only a little bit better”.

Conclusions: This preliminary study demonstrates a trend that individualized IASTM reduced joint stiffness. Therefore, more research is encouraged to explore the benefits of using individualized IASTM to improve joint stiffness and muscle tightness.



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Title: Dry Needling for Rectus Femoris Injury in a 14-Year-Old American Football Player: A Case Study

Authors: W. Steven Tucker, PhD, LAT, ATC and Gary A. Kearns, PT, ScD

Institutions/Departments: Texas Tech University Health Sciences Center, Department of Rehabilitation Sciences

Background: Rectus femoris injuries are common in athletics, with severe cases requiring prolonged rehabilitation and prone to complications. This case study describes a young athlete with a rectus femoris injury that benefited from dry needling during the recovery process. A 14-year-old male football player felt a stretch in the anterior thigh during a kickoff at the end of practice. He reported the injury to the athletic trainer the next day. He presented with tenderness, swelling, 4/5 strength, and normal gait. MRI confirmed T2 hyperintensity surrounding the central tendon consistent with a rectus femoris strain.

Intervention: Patient was withheld from football activities, and initial treatment focused on conservative care. Open chain exercises began when pain subsided, progressing to closed chain exercises and running as tolerated. At week 8, he resumed sprinting and limited practice, returning to full participation at week 9, excluding kicking. At week 11, he experienced periodic pain and tightness with activities. A band of thickened muscle fibers was palpable at mid-thigh. Two dry needling sessions, one week apart, reduced the symptoms and allowed continued progression of activities.

Outcome: Patient competed in winter basketball and spring baseball without symptoms or limitations. At 12-months, he reported pre-injury kicking performance.

Conclusions: This case study highlights a significant rectus femoris injury in a young athlete. A structured rehabilitation program, including dry needling, reduced symptoms and supported full return to sports. Dry needling helped resolve myofascial tightness, aiding in long-term recovery and performance.

Title: The Association Between Sports-Related Concussion and Mental Health Outcomes in Athletes: A Systematic Review and Meta-Analysis

Authors: Hugo Zamarron, Roberto Fraga, Arjun Bellamkonda, Eduardo Aquino, Patrick De La Torre *University of Texas Rio Grande Valley School of Medicine, Edinburg, TX*

Background: Sports-related concussion (SRC) has gained recognition not only as a neurological injury but also as a potential precipitant of adverse mental-health outcomes. While numerous studies suggest links between concussion and depression, anxiety, and suicidality, quantitative synthesis across athlete populations remains limited.

Objective: To synthesize and quantify the association between SRC and mental-health outcomes among athletes through a systematic review and meta-analysis.

Methods: Following PRISMA 2020 guidelines, Pubmed and Scopus were systematically searched through October 2025 using pre-defined keywords for “concussion,” “athlete,” and “mental health.” The search identified 182 records, of which 15 met inclusion criteria after title, abstract, and full-text screening. Eligible studies included athletes with documented concussion histories compared with non-concussed peers and reported quantitative measures of depression, anxiety, or suicidality. Data were extracted for sample size, concussion ascertainment, outcome measures, and effect estimates. Random-effects meta-analysis were conducted to pool odds ratios (OR) or standardized mean differences (SMD). Study quality was evaluated using the Newcastle-Ottawa Scale.

Results: Fifteen studies ($\approx 85,000$ participants) were included. Pooled analysis showed that athletes with prior concussion had higher odds of depressive symptoms (pooled OR ≈ 1.8 , 95% CI 1.3-2.4) and suicidality (pooled OR ≈ 1.5 , 95% CI 1.1-2.1) compared with controls. Heterogeneity was moderate ($I^2 = 55\%$), largely explained by age and outcome variability.

Conclusions: Sports-related concussion are associated with elevated risks of depression and suicidality in athletes. Integrating mental-health screening into concussion management may improve long-term recovery and well-being.



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Kneeling Before the Data: A Bibliometric Analysis of Patellofemoral Pain Syndrome

Authors:

Brian S. Tao, BA,¹ Hailey B. Hulse BS,² Mudassir Khan BS,² Kevin A. Hao, MD,³ Antonio Cusano, MD,⁴ Robert L. Parisien, MD,⁵ Richard Ma, MD,⁶ Xinning Li, MD¹

Institutions/Departments:

1 Boston University School of Medicine, Boston, MA, USA; 2 University of Illinois College of Medicine-Rockford, IL, USA; 3 Department of Orthopaedic Surgery & Sports Medicine, University of Florida, Gainesville, FL, USA; 4 Department of Orthopaedic Surgery, University of Connecticut, Farmington, CT, USA; 5 Department of Orthopaedics, Icahn School of Medicine at Mount Sinai, New York, NY, USA 6 Department of Orthopaedic Surgery, University of Missouri School of Medicine, Columbia, MO, USA

Background:

Patellofemoral pain syndrome (PFPS), or “runner’s knee,” is the most common cause of anterior knee pain in adolescents and adults, with prevalence rates up to 22.7% in the general population and 28.9% in adolescents. Historically described for over a century, PFPS has evolved from a structural cartilage-based diagnosis to a multifactorial loading-related condition. Despite its clinical significance, the bibliometric landscape of PFPS research has not been well characterized. This study aimed to identify and analyze the top 100 most-cited PFPS articles in orthopaedic literature.

Methods:

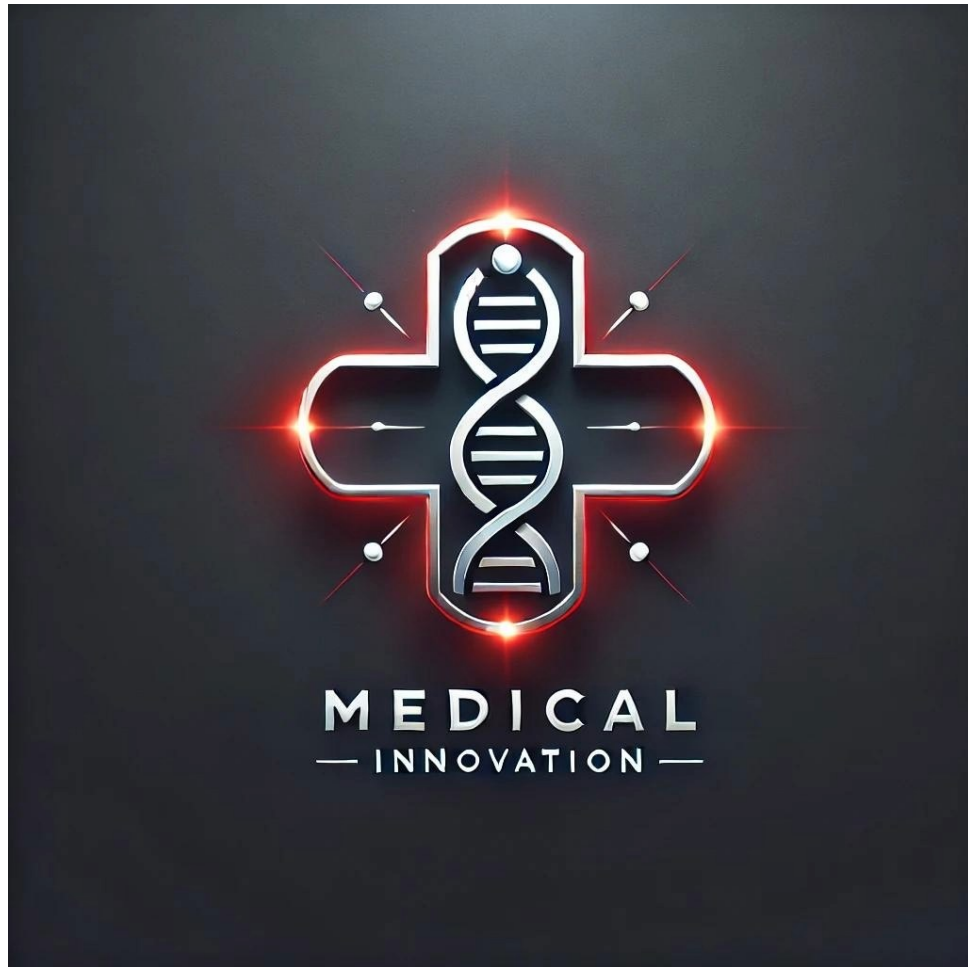
A Web of Science search was performed using the terms “PFPS” OR (“Patellofemoral” AND “Pain”). Articles focused primarily on PFPS were included; studies addressing chondromalacia patella, instability, tendinopathy, or patellofemoral osteoarthritis were excluded. The top 100 most-cited articles were evaluated for publication year, citation count, citations per year, study design, level of evidence, author productivity, journal impact, and keyword network relationships. Analyses were performed using Python 3.10.0.

Results:

The 100 most-cited PFPS articles received 25,286 total citations (mean 253). Citation frequency steadily increased starting in 1990, with a publication peak in 2002. Six articles were cited more than 500 times, and one introduced the commonly used Anterior Knee Pain Scale. One journal accounted for over 5,000 citations, and two authors each contributed 14 articles. The United States produced the largest proportion of studies (n=55). Most studies were level 3 evidence (n=33). Citation rates were not associated with journal impact factor after adjusting for design; however, lower-level evidence studies were cited more frequently. Keyword centrality emphasized themes related to patellofemoral pain, knee function, physical therapy, sports, patella, and clinical guidelines.

Conclusions:

PFPS research has expanded substantially, with over 25,000 citations across the top 100 influential publications. Foundational contributions—such as Kujala’s Anterior Knee Pain Scale, Powers’s kinematic framework, and Hamill’s dynamical variability model—have shaped modern assessment and rehabilitation strategies. Bibliometric trends highlight the influence of conceptual and measurement frameworks over specific interventions. This analysis provides an updated overview of PFPS research development and informs future directions in clinical and biomechanical investigation.



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Trends and Disparities in ACL Injury and Reconstruction from 2016 to 2024: An Analysis of the United States TriNetX Database

Chenyu Huang^{1,2,3} Jiahui Dai¹ Raymond Qiao⁴ William Tang² Luohua Jiang^{1*}

1. Department of Epidemiology and Biostatistics, Joe C. Wen School of Population & Public Health, University of California, Irvine, CA, USA 2. Department of Biomedical Engineering, University of California, Irvine, CA, USA 3. Department of Orthopedic Surgery, University of California, Irvine, CA, USA. 4. Sage Hill High School

Background: Anterior cruciate ligament (ACL) injuries represent a major source of morbidity in athletic and physically active populations. Contemporary patterns of ACL reconstruction timing and demographic disparities remain incompletely understood.

Methods: We analyzed ACL injuries and reconstructive surgeries from 2016–2024 using data from a large federated electronic health record network (TriNetX). ACL injuries and reconstructions of US patients were identified using ICD-10 (S83.51x) and CPT 29888. Surgery rates and time-to-reconstruction were calculated, and stratified comparisons were performed by age group, sex, and race/ethnicity.

Results: We identified 296,623 ACL injuries from 2016–2024, with an overall reconstruction surgery rate of 26.9%. Surgery rates rose from 2016–2019 (25–26%), dipped slightly in 2020 (24.9%), and increased again in 2021–2024 (28–29%). Reconstruction rates were highest among adolescents (36% in ages 10–17) and decreased progressively with age (21.2% in ages 45–54, 3.8% in ≥65). Race/ethnicity differences were substantial. Asian patients had the highest proportion of reconstruction (32.8%), while Non-Hispanic Black patients had the lowest (26.0%). Stratified analyses showed that non-Hispanic Black patients had consistently lower surgery rates in both age groups. Among younger patients (< 45 years old), surgery rates were 29.4% for Black individuals versus 35.7% for Asians; in the older group (45+ years old), 8.7% versus 21.7%, respectively.

Conclusion: ACL surgical care exhibits pronounced demographic differences, with non-Hispanic Black patients experiencing consistently lower rates of reconstruction. These inequities highlight the need for improved access, earlier referrals, and targeted initiatives to support all patients receiving timely and equitable ACL surgical care.

Title: Parasympathetic Dominance after Concussions: Heart Rate Suppression Across Injury Severity

Authors: Cole Freedman¹, Hugo Zamarron¹, Maximo Alvarez¹, Paul Kim¹, Erick Amie², Aaron Spicker³

Institutions/Departments: University of Texas at Rio Grande Valley School of Medicine; University of Houston; University of Texas at Austin

Background: Although concussions are known to affect autonomic regulation, few studies have quantitatively compared how heart rate (HR) and systolic blood pressure (SBP) respond across levels of concussion severity or consciousness. Prior research prioritized symptom recovery or cognitive outcomes rather than physiology. The mechanisms underlying altered autonomic balance remain poorly defined.

Methods: This poster examined how HR and SBP vary in concussion patients who went to an Emergency Room in 2021 based on loss of consciousness (LOC) status and injury severity, as defined by Abbreviated Injury Scale (AIS) codes, using data from the Emergency Medical Services and Trauma Registries. Concussion cases were stratified by LOC (yes/no) and AIS severity (1/2). Mean HR/SBP were compared between groups using two-tailed t-tests.

Results: Patients with LOC had higher SBP (~134 mmHg) and significantly lower HR (~88.5 bpm, $p \approx 0.0005$) than those without LOC (SBP ~130 mmHg, HR ~93 bpm). Similarly, AIS severity 2 patients demonstrated slightly elevated SBP (~134 mmHg) and lower HR (~88.5 bpm, $p \approx 0.01$) compared to AIS severity 1 patients (SBP ~130.5 mmHg, HR ~93 bpm).

Conclusions: Patients with LOC or more severe concussions exhibited HR suppression alongside stable or elevated SBP, reflecting enhanced vagal activation and parasympathetic predominance during autonomic disruption. HR was more sensitive than SBP to concussion-related autonomic effects ($p \approx 0.01$ vs 0.38 for LOC; $p \approx 0.0005$ vs 0.02 for severity), suggesting that HR may serve as a more direct reflection of autonomic activity.

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CME/CE INFORMATION

Activity Name: Big Sky Sports Medicine Conference

Date: January 11 – 15, 2026

Location: Big Sky, Montana

Activity Code: 95265

Target Audience: The conference is designed to provide education on the latest advancements in sports medicine, injury prevention, treatment techniques, and rehabilitation. It is designed for individuals looking to enhance their knowledge and skills in managing athletic injuries and optimizing performance in athletes.

Accreditation Statements:

Michigan State University College of Osteopathic Medicine is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians. MSUCOM designates this live activity for a maximum of *24.0 AMA PRA Category 1 Credit(s)*[™]. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

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