

# ler

15 YEAR  
ANNIVERSARY

LOWER EXTREMITY REVIEW

April 25 / volume 17 / number 4

## Firefighter Injuries in the US

- 10 MY TOE CAN'T GO: HELPING CHILDREN UNDERSTAND TYPE 2 DIABETES
- 19 DERM BIOPSIES PREVENT DIAGNOSTIC MISCUES
- 24 CAGA DIRTY TRUTH #2: THE PHYSICS OF FOOT MEETS FLOOR MEETS FORCE
- 36 STRENGTHEN HIP MUSCLES TO IMPROVE RUNNING KINEMATICS
- 44 HOW MUCH PROTEIN DO WE NEED?





# Available 24/7/365

lerMARKETPLACE.com is THE place to learn about the products you need now from the names you trust.



**\*48HR**

**ORTHOTIC LAB TURNAROUND**

**FIRE YOUR LAB – HIRE US**

---

**WE'RE NOT  
KIDDING**

---



**TRY US**

\*Our company average turnaround time.



## HERE'S WHAT YOU ARE GOING TO LOVE:

- ✓ 48 Hour Turnaround Time
- ✓ Outstanding Clinical Service
- ✓ High Quality, Custom Orthotics
- ✓ Dedicated & Experienced Territory Managers
- ✓ 45-Day Money Back Guarantee

**START TODAY**  
**Call 833-496-2340**

**Footmaxx®**

# Fall in Love With Your Orthotic Lab

Unrivaled custom orthotics are just the  
beginning at Orthotica Labs



**MAY WE TELL YOU MORE?**

888.895.1305

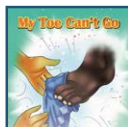
[orthotica.com/learn-more](http://orthotica.com/learn-more)

  
**ORTHOTICA**  
*Labs*

### EDITORIAL OBSERVATION

#### 10 MY TOE CAN'T GO: CHILDREN & EMPATHY SLOW AMPUTATION, POLYNEUROPATHY & T2DM

Born from the heartbreak and urgency of polyneuropathy and amputation, this children's book explores diabetes education from a whole new perspective.



By Laura Fonda Hochnadel

### AD INDEX

#### 39 GET CONTACT INFO FOR ALL OF OUR ADVERTISERS

### NEW & NOTEWORTHY

#### 40 PRODUCTS, ASSOCIATION NEWS & MARKET UPDATES

### THE LAST WORD

#### 44 HOW MUCH PROTEIN DO WE NEED?

*Designed by @YLMsportScience*

### LEREXPO CONVERSATIONS

#### 19 DIAGNOSTIC MISCUES IN PODIATRIC DERMATOLOGY

Earlier – not fewer – biopsies can reveal unexpected underlying conditions, including malignancies and autoimmune disorders.



By Leland Jaffe, DPM, FACFAS.CWSP

### SHORTTAKES FROM THE LITERATURE

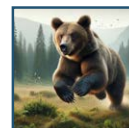
- 14 • Dynamic Stretching of Foot Intrinsic Muscles Improves Gait & More in Stroke
- Meta Analysis Shows Effectiveness of Exercise Therapy on CAI
- What To Do About “Too Much Sitting”
- qMRI Biomarkers for OA & Knee Replacement
- Hallux Valgus, Neuromuscular Control & Risk of Falls in Elderly
- Magnesium Plantar Plate Prototype for 1st TMT Joint Fusion
- Study Shows Orthopedic Insoles Can Change Kinematic, Kinetic, & iEMG of Gait
- Foot Massage Improved Volume & Composition of Breast Milk
- Weight-Loss Surgery Has Lasting Benefits in Teens
- Study Details 3 Years of Injuries in University Women's Soccer

### FEATURE ARTICLES

#### 24 CAGA 101: THE 12 DIRTY TRUTHS PLAYBOOK

#### DIRTY TRUTH #2: REALITIES OF CENTER OF PRESSURE IN DYNAMIC WORLD

When our feet collide with the floor with force, that surface returns with the ground reactive force.



By Jay Segel, DPM; Sally Crawford, MS

#### 28 FIREFIGHTER LOWER EXTREMITY INJURIES IN THE UNITED STATES

Firefighting is a difficult and dangerous job. This study characterizes lower extremity injuries among firefighters in the US.



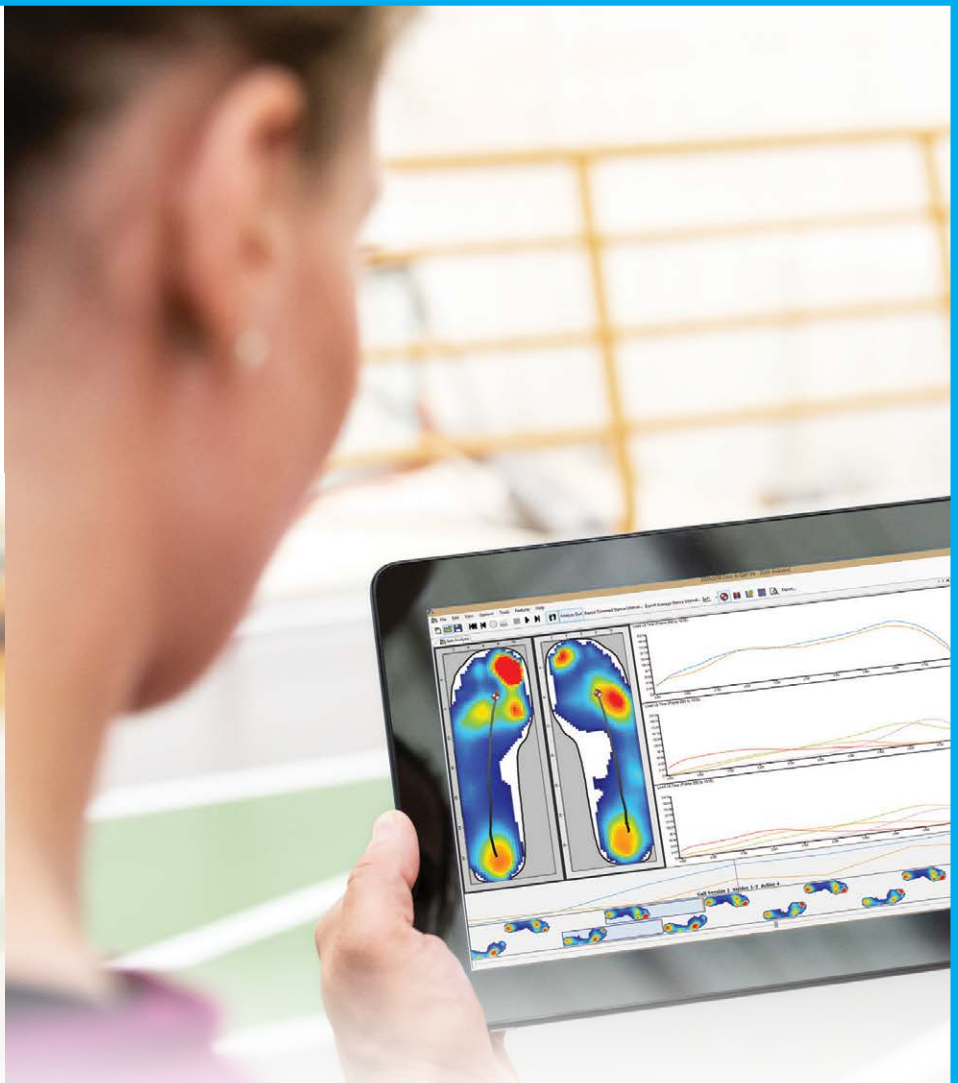
By Mathias B. Forrester, BS

#### 36 TARGETED HIP MUSCLE STRENGTHENING IMPROVES LOWER EXTREMITY KINEMATICS IN RUNNERS

This study looked at functional hip abductor strength training in runners with medial tibial stress syndrome.



By Shreen Ahmed Lashien, Ahmed Omar Abdelnaeem, and Ebtessam Fawzy Gomaa



## MAKE CONFIDENT DECISIONS WITH RELIABLE, HIGH-RESOLUTION LAB-QUALITY INSOLE PRESSURE DATA

For foot clinicians and physical therapists, XSENSOR®'s X4 Intelligent Insole System provides accurate foot function, gait analysis, and plantar pressure data for any patient evaluation scenario. With fast, compact, and discreet on-shoe wireless electronics paired with durable, thin, and flexible sensors, the X4 system offers assurance of quality data to better understand the impact of orthotic, surgical, or therapeutic interventions and pathology.

### EASY TO USE

Fast set-up and user-friendly software means you can capture and review plantar data in under 10 minutes

### UNPARALLELED IMAGERY

Highest quality, high-resolution dynamic pressure data and imagery

### ADVANCED FUNCTIONALITY

Complete analysis for clinical and research testing with XSENSOR's Foot & Gait VU software

### LAB-QUALITY DATA

High-speed sampling allows for collection of anatomically accurate in-shoe data from 230 sensing points per foot

### WIRELESS & UNDETECTABLE

Ultra-thin sensors conform to the footbed and compact on-shoe electronics are virtually undetectable to the wearer

### ROBUST SENSORS & ELECTRONICS

Easy-to-use sensors are ready out of the box and support trouble-free testing

**CONTACT US TODAY** TO LEARN MORE

[www.xsensor.com](http://www.xsensor.com) | [sales@xsensor.com](mailto:sales@xsensor.com)

# XSENSOR

Intelligent Dynamic Sensing



**Richard Dubin**

**Publisher and Chief Executive Officer**

rich@lermagazine.com | 518.221.4042

## STAFF

### Editor

Janice T. Radak | janice@lermagazine.com

### Associate Editor

Laura Fonda Hochnadel | laura@lermagazine.com

### Marketing Manager

Glenn Castle | glenn@lermagazine.com

### Graphic Design/Production and Website Development

Anthony Palmeri | PopStart Web Dev  
webmaster@lermagazine.com

## Lower Extremity Review

Lower Extremity Review informs healthcare practitioners on current developments in the diagnosis, treatment, and prevention of lower extremity injuries. LER encourages a collaborative multidisciplinary clinical approach with an emphasis on functional outcomes and evidence-based medicine. LER is published monthly, except for a combined November/December issue and an additional special issue in December, by Lower Extremity Review, LLC.

Subscriptions may be obtained for \$38 domestic and \$72 international by writing to: LER, PO Box 390418, Minneapolis, MN, 55439-0418. Copyright ©2025 Lower Extremity Review, LLC. All rights reserved. The publication may not be reproduced in any fashion, including electronically, in part or whole, without written consent. LER is a registered trademark of Lower Extremity Review, LLC. POSTMASTER: Please send address changes to LER, PO Box 390418, Minneapolis, MN, 55439-0418.

### LOWER EXTREMITY REVIEW

41 State St. • Suite 604-16 • Albany, NY 12207  
518.452.6898

## Lower Extremity Review Mission

*Showcasing evidence and expertise across multiple medical disciplines to build, preserve, and restore function of the lower extremity from pediatrics to geriatrics.*

### EDITORIAL PILLARS

- Biomechanics matter
- Injury prevention is possible
- Collaborative care leads to better outcomes
- Movement is essential
- Diabetic foot ulcers can be prevented

## EDITORIAL ADVISORY BOARD

### David G. Armstrong, DPM, MD, PhD

Professor of Surgery and Director, Southwestern Academic Limb Salvage Alliance (SALSA), Keck School of Medicine of the University of Southern California, Los Angeles, California

### Windy Cole, DPM

Medical Director, Wound Care Center, University Hospitals Ahuja Medical Center

Adjunct Professor/Director Wound Care Research

Kent State University College of Podiatric Medicine  
Cleveland, Ohio

### Robert Conenello, DPM

Orangetown Podiatry  
Clinical Director, NJ Special Olympics  
NYPD Honorary Surgeon  
Greater New York City Area, New York

### Sarah Curran, PhD, FCPodMed

Professor, Podiatric Medicine & Rehabilitation  
Cardiff Metropolitan University  
Cardiff, United Kingdom

### Paul DeVita, PhD

Director, Biomechanics Laboratory  
Leroy T. Walker Distinguished Professor of Kinesiology  
East Carolina University  
Greenville, North Carolina

### Stefania Fatone, PhD, BPO

Professor and Association Chair  
Department of Rehabilitation Medicine  
University of Washington  
Seattle, Washington

### Geza Kogler, PhD, CO

Program Director  
MS Prosthetics and Orthotics  
Kennesaw State University, Clinical Biomechanics Laboratory  
Kennesaw, Georgia

### Robert S. Lin, MED,CPO,FAAOP

Managing Partner Biometrics INC.  
Hartford, Connecticut

### Bijan Najafi, PhD

Professor of Surgery  
Director, interdisciplinary Consortium on Advanced Motion Performance (iCAMP)  
Director, Clinical Research in Vascular Surgery  
Baylor College of Medicine  
Houston, Texas

### Antonio Robustelli, MSc, SCS

Sports Performance Consultant  
Applied Sport Scientist/Technologist  
Strength & Conditioning Specialist  
Salerno, Italy

### Jarrod Shapiro, DPM

Vice Chair, Department of Podiatric Medicine, Surgery & Biomechanics  
Associate Professor of Podiatric Medicine, Surgery & Biomechanics  
Western University of Health Sciences  
Liaison, American College of Podiatric Medicine  
Pomona, California

### Philip Stotter, CEP

Visionary at Stotter Technologies  
Director of Sports Science  
V1 Sports  
Cleveland, Ohio

### Bruce E. Williams, DPM

Medical Director  
Go4-D  
Chicago, Illinois

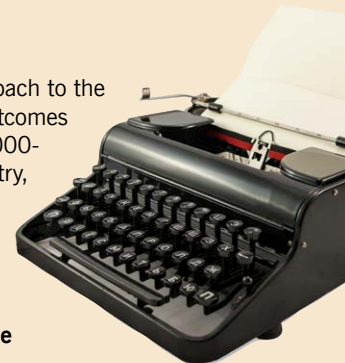
## INFORMATION FOR AUTHORS

LER encourages a collaborative multidisciplinary clinical approach to the care of the lower extremity with an emphasis on functional outcomes using evidence-based medicine. We welcome manuscripts (1000-2000 words) that cross the clinical spectrum, including podiatry, orthopedics and sports medicine, physical medicine and rehabilitation, biomechanics, obesity, wound management, physical and occupational therapy, athletic training, orthotics and prosthetics, and pedorthics.

See detailed Author Guidelines at [lermagazine.com](http://lermagazine.com) – click the Editorial tab on the homepage.

### ELECTRONIC SUBMISSIONS

Please attach manuscript as an MS Word file or plain text. Tables may be included in the main document, but figures should be submitted as separate jpg attachments. Send to: [janice@lermagazine.com](mailto:janice@lermagazine.com)



# Editorial **Observation:** Book Review

## *My Toe Can't Go*: Children & Empathy Slow Amputation, Polyneuropathy & T2DM

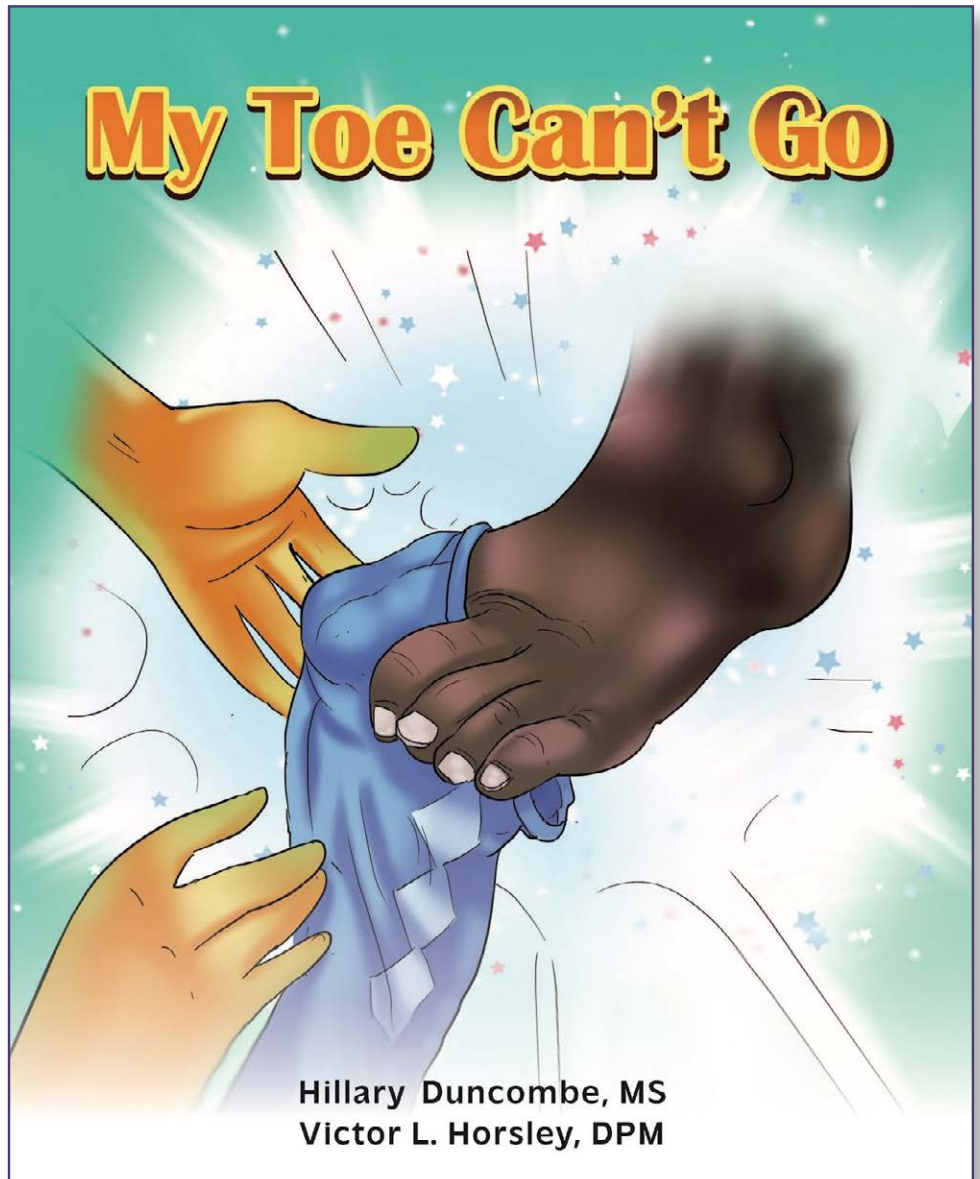
BY LAURA FONDA HOCHNADEL

*My Toe Can't Go* was born from heartbreak and urgency, said children's author Hillary Duncombe, MS. "Watching my sister suffer the devastating effects of type 2 diabetes mellitus (T2DM) and polyneuropathy—leading to a series of amputations—was unbearable." Within a month, her sister lost her toes, midfoot, and finally her leg before succumbing to the disease. Before she died, her young daughter would tearfully ask, "Why is this happening to my mummy?"

Internationally, every 20 seconds a limb is lost due to T2DM complications. For many families, diabetes isn't just a medical condition—it's a devastating reality. Duncombe knew no child should endure such pain. "I couldn't stand the thought of other families experiencing the same trauma," she said. Through sleepless nights of prayer, frantic writing, and tears, *My Toe Can't Go* emerged.

Designed for children age 7–12, a pivotal time for developing lifelong health habits, the book turns familiar, vibrant fruits and vegetables into characters that inspire. "It hit me like a lightning bolt—the same foods that meant life and health in my childhood could now teach a new generation," said Duncombe. "Growing up in The Bahamas, freshly grown fruits and vegetables weren't just food—they were culture, laughter, and a form of love, always present at our table, complementing every meal with freshness and vitality."

She wanted these staples of health to become lasting representations for children and families—a reminder that everyday food choices shape our well-being. By weaving these characters into a story with engaging activities and recipes, *My Toe Can't Go* becomes a powerful tool for families to embrace healthier habits together. "The STEM [science, technology, engineering, and mathematics]-compliant approach



ensures this resource integrates seamlessly into classrooms and daily life, sparking meaningful conversations and actions that lead to real change," said Duncombe.

The story follows GrammyBurger, a warm yet cautionary figure whose swollen, shiny red toe feels no pain—a classic symptom of polyneuropathy. Duncombe explains, "Her

story helps young readers grasp the reality of polyneuropathy and amputation in a way that is eye-opening but not fearful or overwhelming," she continued. "By focusing on an adult, the narrative highlights what's at stake while empowering children to take preventive action for themselves and their families. Children are natural change agents. When they understand

why health matters, they spark conversations that lead to better choices.” *My Toe Can’t Go* plants the seeds of early awareness, equipping the next generation with the knowledge and tools to take control of their health.

Duncombe co-authored *My Toe Can’t Go* with Victor L. Horsley, DPM, whose mission is to cut amputation rates by 50% in 5 years. “We met at a health conference where he spoke about polyneuropathy and its link to type 2 diabetes–related amputations—it struck a deep chord with me,” she recalled. “It felt like an answer to my prayers. Our shared passion for prevention made collaboration inevitable.” Horsley ensured the book’s medical content wasn’t just static facts but a dynamic, engaging resource, making complex health information accessible and actionable for children.

Together, Duncombe and Horsley created more than just a book—they built a lifesaving resource that is both medically sound and accessible, giving families and educators the tools to make a real impact. Duncombe envisions *My Toe Can’t Go* as a cornerstone in classrooms,

## Grammyburger’s story helps young readers grasp the reality of polyneuropathy and amputation in a way that is eye-opening but not fearful or overwhelming

equipping children with STEM-aligned, life-saving knowledge about T2DM and polyneuropathy. But its impact doesn’t stop there. She sees it as a vital resource for families and communities, fostering meaningful conversations and inspiring real, lasting change. Beyond schools and homes, she is committed to integrating *My Toe Can’t Go* into healthcare organizations across the U.S. and the Caribbean, ensuring amputation prevention becomes a fundamental standard in health education. “This isn’t just about awareness,” she says. “It’s about action—giving the next generation the knowledge to rewrite

their health story before it’s too late.”

According to Duncombe, Caribbean LEAP (Lower Extremity Amputation Prevention) is at the heart of *My Toe Can’t Go*, aligning with its mission to combat polyneuropathy and reduce amputations caused by T2DM. By featuring Caribbean LEAP on the back cover, Duncombe and Horsley emphasize their commitment to spreading awareness and driving real change. “Ninety percent of donations go directly to supporting educational systems, libraries, and community centers, while the remaining 10% covers essential administrative and fundraising costs as its vision continues to empower communities,” Duncombe explained. As a dynamic and evolving initiative, Caribbean LEAP is expanding its reach, updating its website to provide critical information and further engage communities. [ler](#)

For information on how to purchase the book, visit [CaribbeanLEAP](#).

*Laura Fonda Hochadel is Associate Editor at Lower Extremity Review.*

**W**  
**THE WESTERN**  
Foot and Ankle Conference

JUNE 19–22, 2025  
**REGISTER NOW** →

**REGISTRATION NOW OPEN!**



## DYNAMIC STRETCHING OF FOOT INTRINSIC MUSCLES IMPROVES GAIT & MORE IN STROKE

**Table 4**  
Changes in the DGI in each group (n = 20).

Parameters	Lunge exercise (n = 10)		Foot intrinsic muscle dynamic stretching (n = 10)		Between groups P value
	Pretest	Posttest	Pretest	Posttest	
DGI (point)	15.1 ± 3.9	18.9 ± 3.8*	17.7 ± 3.1	25.3 ± 2.4*	.001**


DGI = dynamic gait index; values are expressed as mean ± standard deviation.  
\*P < .05 indicate a significant difference between pre- and posttreatments within the group.  
\*\*P < .05 indicate a significant difference between the experimental group.

\*The DGI includes 8 specific gait tasks: gait level surface, change in gait speed, gait with horizontal head turns, gait with vertical head turns, gait and pivot turn, step-over obstacles, step-around obstacles, and stairs. These tasks are relevant to both community- and home-based ambulations. Performance levels were categorized into 3 grades using a 4-point scale (normal, 3 points; minor impairment, 2 points; moderate impairment, 1 point; and severe impairment, 0 points) as an assessment tool. The DGI has shown a reliability and validity of 0.96 in research involving older individuals.

A study from Korea has demonstrated that foot intrinsic muscle dynamic stretching training improved dynamic balance, velocity, step lengths, stride length, and dynamic gait index (DGI) in patients with chronic stroke.

The study objective was to compare the effects of a 4-week program of foot intrinsic muscle dynamic stretching with those of lunge exercise on static balance, dynamic balance, gait parameters (velocity, cadence, step length, and stride length), and the dynamic gait index (DGI\*) in chronic stroke patients.

Participants were randomized into either the foot intrinsic muscle dynamic stretching (n = 10) or standard lunge exercise (n = 10) groups. Both groups performed 3 sets of lunge exercises 5 times per week for 4 weeks. Each set comprised 10 repetitions. Static and dynamic balance, gait parameters, and the DGI were measured after 4 weeks of training.

After 4 weeks of training, the foot intrinsic muscle dynamic stretching group showed significant improvement in all outcome measures compared with the baseline ( $P < .05$ ). Furthermore, timed up and go, velocity, step length, stride length, and DGI showed greater improvement in the foot intrinsic muscle dynamic stretching group than in the standard lunge exercise group ( $P < .05$ ). 


**Source:** Kwag Y, Park D. Effects of foot intrinsic muscle dynamic stretching on balance, gait parameters, and dynamic gait index in patients with chronic stroke: A randomized controlled study (CONSORT). *Medicine*. 2025;104(8):p e41507. DOI: 10.1097/MD.0000000000041507.

## META ANALYSIS SHOWS EFFECTIVENESS OF EXERCISE THERAPY ON CAI

Lateral ankle sprains are one of the most common musculoskeletal injuries. Up to 70% of individuals who sustain lateral ankle sprains develop chronic ankle instability (CAI). Exercise therapy is considered an effective treatment for patients with CAI.

This meta-analysis investigated the efficacy of exercise therapy in CAI patients by reviewing 15 randomized controlled trials (RCTs) involving 586 participants. Databases including PubMed, EMBASE, Cochrane Library, and Web of Science were searched from inception to September 13, 2024. The Cochrane Risk of Bias Tool was used to assess study quality. Meta-analysis, sensitivity analysis, and publication bias analysis were conducted using RevMan 5.3.0 and Stata 18.0 software. The Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) approach was applied to evaluate the quality of evidence. Main outcomes were assessed using the Foot and Ankle Ability Measure (FAAM) and the Star Excursion Balance Test (SEBT).


The results demonstrated that exercise therapy significantly improved FAAM-S (MD = 7.98, CI: 4.11 to 11.86,  $P < 0.0001$ ,  $I^2 = 30%$ ). Long-term exercise therapy (over 4 weeks) significantly enhanced FAAM-A (MD = 10.95, CI: 6.60 to 15.29,  $P < 0.00001$ ,  $I^2 = 0%$ ) and dynamic balance ability of ankle joint (SEBT-anterior: MD = 4.83, CI: 1.04 to 8.63,  $P = 0.01$ ,  $I^2 = 62%$ ; SEBT-posteromedial: MD = 6.93, CI: 2.37 to 11.48,  $P = 0.003$ ,  $I^2 = 69%$ ; and SEBT-posterolateral: MD = 8.98, CI: 2.66 to 15.29,  $P = 0.005$ ,  $I^2 = 86%$ ). After categorizing by exercise type, the results indicated that strength training was more effective in improving SEBT-PL (MD = 8.15, CI: 6.09 to 10.21,  $P < 0.00001$ ,  $I^2 = 0%$ ), joint mobilization was more effective in improving SEBT-A (MD = 7.65, CI: 4.93 to 10.37,  $P < 0.00001$ ,  $I^2 = 0%$ ), and proprioceptive training was more effective in improving SEBT-PM (MD = 10.46, CI: 5.27 to 15.65,  $P < 0.0001$ ,  $I^2 = 33%$ ).

In conclusion, long-term, multifaceted exercise therapy demonstrates superior rehabilitation efficacy for patients with CAI. Personalized treatment plans, informed by SEBT assessment results, should prioritize targeted interventions such as joint mobilization, strength training, or proprioceptive training. This approach holds significant theoretical and practical value for optimizing CAI treatment strategies and enhancing patient outcomes. 

**Source:** Zhang C, Luo Z, Wu D, Fei J, Xie T, Su M. Effectiveness of exercise therapy on chronic ankle instability: a meta-analysis. *Sci Rep*. 2025 Apr 5;15(1):11709. doi: 10.1038/s41598-025-95896-w. Use is per CC BY.

## WHAT TO DO ABOUT “TOO MUCH SITTING”

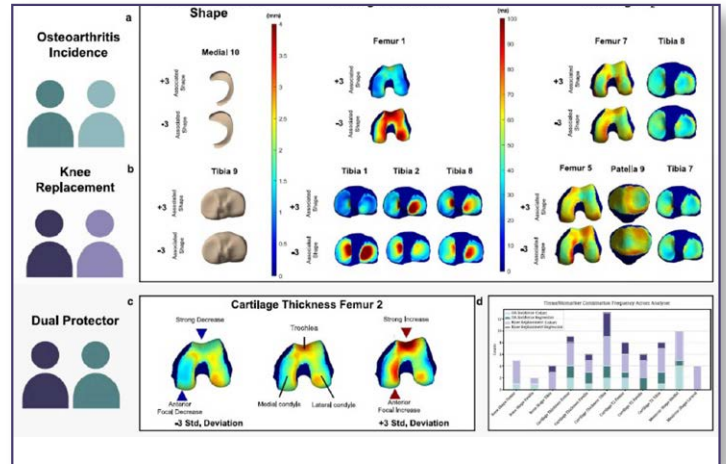


“...In one analysis of sedentary behavior, participants were found to spend 14 hours sitting each day. In the NHANES nationally representative survey, the self-reported number of hours spent sedentary in 2007-2008 was 5.7, and this increased to 6.4 hours per day for 2015 – 2016 (Du et al 2019). Using accelerometry-derived data, U.S. adults spend 8.2 hours per day engaging in sedentary behavior, and adults in Europe sit 8.8 hours per day... Sitting for prolonged periods has been related to metabolic declines in health, and reducing sitting time has been included in the most recent [USDHHS] recommendations for physical activity. The idea is to reduce the amount of sitting each day and replace it with light physical activity, including standing. Standing should not be considered a sedentary activity and should be promoted throughout the day, by standing at coffee breaks, during phone calls, while emailing, and during work breaks, and by adding physical workstations to the workplace.” 


*Excerpted from Lohman TG, Milliken. The Science of Long-Term Weight Loss. Human Kinetics: Copyright ©2025.*

## QMRI BIOMARKERS FOR OA & KNEE REPLACEMENT

This study forms the basis of a digital twin system of the knee joint, using advanced quantitative MRI (qMRI) and machine learning to advance precision health in osteoarthritis (OA) management and knee replacement (KR) prediction. The study authors combined deep learning–based segmentation of knee joint structures with dimensionality reduction to create an embedded feature space of imaging biomarkers. Through cross-sectional cohort analysis and statistical modeling, specific biomarkers were identified, including variations in cartilage thickness and medial meniscus shape, that are significantly associated with OA incidence and KR outcomes. Integrating these findings into a comprehensive framework represents a considerable step toward personalized knee-joint digital



**Figure. Core biomarkers identified across analytical approaches for OA incidence and knee replacement outcomes in digital twin development.** This figure integrates findings from cohort matching and multivariate regression analyses, identifying imaging biomarkers consistently associated with OA incidence and knee replacement outcomes, which serve as foundational components for building a knee joint digital twin system. **a** OA Incidence Biomarkers: Emphasizes biomarkers significantly associated with the incidence of osteoarthritis, identified through Clinical Cohort Matching and Multivariate Regression Analyses. Emphasizes specific anatomical and molecular changes linked to the early detection and progression of OA. **b** Knee Replacement Biomarkers: Presents biomarkers that distinguish between Control subjects and those who underwent knee replacement surgery. These bio-markers were identified as the most impactful for predicting surgical outcomes through cohort matching and regression. **c** Dual Protective Biomarker: Features a biomarker that consistently demonstrates protective effects against both the onset of OA and the need for knee replacement. Based on cohort comparisons and multi-variate models, the findings suggest potential therapeutic intervention targets. **d** Biomarker Selection Overview: Synthesizes the tissue-biomarker combinations identified as significant across analyses for both OA incidence and knee replacement. The repeated recognition of these biomarkers across analyses accentuates their influence on knee health outcomes and posits their utility for further investigation.

twins, which could enhance therapeutic strategies and inform clinical decision-making in rheumatological care. This versatile and reliable infrastructure has the potential to be extended to broader clinical applications in precision health. 


*Source: Hoyer G, Gao KT, Gassert FG, et al. Foundations of a knee joint digital twin from qMRI biomarkers for osteoarthritis and knee replacement. NPJ Digit Med. 2025 Feb 21;8(1):118. doi: 10.1038/s41746-025-01507-3. Use is per CC BY 4.0.*

## HALLUX VALGUS, NEUROMUSCULAR CONTROL & RISK OF FALLS IN ELDERLY

A new study from China looked at changes in neuromuscular control in elderly adults with hallux valgus to better understand the increased risk of falls in this population. The researchers assessed gait using non-nega-

*Continued on page 14*

tive matrix factorization (NNMF) for electromyography (EMG) and joint motion to compare muscle and kinematic synergies across 3 groups: young controls (YC), elderly controls (EC), and elderly hallux valgus (HVE). They found that the EC group demonstrated the additional activation of calf muscle groups accompanied by decreased ankle motion and increased hip abduction. Compared to the EC group, the HVE group required more thigh flexor muscle groups to compensate for the lack of function of the ankle movements during gait and showed decreased hip abduction but increased knee flexion. During gait, the center of plantar pressure in the HVE group were significantly larger than YC and EC groups ( $P < 0.05$ ).

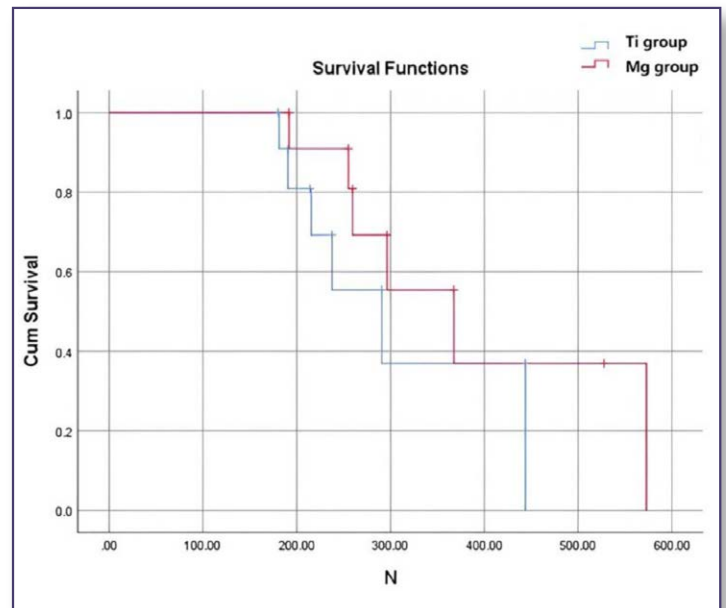
They concluded that elderly individuals with hallux valgus exhibit under-activated calf muscles around foot joints, and despite compensations from thigh muscles, they maintain an imbalance and increased risk of falls. Such information should help clinicians to evaluate HVE control strategies and provide personalized treatment based on these vulnerabilities to reduce the risk of falls. 



**Source:** Liu Y, Chen J, Liu R, et al. High risk of falling in elderly with hallux valgus evaluated by muscle and kinematic synergistic analysis. *Gait Posture*. 2025;118:33-38. doi: 10.1016/j.gaitpost.2025.01.025.

## MAGNESIUM PLANTAR PLATE PROTOTYPE FOR 1ST TMT JOINT FUSION\*

Titanium plantar plates have proven successful in the fixation of the first tarsometatarsal arthrodesis (TMT). However, a second surgery is typically needed for implant removal, and potential adverse effects, carried by the conventional implantations, are not uncommon. The purpose of this study was to determine whether a novel magnesium-based plantar plate system provides similar fusion stability to a titanium-based plantar




**Figure:** Survival analysis (Kaplan-Meier curves) of the Ti and Mg groups related to the applied force due to failure in Newton (N)

plate system under various loading conditions.

Six matched-pair human cadaveric specimens underwent TMT fusions using either a magnesium plantar plate system prototype or a titanium plantar plate system. Specimens were cyclically loaded with a force ranging from 5 N to 50 N for 5,000 cycles, and displacement was recorded. Axial stiffness (N/mm) was calculated from load-displacement curves. Each specimen was loaded to failure at a rate of 5 mm/min, and the ultimate load was recorded.

No significant difference was found in the vertical displacement between Ti group and Mg group after 100 cycles ( $2.4 \pm 1.0$  mm vs.  $1.3 \pm 1.4$  mm,  $P = 0.196$ ), 500 cycles ( $3.3 \pm 1.3$  mm vs.  $1.7 \pm 1.7$  mm,  $P = 0.142$ ), 1,000 cycles ( $3.7 \pm 1.5$  mm vs.  $1.9 \pm 1.9$  mm,  $P = 0.128$ ), 2,500 cycles ( $4.2 \pm 1.7$  mm vs.  $2.3 \pm 2.2$  mm,  $P = 0.172$ ) and 5,000 cycles ( $4.5 \pm 1.8$  mm vs.  $2.3 \pm 3.3$  mm,  $P = 0.125$ ). Additionally, no significant differences were observed in initial stiffness ( $53.1 \pm 19.2$  N/mm vs.  $82.2 \pm 53.9$  N/mm,  $P = 0.257$ ), final stiffness ( $90.6 \pm 48.9$  N/mm vs.  $120.0 \pm 48.3$  N/mm,  $P = 0.319$ ), or maximum load-to-failure ( $259.8 \pm 98.2$  N vs.  $323.9 \pm 134.9$  N,  $P = 0.369$ ; Figure).

Based on the performed biomechanical testing, the magnesium plantar plate system provides mechanical stability equivalent to the titanium plantar plate system in fixation for the first TMT joint fusion. 

**Source:** Zhou P, Ribeiro M, Greven J, et al. \*Biomechanical analysis of a magnesium plantar plate prototype system for the first tarsometatarsal joint fusion: a cadaveric study. *J Orthop Surg Res*. 2024 Nov 28;19(1):802. doi: 10.1186/s13018-024-05208-7.


**\*Editor's Note:** 2 of the 9 authors disclosed they are paid employees from Medical Magnesium GmbH, manufacturer of the magnesium device.

## STUDY SHOWS ORTHOPEDIC INSOLES CAN CHANGE KINEMATIC, KINETIC, & IEMG OF GAIT

An international team of researchers compared lower limb mechanics and muscle activation during walking at self-selected speed under 3 randomized conditions: 5° medial rearfoot posting, 5° medial rearfoot and forefoot posting, and a control flat insole.

A cross-sectional, repeated measures study was conducted on 16 subjects without major anatomical disorders, evaluating the kinematics, kinetics, and muscle activation from the lower limb and pelvis under 3 experimental conditions. Repeated Measures ANOVAs were performed to compare conditions.

The medially posted conditions increased the knee adduction impulse ( $P = 0.006$ ). Significant reductions in muscle activity were noted for the abductor hallucis ( $P < 0.001$ ) electroneuromyography (iEMG) for both sets of medial posted foot orthoses.

Both foot orthoses compared to control insole reduced foot pronation and hip internal rotation, increased the knee adduction impulse, and reduced the muscle activity of the abductor hallucis during the stance phase of walking. 

*Source: Trede R, Selfe J, Budini K, Melo P, et al. Foot orthosis with pos-*

*terior-medial posting alone produces similar effects than anterior-medial plus posterior-medial postings on the lower limb mechanics and muscle activation during normal walking. J Bodywork Move Ther. 2025;42:862-867. Use is per CC BY.*

## FOOT MASSAGE IMPROVED VOLUME & COMPOSITION OF BREAST MILK

One of the important problems for mothers after the birth of a premature infant is a decrease in milk production. This study aimed to investigate the effect of foot reflexology on the volume and composition of breast milk in mothers of premature infants hospitalized in the neonatal intensive care unit.

This randomized clinical trial was conducted on 76 primiparous mothers whose premature infants up to 34 weeks were hospitalized in the neonatal intensive care unit of Ayatollah Rouhani Hospital from February 2023 to November 2023. Mothers in the intervention group received foot reflexology for 20 min on both feet (10 minutes per foot) every morning for 7 consecutive days. On the first and seventh days of the study, both groups were compared in terms of milk volume (ml), triglycerides, cholesterol, albumin, total protein, and calcium (mg/dl).



**lerEXPO**  
ONLINE HEALTHCARE CONFERENCE

CONTINUING EDUCATION  
*On Your Terms  
On Your Time*

**lerEXPO.com**



The mean difference in breast milk characteristics before and after the intervention in the control and intervention groups were as follows: in terms of breast milk volume 12.43 ml and 23.51 ml, triglyceride 418.37 and 406.21, cholesterol 5.48 and 3.67, albumin 1.02 and 0.35, total protein 1.89 and 4.59, calcium was -3.54 and -1.83 mg/dL; the net difference in breast milk volume in the intervention group compared to the control group increased, which was not statistically significant but was significant in terms of value. No significant difference was observed in other components of breast milk.

While not statistically significant, the results of this single-center study showed a trend toward increasing the volume of breast milk, total protein and calcium and thus warrants further investigation. <sup>ler</sup>

**Source:** Nodehi FN, Aziznejadroshan P, Nikbakht HA, Haqshanas M, Halakhor S. *The effect of foot reflexology on the volume and composition of breast milk in mothers of premature infants hospitalized in the neonatal intensive care unit: a randomized controlled trial. BMC Pediatr.* 2024;24(1):799. doi: 10.1186/s12887-024-05270-4. Use is per CC BY.

## WEIGHT-LOSS SURGERY HAS LASTING BENEFITS IN TEENS

About 1 in 5 adolescents in the U.S. has obesity. Lifestyle changes, such as physical activity and dietary changes, are often the first choice for treating childhood obesity. If that doesn't work, medications or weight-loss surgery, also called metabolic and bariatric surgery, may also be considered. But the long-term effects of weight-loss surgery on adolescents are not well known.

To learn more, a multicenter research group launched an NIH-supported clinical study in 2007. It aims to assess the safety and effectiveness of weight-loss surgery among teens who have severe obesity. Severe obesity is defined in teens as having a BMI of 35 or more.

The study enrolled 260 teens (average age, 17) who had bariatric surgery. They received either gastric bypass (161 participants) or sleeve gastrectomy (99 participants). Health-related data were collected within

30 days before each operation and then at various intervals until about 10 years after surgery.

Overall, the researchers found that participants' BMI declined significantly within the first year after surgery and remained low a decade later. Results were similar regardless of the type of surgery. After 10 years, participants had an average 20% reduction in BMI. Those who had greater early weight loss, within 6 months after surgery, tended to have a more beneficial long-term decline in BMI after 10 years.

In addition, many pre-existing conditions at the start of the study were no longer present a decade later. For instance, 57% of those who had hypertension before surgery no longer did after 10 years. Likewise, 54% of those with abnormal cholesterol (dyslipidemia) and 55% of those with type 2 diabetes didn't have those conditions 10 years later.

The researchers note that the 55% reduction in type 2 diabetes was much better than the rates seen in adults after weight-loss surgery in a separate NIH-supported study. That study found that only 18% of adults remained diabetes-free 7 years after weight-loss surgery and only 13% were without diabetes 12 years after surgery.

The authors note that this study validates bariatric surgery as a safe and effective long-term obesity management strategy. <sup>ler</sup>


**Source:** Ryder JR, Jenkins TM, Xie C, et al. *Ten-year outcomes after bariatric surgery in adolescents. N Engl J Med.* 2024;391(17):1656-1658. doi: 10.1056/NEJMc2404054. NIH Research Matters Nov. 19, 2024.



## STUDY DETAILS 3-YEARS OF INJURIES IN UNIVERSITY WOMEN'S SOCCER

Sport Sciences researchers from Waseda University in Japan sought to understand injuries in female university soccer players. Their prospective study investigating injuries in this population over 3 seasons was recently published in the *International Journal of Sports Physical Therapy*. They found the overall injury rate was 1.62/1000 athlete exposures and the game injury rate (9.86/1000 athlete exposures) – much higher than

the practice injury rate (1.39/1000 athlete exposures). Sprains were the most common injury in games and practices; concussions and meniscal tears were also common during games. The lower limbs, particularly the ankles and feet, were the most common anatomical injury sites in both games and practices. Severe injuries requiring long-term withdrawal were frequently observed during games and practices. These included anterior cruciate ligament (ACL) tears, meniscal injuries, and severe

concussions, all of which necessitated prolonged recovery periods and withdrawal from team activities. The table details specific injuries for the lower limb. 

**Source:** Maemichi T, Kumai T. Long-Term Injury Survey in a Japanese University Women's Soccer Team. *Int J Sports Phys Ther.* 2025;20(4):572-582. doi: 10.26603/001c.132248.

**Table 6. Injury details of a university women's soccer team in 2018–2020**

	Practice	Game
Lower limb		
Thigh and gluteus	Quadriceps fasciitis, rectus femoris muscle tear, adductor muscle tear, hamstring muscle strain, iliopsoas muscle strain, femoral lateral epicondyle strain, thigh muscle strain, external obturator muscle strain, groin pain	Thigh muscle contusion
Knee	Anterior cruciate ligament injury/rupture, meniscus injury, patellar tendonitis, Infrapatellar Fat Pad Syndrome, patella bruise	Anterior cruciate ligament injury/rupture, meniscus injury
Lower leg	Peroneal tendonitis, Achilles tendinopathy, medial tibial stress syndrome, triceps surae contusion, peroneal muscle injury, tibia stress fracture	NA
Ankle and foot	Ankle inversion sprain (anterior talofibular ligament injury, calcaneofibular ligament injury), talus bone contusion, Lisfranc joint injury, ankle valgus sprain (triangular ligament injury), Plantar fasciopathy	Ankle inversion sprain (anterior talofibular ligament injury, calcaneofibular ligament injury), heel fat pad inflammation

## CALL FOR MANUSCRIPTS

The Editors of *Lower Extremity Review* want to highlight the work of thoughtful, innovative practitioners who have solved their patients' vexing problems. We are seeking reports of your most intriguing cases in the following areas:

- Biomechanics
- Falls and other injury prevention
- Benefit of movement
- Prevention of diabetic foot ulcers
- Collaborative care

Before you begin to write, query the Editors about your proposed topic (email is fine). Doing so ensures that your manuscript will conform to the mission of the publication and that the topic does not duplicate an article already accepted for publication. Furthermore, a query often allows the Editors and the publication's advisors to make recommendations for improving the utility of the manuscript for readers.

Case reports should be no more than 1500 words (not including references, legends, and author biographies). Photos ( $\leq 4$ ) are encouraged. Case reports can include a literature review as is appropriate for the topic. (Please note that for HIPPA compliance, photos should be de-identified before sending.)

Manuscripts must be original and not under consideration for publication elsewhere. Any prior publication of material must be explained in a cover letter.

All authors must be medical professionals in good standing. Students will be considered as first author only when the byline includes a fully licensed professional.

Manuscripts are submitted with the understanding that they will be reviewed; that revisions of content might be requested; and that the editorial staff will undertake editing, as necessary, aimed at improving clarity and conciseness and

applying conformity to style. Authors will have the opportunity to review and approve the edited version of their work before publication.

The Editors reserve the right to reject any unsolicited or solicited article that does not meet with editorial approval, including approval denied following requested revision.

### Electronic Submission

Please attach the manuscript as a Microsoft Word document or plain text file. Photos, tables, and figures can be embedded in the document, although submission of individual files is preferred. Figures not embedded in the main Word document should be submitted as .jpg files.

Please send queries and submissions to: Janice@lermagazine.com

*We look forward to hearing from you!*

Introducing

# THE MOORE BALANCE BRACE SIGNATURE EDITION

Developed by Jonathan Moore, DPM, in collaboration with Orthotica Labs, the *MBB Signature Edition* will help seniors maintain and prolong independent living by reducing their risk of falling.

Compelling new features, enhanced patient outcomes...



Faithfully captures the contour of the arch



Rearfoot extrinsic post for enhanced stability



Single Velcro® closure for easier donning & doffing



Premium leather inside and out for superior durability and comfort

If Dr. Moore hasn't signed it,  
it's not an MBB

*Jonathan Moore*



Call to order or for more information.

**888.895.1305**

[orthotica.com/learn-more](http://orthotica.com/learn-more)

## Case #1

## Summary

**\*REMEMBER:**

- **Any** Lesion even those thought to be persistent pyogenic granuloma, chronic onychocryptosis, resistant verrucae that **does not respond to reasonable therapy in a timely fashion** may require a more thorough exam.
- ***Journal of Dermatologic Surgery and Oncology***
  - P&A procedure has a success rate > 95%<sup>1-3</sup>

1. Ceilley RI, Collison DW. Matricectomy. *J Dermatol Surg Oncol.* 1992 Aug. 18(8):728-34.  
 2. Salasche SJ. Surgery. Scher RK, Daniel CR, eds. *Nails: Therapy, Diagnosis, Surgery.* Philadelphia, Pa: WB Saunders; 2005. 326-49.  
 3. Leshin B, Whitaker DC. Carbon dioxide laser matricectomy. *J Dermatol Surg Oncol.* 1988 Jun. 14(6):608-11.

bako<sup>dx</sup>



Figure 1. Squamous cell carcinoma

BY LELAND JAFFE, DPM, FACFAS, CWSP

**1. Why is performing a biopsy so important in podiatric dermatology?** Performing a biopsy is crucial for achieving diagnostic accuracy. Podiatric physicians may biopsy less frequently than their dermatology counterparts, but an earlier biopsy can significantly improve patient care. Many skin conditions can mimic common podiatric issues, and a biopsy allows for histopathological examination, which can definitively rule out or confirm various diagnoses, including malignancies, inflammatory conditions, and infections. Delaying biopsy when treatment is ineffective can lead to prolonged suffering and potentially worse outcomes, as illustrated by the case of the squamous cell carcinoma initially

misdiagnosed as a chronic ingrown toenail issue.

**2. What “red flags” should prompt a podiatric physician to consider a biopsy for a nail or skin condition?** Several clinical scenarios should raise suspicion and prompt consideration for a biopsy. These include:

- **Lack of response to standard treatments:** If a common condition such as an ingrown nail or presumed fungal infection doesn't improve with appropriate therapy within a reasonable timeframe (eg, 2 chemical matrixectomies without success or lack of improvement with antifungal treatment), further investigation is warranted.
- **Unusual presentation or location:** Lesions

appearing in atypical locations (eg, a non-healing ulcer on the side of a toe or a lesion on a non-weightbearing surface that resembles a diabetic foot ulcer) should be viewed with suspicion.

- **Prolonged duration or progression:** Skin lesions or wounds that persist for an extended period (eg, a wound present for 4–6 years without typical venous disease signs) or show progressive changes despite treatment should be biopsied to rule out underlying pathology, including malignancy.
- **Suspicious clinical features:** While not always obvious, changes in a lesion's appearance, such as rapid growth, unusual

This article is a summary of Dr. Jaffe's presentation from the 2025 No-Nonsense Seminar held March 7–9. To view the full presentation with questions and answers—and see the agenda for the 3-day program, visit <https://nononsense2025.lerexpo.com>. Continuing education credits are available for this and many of the lerEXPO programs.

Continued on page 20

## Case #2

### Basal Cell Carcinoma (BCC)

- Most common type of skin cancer
- Locally invasive /aggressive / destructive, but limited ability to metastasize
  - Tumors growth dependent on its stromal cells
  - **Stroma is not disseminated with tumor cells into vessels; limited potential for growth distant from initial site**
- Usually arises from epidermis that has ability to grow hair follicles
- 40% patients with one BCC will develop another lesion within 5 years
- Diagnosis is made via punch biopsy
- **Treatment → surgical resection (4 mm margins)**
  - Smaller lesions → cryosurgery or electrosurgery



Figure 2. Squamous cell carcinoma

## Case #5

### Nodular Melanoma

- **Worst prognosis**
  - Tumor essentially begins in the vertical growth phase
- Presents as uniformly elevated thick plaque or dome shaped lesion
- Typically uniformly blue/black
- **Arises rapidly from normal skin**
- **No radial growth phase** as in LMM and SSM



Figure 3. Nodular amelanotic melanoma

coloration (or lack thereof in cases of amelanotic melanoma), or features inconsistent with the presumed diagnosis, should increase the index of suspicion for a more serious condition.

- **History of predisposing factors:** A history of significant trauma (eg, previous burn injury) in the area of a non-healing wound should raise suspicion for malignant degeneration (Marjolin's ulcer) and necessitate early biopsy.

### 3. What are some examples of diagnostic miscues you've seen in your practice?

- A squamous cell carcinoma (Figure 1) of the great toenail bed initially treated as a recurring ingrown toenail with multiple phenol matrixectomies.
- A basal cell carcinoma (Figure 2) on the lower leg misdiagnosed and treated for years as a venous stasis ulcer.
- A squamous cell carcinoma on the toe of a patient with diabetes and neuropathy initially managed as a typical diabetic foot ulcer.
- A squamous cell carcinoma arising in a chronic burn scar on the lower leg, where the history of the burn injury should have prompted earlier suspicion for malignancy.
- A nodular amelanotic melanoma (Figure 3) on the medial calcaneus initially thought to be related to an insect bite or a benign skin tumor.
- Bullous pemphigoid, an autoimmune blistering disease, initially presenting as a seemingly friction-induced blister.
- Acral spongiotic dermatitis (numular eczema) misdiagnosed and treated as tinea pedis due to a moccasin-like distribution of erythema and scaling.
- Pyoderma gangrenosum, a rare inflammatory skin condition, initially mistaken for an infected lesion or spider bite.

### 4. What is the significance of considering malignant diagnoses like squamous cell carcinoma

**and melanoma?** Squamous cell carcinoma (SCC) and melanoma are serious forms of skin cancer that can occur on the feet and ankles. SCC has the potential to metastasize, particularly if it arises in areas of chronic inflammation, burns, or in immunocompromised individuals. Early diagnosis and surgical excision with appropriate margins are crucial for preventing local destruction and distant spread. Melanoma, especially nodular melanoma, can be aggressive and has a poorer prognosis if not diagnosed and treated early. Recognizing the possibility of these malignancies, even when clinical presentation is atypical (eg, amelanotic melanoma resembling a benign nodule), and performing timely biopsies are essential for improving patient outcomes and potentially saving lives. Involving surgical oncology for further evaluation and management is often necessary in such cases.

### 5. How should a podiatric physician approach a non-healing wound, and when should a biopsy be considered? For non-healing wounds, podiatric physicians should:

- Thoroughly evaluate the patient's history, including the duration of the wound, previous treatments, associated medical conditions (eg, diabetes, vascular disease), and any history of trauma or prior skin conditions.
- Perform a comprehensive physical examination, paying close attention to the wound's characteristics (location, size, depth, appearance of the wound bed and surrounding skin) and assessing for signs of infection or underlying vascular insufficiency.
- Consider ordering appropriate diagnostic

tests, such as vascular studies (eg, venous duplex for suspected venous ulcers) or cultures if infection is suspected.

- Establish a differential diagnosis, considering not only common causes of foot ulcers but also less frequent conditions, including malignancies and inflammatory dermatoses.
- Have a low threshold for performing a biopsy, especially if the wound does not respond to appropriate treatment within a reasonable timeframe (eg, no significant reduction in size of a non-infected diabetic foot ulcer within 4 weeks). Biopsy should also be considered if the clinical presentation is atypical or suspicious for a non-ulcerative pathology.

### 6. What are the different types of skin biopsies, and when might each be appropriate?

- **Punch biopsy:** A small, circular piece of skin is removed using a cylindrical blade. This is useful for sampling a specific area of a lesion and can provide full-thickness samples. A 2–3 mm punch biopsy is useful for initial evaluation of various skin conditions.
- **Shave biopsy:** A thin layer of skin is shaved off the surface. This is suitable for superficial lesions and can be diagnostic for certain conditions. A deep shave biopsy with a dermablade might be considered for a lesion like a suspected pyogenic granuloma or for initial sampling of a lesion where the depth isn't the primary concern initially.
- **Excisional biopsy:** The entire lesion is removed along with a margin of surrounding normal skin. This is often the preferred method for suspected melanomas to ensure complete removal and accurate staging based on depth. A narrow-margin excisional biopsy is generally recommended for suspected melanomas.
- **Incisional biopsy:** Only a portion of a larger lesion is removed. This is useful when the lesion is too large to excise

---

Several clinical scenarios should raise suspicion and prompt consideration for a biopsy.

Continued on page 22


entirely or when multiple areas need to be sampled.

The choice of biopsy technique depends on the clinical presentation, suspected diagnosis, and location of the lesion. For suspected melanomas, a narrow margin excisional biopsy is generally recommended. For other conditions, punch or shave biopsies may be sufficient for diagnosis.


**7. What is direct immunofluorescence (DIF), and when is it a useful diagnostic tool?** DIF is a specialized laboratory technique used to detect the deposition of antibodies and complement proteins in skin tissue. It is particularly useful in diagnosing autoimmune blistering diseases, such as bullous pemphigoid, and certain connective tissue disorders. In the case presented, DIF was useful in identifying the IgG antibody deposition along the epidermal-dermal junction, confirming the diagnosis of bullous pemphigoid, which would not have been possible with standard histopathological staining alone. When autoimmune blistering conditions are suspected

based on clinical presentation, a biopsy sample should be sent in Zeus or Michael's medium (in addition to formalin-fixed tissue) to allow for DIF testing.

**8. What is the importance of interprofessional collaboration in managing complex dermatological conditions of the foot and ankle?** Interprofessional collaboration is vital in managing complex dermatological conditions. When a podiatric physician diagnoses or suspects conditions like squamous cell carcinoma, melanoma, bullous pemphigoid, or pyoderma gangrenosum, involving specialists such as dermatologists, surgical oncologists, rheumatologists, and wound care specialists is crucial. Surgical oncologists are essential for the definitive surgical management of skin cancers and for evaluating the risk of metastasis. Dermatologists can provide expertise in diagnosing and managing a wide range of skin conditions, including complex or rare cases. Rheumatologists are necessary for the systemic management of autoimmune diseases like bullous pemphigoid. A collaborative approach ensures that patients receive comprehensive

care, accurate diagnosis, appropriate treatment, and optimal outcomes. It is critically important to refer patients with diagnosed squamous cell carcinoma or melanoma to surgical oncology and involving rheumatology in the management of bullous pemphigoid. 

*Leland Jaffe, DPM, FACFAS, CWSP, is currently a Podiatric Physician with the Endeavor Health Medical Group in Chicago, IL. Before this appointment, he served as an Associate Professor with the Scholl College of Podiatric Medicine at Rosalind Franklin University.*



**BIOMECHANICS  
& ORTHOTIC  
Innovation Summit 2025**  
Saturday, June 7, 2025  
11:00am - 8:00pm EST  
8 CECH | 8 CEU  
\$79

Powered by  
**ler EXPO**  
ONLINE HEALTHCARE CONFERENCE

# MultiMotion

Pediatric Hip Abduction System

**FOR SAFE TREATMENT**  
of correctable pediatric hip contractures!



- Safe and gradual joint mobilization
- Improved joint movement
- Stretch spastic muscles

**allard** | USA

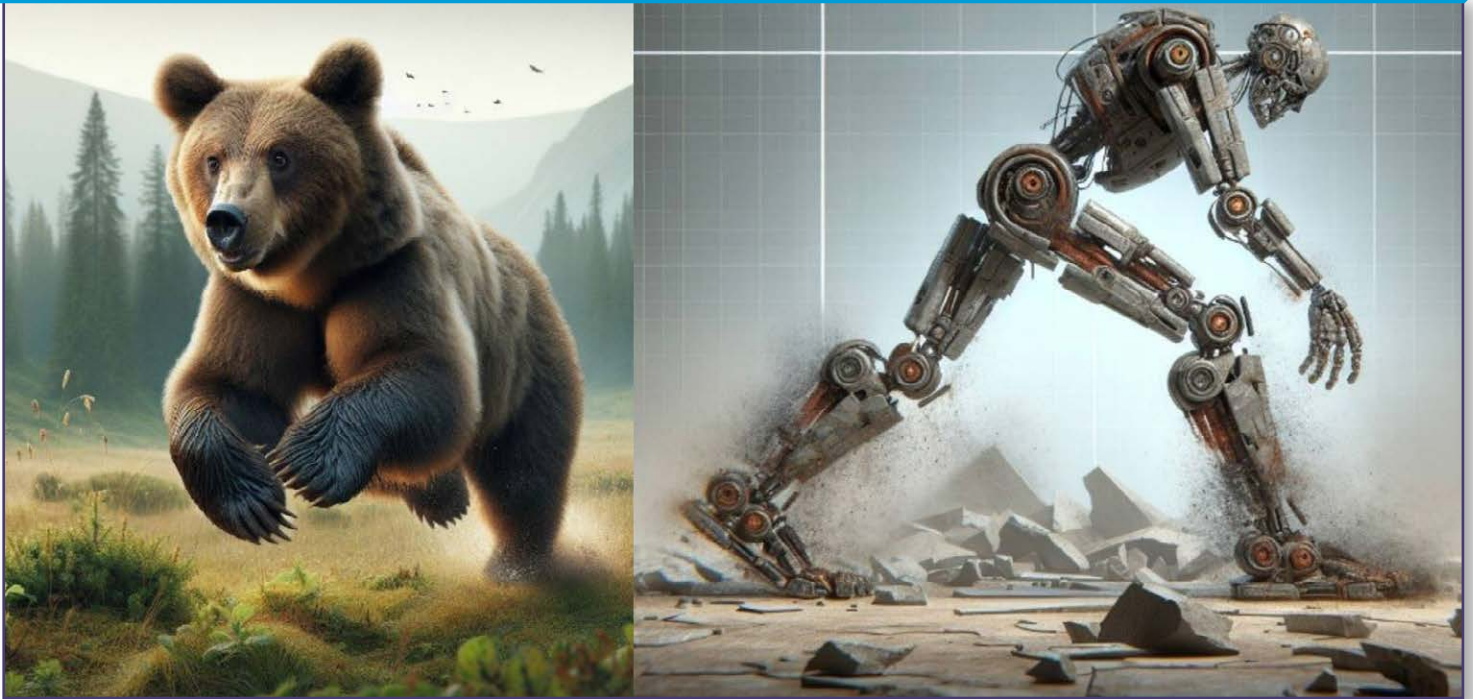
[allardusa.com](http://allardusa.com)

**ALLARD USA, INC.**  
300 Forge Way, Suite 3  
Rockaway, NJ 07866-2056

[info@allardusa.com](mailto:info@allardusa.com)  
Toll Free 888-678-6548  
Fax 800-289-0809

# CAGA 101: The 12 Dirty Truths Playbook

## Dirty Truth #2: Realities of Center of Pressure in Dynamic World



**Legend:** The bear can stand and walk on two limbs, but when it comes time for urgent action or rapid motion, it drops down on all fours for efficiency, speed, and ease. Humans, however bionic we are, have not evolved that way, and arthritis from repetitive micro-trauma is a consequence.

BY JAY SEGEL, DPM; SALLY CRAWFORD, MS

It's a physics problem – We live dynamic lives, in turn, we suffer dynamic consequences!

In the last installment, we focused on our problematic anatomy. We continue this discussion by looking at what happens when we add the interaction between 2 dissimilar bodies, the foot and the floor, and the introduction of force. The bad news is that our feet collide with the support surface with force, and that support surface returns the favor by hitting the foot in an equal and opposite manner called the ground reactive force. The good news is that we can apply the laws of physics, specifically, the formulae of collision dynamics, which allows us to understand, predict, and manage this repetitive set of actions. We can see some of this happening and we can observe the negative results on the body, but to measure these interactions, we need a reliable, reproducible device with a set of tools – that is the science and discipline of Computer Aided Gait Analysis (CAGA).

CAGA allows us to better understand the consequences of individual biomechanical and structural deformities, weaknesses, asymmetry, and abnormalities compromising balance during stance and human locomotion. But what it really can come down to is a better understanding and explanation of basic physics.

As a baseline, the vast majority of us do not have mechanical woes while resting or in bed; the challenges begin with weight-bearing and bipedal movement. As a living example, we like to use the bear as a model. We like to say that what it doesn't understand didactically,

---

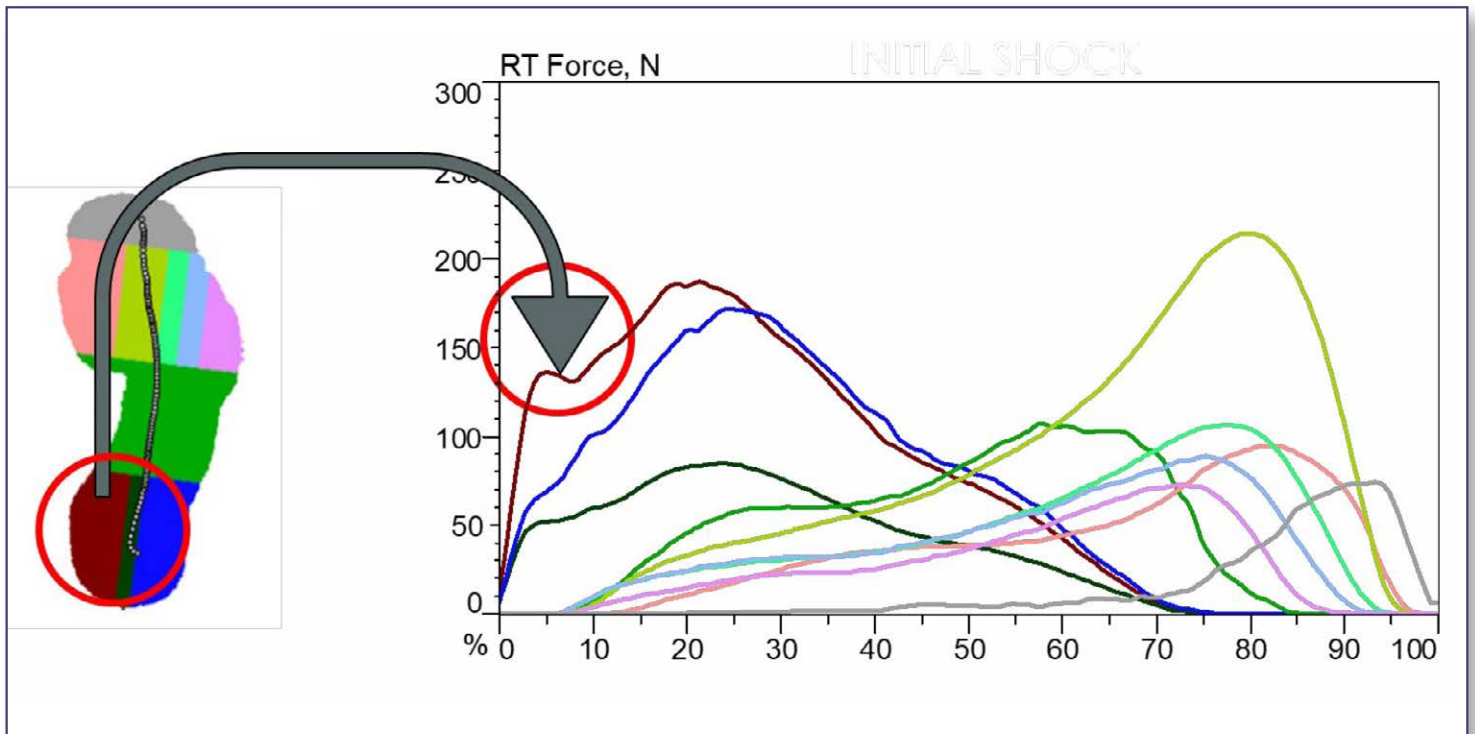
CAGA allows us to better understand the consequences of individual biomechanical and structural deformities...

it knows instinctually.

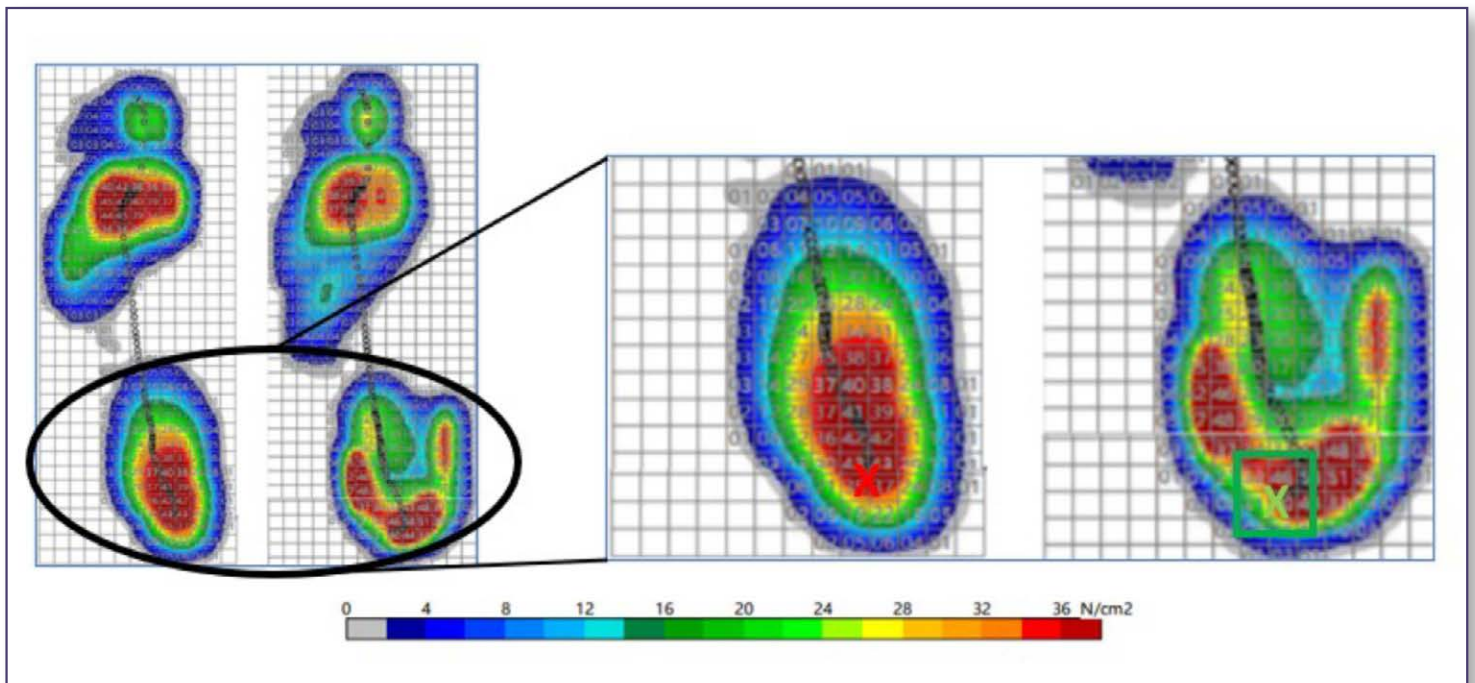
When we get out of bed and put our weight on our feet, we add significant challenges to our problematic anatomy by adding forces. When we, as a manner of speaking, hit the floor, the support surface hits us back. This is a phenomenon known as ground reactive forces and is one of Newton's natural laws of physics. However, there is a second force added that is often not considered – gravity.

When we add locomotion to the equation, it's useful to consider each step as a collision between a 3-dimensional foot of limited mass and a 2-dimensional support surface of relatively unlimited mass. This is, as we say, a battle the foot cannot win, and in fact, it loses this battle about 4 million times a year based on average human walking patterns. These deforming forces destroy joint integrity and neutrality.

Now, with some physics under our belt, we can layer on quantitative visuals to guide interpretations of this problem using the center

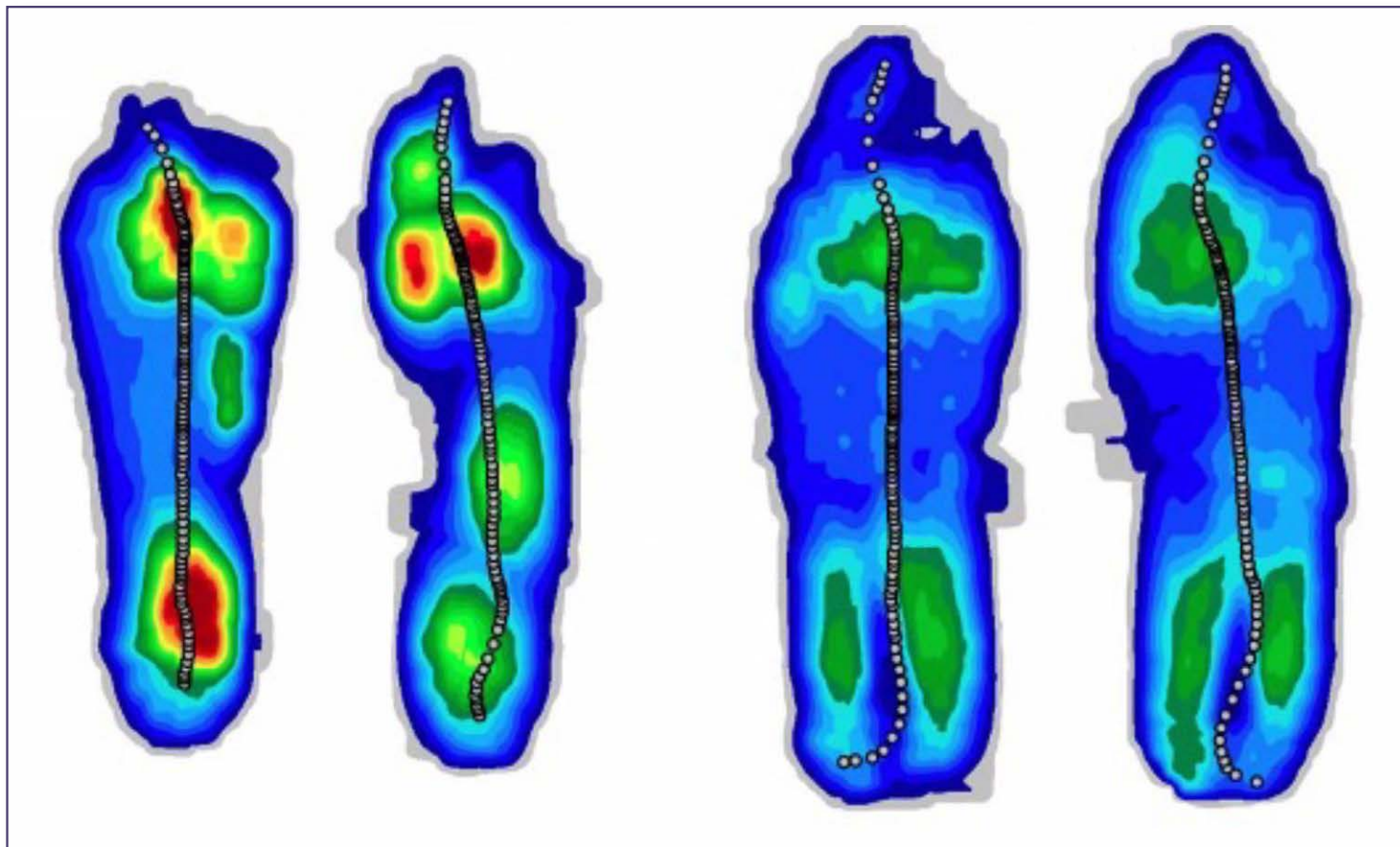


**Figure 1:** The center of pressure (COP) gait line is a visual expression of the path progression of loading (shown left in the figure). The COP is based on contact with the ground, which is represented in CAGA as the ground reactive forces (graphed on the right in the figure). Simply put, the line is an aggregate of points representing the COP, plotted on the X and Y coordinates repetitively at the sample rate, starting at the red circle. COP gait lines objectively demonstrate how that force impacts each point in movement and loading.



**Figure 2:** Three things happen to reduce pain and aid walking and deal with Newton's dirty truths: 1) Locally, the impact point is shifted posterior, back, and away from a typical but not ideal area that coincides with plantar heel spurs and the vulnerable origin of the plantar fascia. 2) The increase in the landing foot/floor angle allows for a more efficient gait with greater power and momentum in each step. 3) An improvement in spatial and temporal gait elements and the progression of the foot through each step as observed in the "center of pressure" graph.

Continued on page 26




**Figure 3:** With the help of the ground reaction force, we can live dynamic lives but at the same time, it is the most destructive phenomenon humans face. Force is the root cause of impact, shock, tearing, and friction as represented in average pressure plots characterizing exact influences we have control over: shoe and footwear solutions.

of pressure (COP) data from CAGA. The COP is a fundamental concept in studying human movement and balance (Figure 1). When a person stands or walks, their body exerts a force on the ground, which is countered by an equal and opposite force known as the ground reaction force (GRF). The COP is the point where this total force (the GRF) is concentrated, playing a vital role in maintaining stability and preventing falls.

The COP is supposed to represent a forward progression of weight bearing from heel to toe. If initial contact is moved to the forefoot, we see a devastating alteration of pressure flow, known as retrograde COP. Again, all thanks to physics! Instead of this line moving normally from heel to toe, we see a period where our center of pressure is moving backward while our body momentum wants to

trend forward. This potential for divergence of force is the very definition of shear stress that would have direct impact on the many joints of the foot and ankle with stark negative effects on the entire kinetic chain!

As gait is a cyclical and repetitive set of events, looking at the aggregate of the COP gait lines and pressure plots, in motion, is critical (Figure 3).

As a sidebar, some of the language may seem familiar from prior months, and that is done deliberately. Over the years of practicing, teaching, and writing about biomechanics, these familiar phrases and analogies have helped to convey lofty concepts in easily digestible pieces in a consistent framework. Please look forward to next month's CAGA 101 covering more on what we can't see with our eyes without the help of these tools. 

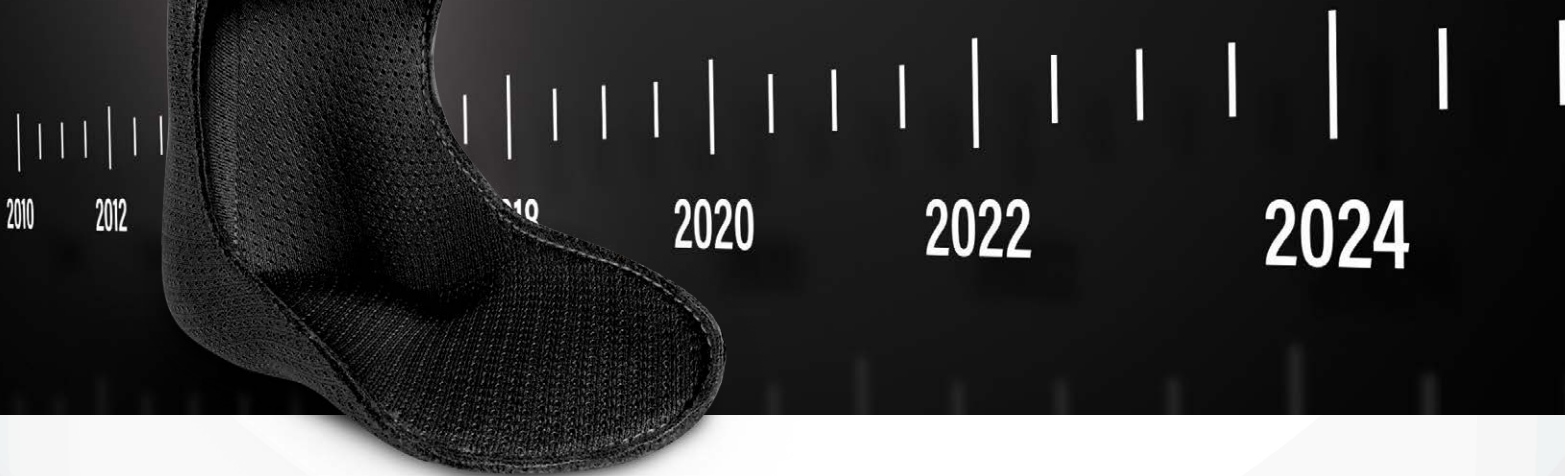
*Jay Segel, DPM, is a Podiatrist, Biomechanist, Orthotic and Gait Analysis Specialist, in Martha's Vineyard, MA.*

*Sally Crawford, MS, is a Biomedical Engineer, IT director, and data manager.*

*Part 1 of this 12-part series, CAGA 101: The 12 Dirty Truths Of Foot Mechanics, which appeared in the February issue, can be accessed at <https://tinyurl.com/y78kj5s3>.*

ARIZONA BALANCE BRACE

**OVER A DECADE**  
OF POSITIVE PATIENT OUTCOMES



## Arizona Balance Brace: Podiatrists' top choice for treating balance issues

With over a decade of success, the **Arizona Balance Brace** is the only balance brace with a proven track record of impacting **tens of thousands of patients' lives**.



Scan to learn more about how to  
**Implement a Fall Prevention Program in your practice**



The OHI Family of Brands



# Firefighter Lower Extremity Injuries in the United States

BY MATHIAS B. FORRESTER, BS

**Background:** In 2020, there were over 1 million career and volunteer firefighters in the United States (US). Thousands of injuries involving firefighters occur annually. The body part involved in the highest proportion of injuries is the lower extremity. The objective of this study was to characterize firefighter lower extremity injuries in the US.

**Methods:** Data were obtained from the National Fire Incident Reporting System (NFIRS), which collects information on incidents to which fire departments respond in the US. Cases were firefighter lower extremity injuries reported to NFIRS during 2014–2023. The distribution of cases was determined for type of injury, patient characteristics, and circumstances of injury.

**Results:** A total of 20,987 records of firefighter lower extremity injuries were reported to NFIRS during 2014–2023. The distribution of the injuries by body part was 43.6% knee, 25.6% ankle, 13.8% lower leg, 10.3% foot and toes, and 6.7% upper leg. The most commonly reported injuries were 48.1% strain or sprain, 20.3% pain only, 7.2% swelling, and 5.3% contusion or bruise (minor trauma). The severity of 64.9% of the injuries was classified as report only, first aid only, and treated by physician (not a lost-time injury); 35.0% of the injuries were classified as lost-time injuries or death. The location where the patient was treated was 41.6% not transported, 27.2% hospital, 7.6% doctor's office, 5.4% station or quarters, 2.0% other or undetermined, and 16.3% not documented.

**Conclusion:** Several thousand firefighter lower extremity injuries occur each year in the US. However, most of these injuries are not likely to be severe and may be managed outside of a hospital. The information in this study may be useful for creating strategies to prevent firefighter lower extremity injuries.



Firefighting is a difficult job handled on both paid career and volunteer levels. According to the National Fire Prevention Association (NFPA) Survey of Fire Departments for US Fire Experience, during 2020, there were 29,452 fire departments in the United States (US) in 2020. In that same year, there were an estimated 1 million career and volunteer firefighters.<sup>1</sup>

During 2018–2020, there was an estimated average of 61,325 firefighter injuries annually. The firefighters were injured while performing fire suppression activities (at the location of the fire or fireground), responding to or returning from an incident (including fire and nonfire emergencies), working at on-scene nonfire emergencies (includes rescues, hazardous calls, and natural disaster calls), training, and participating in other on-duty activities (eg, inspection or maintenance duties). The most common causes of injuries were overexertion or strain (29%), exposure to hazard (17%), contact with object (13%), fall (12%), and slip or trip (11%). Twen-

ty-one percent of the injuries involved the lower extremity; the lower extremity accounted for the highest proportion of injuries of any body part.<sup>2</sup>

The objective of this study was to characterize firefighter lower extremity injuries in the US.

## Methods

Data for this retrospective epidemiological study were obtained from the US Fire Administration (USFA) National Fire Data Center (NFDC). The NFDC collects information on incidents to which fire departments respond in the National Fire Incident Reporting System (NFIRS).<sup>3</sup> Participation in the NFIRS is voluntary, and not all US fire departments participate.<sup>4,5</sup> However, as of 2023, over 22,000 US fire departments in all 50 states reported incident data to NFIRS.<sup>3,5</sup>

Participating fire departments submit information to NFIRS on all incidents to which they respond.<sup>3,4</sup> The information provided describes the kind of incident to which they responded, the location of the incident, the resources used to

**Table 1. Firefighter lower extremity injuries reported to the National Fire Incident Reporting System during 2014-2023 by diagnosis and severity**

Variable	Number	Percent
<b>Primary apparent symptom</b>		
Strain or sprain	10,103	48.1
Pain only	4,269	20.3
Swelling	1,507	7.2
Contusion/bruise: minor trauma	1,116	5.3
Fracture	620	3.0
Cut or laceration	477	2.3
Stab wound/puncture wound: penetrating	442	2.1
Burns only: thermal	349	1.7
Abrasion	307	1.5
Other	1,178	5.6
Not documented	619	2.9
<b>Severity</b>		
Report only, including exposure	8,194	39.0
First aid only	2,615	12.5
Treated by physician, not a lost-time injury	2,809	13.4
Lost time injury, moderate severity	6,921	33.0
Lost time injury, severe	418	2.0
Lost time injury, life threatening	7	0.0
Death	2	0.0
Undetermined	21	0.1
<b>Total</b>	<b>20,987</b>	

mitigate it, and other information to understand the nature and causes of the fire, hazardous material, and emergency medical service (EMS) incidents. Information is also collected on civilian or firefighter casualties and an estimate of property loss.<sup>4</sup> NFIRS consists of 11 modules (data subsets). Not all modules are completed for all incidents. Information is first sent to local agencies, who then forward the completed NFIRS information to the state agency responsible for NFIRS

data. The state agency combines the information with data from other fire departments into a statewide database and then electronically sends the data to the NFDC at the USFA.<sup>4</sup>

Each year the USFA compiles publicly released NFIRS incident data that were collected by the states during the previous calendar year into a public data release (PDR) that is available free of charge.<sup>6</sup> Each annual database can be downloaded at:<sup>7</sup> <https://www.fema.gov/about/>

[openfema/data-sets/fema-usfa-nfirs-annual-data](https://openfema/data-sets/fema-usfa-nfirs-annual-data).

Cases were firefighter lower extremity injuries reported during 2014–2023. Injuries involving firefighters were identified using the NFIRS Fire Service Casualty Module, which is used to report all injuries, deaths, or exposures to fire service personnel. This includes casualties that occur in conjunction to both incident responses and non-incident events such as station duties or training. A separate Fire Service

*Continued on page 30*

**Table 2. Firefighter lower extremity injuries reported to the National Fire Incident Reporting System during 2014-2023 by patient characteristics**

Variable	Number	Percent
<b>Patient age (years)</b>		
18-29	3,695	17.6
30-39	6,164	29.4
40-49	6,355	30.3
50-59	3,842	18.3
60+	539	2.6
Unknown*	392	1.9
<b>Patient sex</b>		
Male	19,674	93.7
Female	1,313	6.3
<b>Career versus volunteer status</b>		
Career	13,504	64.3
Volunteer	2,258	10.8
Not documented	5,225	24.9
<b>Usual assignment</b>		
Suppression**	13,683	65.2
Emergency medical service	1,529	7.3
Training	548	2.6
Other	856	4.1
Not documented	4,371	20.8
<b>Total</b>	<b>20,987</b>	

\*Records with ages listed as <18 years or >85 years grouped in Unknown.

\*\*Includes hazardous materials, rescue, incident command, and safety.

Casualty Module is required for each casualty or health exposure. Lower extremity injuries were identified by searching the Fire Service Casualty Module for those records where the Primary Area of Body Injured (PABI) numeric field included codes for the lower extremity: 71 – Leg, upper; 72 – Leg, lower; 73 – Knee; 74 – Ankle, and 75 – Foot and toes. It should be noted that each record only documents a single primary symptom and

the associated body part.

The distribution of cases was determined for type of injury, patient characteristics, and circumstances of injury. Some of the documented ages were considered inaccurate (eg, age less than 10 years, age greater than 100 years), so ages less than 18 years or greater than 85 years were grouped in the unknown category.

Since the data are publicly available and

de-identified, the study is exempt from institutional review board approval.

## Results

A total of 20,987 records of firefighter lower extremity injuries were reported to NFIRS during 2014–2023. The distribution of the injuries by body part was 9,151 (43.6%) knee, 5,378 (25.6%) ankle, 2,896 (13.8%) lower leg,

2,152 (10.3%) foot and toes, and 1,410 (6.7%) upper leg.

Table 1 provides the distribution of firefighter lower extremity injuries by diagnosis and severity. The most reported lower extremity injuries were strain or sprain, pain only, swelling, and contusion or bruise (minor trauma), accounting for 81.0% of all lower extremity injuries. For 64.9% of the injuries, the severity was classified as report only, first aid only, and treated by physician (not a lost-time injury); for 35.0% of the injuries, the severity was classified as lost-time injuries or death. The location where the patient was treated was 8,723 (41.6%) not transported, 5,698 (27.2%) hospital, 1,598 (7.6%) doctor's office, 1,128 (5.4%) station or quarters, 429 (2.0%) other or undetermined, and 3,411 (16.3%) not documented.

Table 2 shows the distribution of firefighter lower extremity injuries by patient characteristics. Most (59.7%) of the firefighters were age 30–49 years, and the majority of firefighters were male. Most of the firefighters were career firefighters, and the majority of firefighters were assigned to fire suppression, followed by emergency medical services.

The annual number of reported firefighter lower extremity injuries ranged between 2,124 and 2,409 (annual mean 2,265) during 2014–2019 and 1,825 and 1,889 (annual mean 1,850) during 2020–2023. There were 5,885 (28.0%) reported injuries during January–March, 5,226 (24.9%) during April–June, 5,142 (24.5%) during July–September, and 4,734 (22.6%) during October–December. There was little variation by day of the week (data not shown). The states with the highest number of reported injuries were 1,947 (9.3%) Massachusetts, 1,773 (8.4%) Ohio, 1,599 (7.6%) Florida, 1,469 (7.0%) Illinois, 1,097 (5.2%) New York, and 1,077 (5.1%) Texas.

Table 3 presents the distribution of firefighter lower extremity injuries by the circumstances of the injury. The most common causes of injury were slip or trip, overexertion or strain, and fall. The majority (67.8%) of injuries occurred at scene outside or in the structure. The most common activities at the time of the injury, accounting for 37.5% of the total injuries,

were 2,125 (10.1%) handling charged hose lines, 1,830 (8.7%) getting off fire department vehicle, 1,530 (7.3%) providing emergency medical service care, 1,456 (6.9%) extinguishing fire or neutralizing incident (other), and 928 (4.4%) training activity or drill.

## Discussion

This study examined firefighter lower extremity injuries reported to a national database of incidents to which fire departments respond during a recent 10-year period. Such information is important because there were an estimated 1 million career and volunteer firefighters in 2020.<sup>1</sup> Thousands of firefighter injuries occur annually. The highest proportion of these injuries (21%) involve the lower extremity.<sup>2</sup>

This study found that the part of the lower extremity that was the primary area of injury was the knee, followed in descending order by the ankle, lower leg, foot and toes, and upper leg. The most frequently reported symptoms were strain or sprain, pain only, swelling, and contusion or bruise (minor trauma), accounting for 81% of the total symptoms. Such symptoms might not be considered serious and not expected to require extensive medical attention. This is consistent with the observation that the severity of 65% of the injuries were classified as report only, first aid only, and treated by physician (not a lost-time injury), and 35% of the injuries were classified as lost-time injuries or death. Furthermore, 55% of the injured firefighters were not transported or were taken to a doctor's office, station or quarters, or residence, and only 27% of the injured firefighters were taken to a hospital.

Of the firefighters with lower extremity injuries, 60% were age 30–49 years, and 94% were male. This is consistent with the NFPA Survey of Fire Departments for US Fire Experience During 2020, which found that 50% of firefighters were age 30–49 years, and 91% were male.<sup>1</sup> Most of the firefighters with lower extremity injuries were career firefighters. This contrasts with the 2020 survey, which reported that 35% of firefighters were career firefighters.<sup>1</sup> This might suggest that career firefighters are at greater risk of lower extremity injuries. If this is true, it may relate to differences between career

and volunteer firefighters in the activities they perform. It also may reflect differences between career and volunteer fire departments with respect to participation in NFIRS.

The annual mean number of firefighter lower extremity injuries was 2,265 during 2014–2019 and 1,850 during 2020–2023, a decline of 18% in the latter part of the study period. Between 2013 and 2022, there was a 4% decrease in residential building fires.<sup>8</sup> With fewer residential building fires, firefighters might be less likely to be injured. In addition, the COVID-19 pandemic began in late 2019 to early 2020<sup>9</sup>; the societal disruptions associated with the pandemic may have affected the pattern of firefighter activities and their risk of lower extremity injury.

Massachusetts reported the highest number of firefighter lower extremity injuries, followed by Ohio, Florida, Illinois, New York, and Texas. This may reflect geographic differences in the number of incidents to which fire departments might respond, in the number of firefighters, or risk of lower extremity injury to firefighters. However, it may also be due to geographic differences in fire department participation in NFIRS.

This study is subject to limitations. Fire department participation in NFIRS is voluntary, so the database does not include all incidents to which all US fire departments respond.<sup>5</sup> This particularly needs to be considered in the analysis of certain variables such as geographic region and whether the injured firefighter was a career or volunteer firefighter. In addition, each record only documents a single primary symptom and the associated body part. An injury may involve multiple symptoms and/or multiple body parts. Thus, the number of lower extremity injuries included in the study should be considered a minimum number of such injuries.

In conclusion, this study found that approximately 2,000 firefighter lower extremity injuries were reported to NFIRS each year. This study suggests that most firefighter lower extremity injuries are not likely to be severe and may be managed outside of a hospital. The information in this study may be useful for creating strategies to prevent firefighter lower extremity injuries. (ler)

Continued on page 32

**Table 3. Firefighter lower extremity injuries reported to the National Fire Incident Reporting System during 2014-2023 by circumstances of the injury**

<b>Variable</b>	<b>Number</b>	<b>Percent</b>
<b>Cause of injury</b>		
Slip/trip	6,707	32.0
Overexertion/strain	3,465	16.5
Fall	2,921	13.9
Contact with object (firefighter moved into/onto)	1,826	8.7
Struck or assaulted by person/animal/object	1,140	5.4
Exposure to hazard	575	2.7
Jump	430	2.0
Other cause	1,890	9.0
Undetermined	1,383	6.6
Not documented	650	3.1
<b>Location where injury occurred</b>		
At scene, outside	9,767	46.5
At scene, in structure	4,455	21.2
At fire department location	3,785	18.0
Enroute to incident or assignment	281	1.3
At medical facility	191	0.9
Returning from incident or assignment	161	0.8
Enroute to fire department location	69	0.3
Enroute to medical facility	67	0.3
Returning from medical facility	4	0.0
Other location	1,004	4.8
Undetermined	145	0.7
Undocumented	1,058	5.0
<b>Total</b>	<b>20,987</b>	

# EXPLORE MORE. ADVENTURE MORE.

The lightweight and breathable Expedition orthotic is engineered for repeated impact and shock absorption.

Start providing Footmaxx orthotics today!

**1.800.779.3668**

Expedition  
By Footmaxx

**Footmaxx**<sup>™</sup>  
[Footmaxx.com/get-started](http://Footmaxx.com/get-started)

Mathias B. Forrester, BS, is an independent researcher in Austin, Texas. Now retired, he has performed public health research and consultation for various university and government programs for 40 years.

References

1. Fahy R, Evarts B, Stein GP. U.S. Fire Department Profile - 2020. National Fire Protection Association, Quincy, Massachusetts, US, 2022. Available at <https://npr.brightspotcdn.com/03/bf/7bb8a5f04651b-98de071b3464196/osfdprofile.pdf>. Accessed February 22, 2025.
2. U.S. Fire Administration. Fire-Related Firefighter Injuries Reported to the National Fire Incident Reporting System (2018-2020). November 2022. Available at <https://www.usfa.fema.gov/statistics/reports/firefighters-departments/firefighter-injuries-v22i4.html>. Accessed February 22, 2025.
3. U.S. Fire Administration. National Fire Incident Reporting System. October 9, 2024. Available at <https://www.usfa.fema.gov/nfirs/>. Accessed February 22, 2025.
4. U.S. Fire Administration. National Fire Incident Reporting System Complete Reference Guide. January 2015. Available at <https://www.usfa.fema.gov/nfirs/documentation/>. Accessed February 22, 2025.
5. The National Fire Incident Reporting System and the Public Data Release File. NFIRS and PDR Overview 2023. In the 2023 All Incidents data download.
6. U.S. Fire Administration. Access NFIRS Data. October 17, 2024. Available at <https://www.usfa.fema.gov/nfirs/access-data/>. Accessed February 22, 2025.
7. Federal Emergency Management Agency. Annual NFIRS Public Data. Available at <https://www.fema.gov/about/openfema/data-sets/fema-usfa-nfirs-annual-data>. Accessed February 22, 2025.
8. U.S. Fire Administration. Residential fire estimate summaries (2013-2022) U.S. Fire Administration, May 15, 2024. Available at <https://www.usfa.fema.gov/statistics/residential-fires/#:~:text=Overall%20trends%20for%20residential%20building,An%208%25%20decrease%20in%20injuries>. Accessed February 22, 2025.
9. Muccari R, Chow D, Murphy J. Coronavirus timeline: Tracking the critical moments of Covid-19. NBC News December 29, 2020. Available at <https://www.nbcnews.com/health/health-news/coronavirus-timeline-tracking-critical-moments-covid-19-n1154341>. Accessed February 22, 2025.



**DATE AND TIME**  
**FRIDAY, MAY 30 - 8:45AM - 4:25PM EDT**

Experts in osseointegration surgery and prosthetics will provide hands-on and didactic education on osseointegration's role in amputee care. Learn about surgical techniques, prosthetic integration, patient evaluation, and postoperative rehabilitation. Gain essential skills to optimize outcomes for amputees with bone-anchored prostheses.

[tinyurl.com/3t5p38hv](https://tinyurl.com/3t5p38hv)

 VIRTUAL OR ONSITE AT HOSPITAL FOR SPECIAL SURGERY

- Highlights of the agenda include:
- Lectures
  - Patient Testimonials
  - Live Demonstration - Making Of Prosthetic Leg
  - Q & A



iStockphoto.com #977638298

## FIREFIGHTER FOOTWEAR

Firefighter footwear is subject to a host of regulations, primarily set by the National Fire Protection Association (NFPA) – but selected by the local authority for fire jurisdiction. This footwear is designed to provide adequate protection against multiple hazards encountered during firefighting as well as support and stability since boots are the 1 piece of equipment in almost constant touch with the fire scene itself. Boots must meet several regulations including:

### **Structural & Proximity Firefighting:**

Boots used in structural and proximity firefighting are tested for thermal insula-


tion and resistance to flame with several additional tests including melting of sewing thread and resistance to liquid penetration, blood-borne pathogens, puncture, cut, and abrasion. Soles and heels are tested for slip resistance, abrasion resistance, and electrical protection, and must provide good traction. Other tests cover secure attachment of stud posts and eyelets, corrosion resistance of metal hardware, and labeling.

Boots must be at least 8 inches high, with some jurisdictions requiring a height of 250mm (9.84 inches).

**Wildland Firefighting:** Boots used in

wildland firefighting must be able to deal with rough terrain, hot embers, and other unique challenges. These boots are often made of leather uppers for durability, but leather is not a requirement.

Individual fire departments (or the local authority for fire jurisdiction) may have further requirements.

Access to all of NFPA codes and standards is free at [www.nfpa.org](http://www.nfpa.org). 

*Thanks to Curt Floyd, Deputy Chief retired, EFO, CFPS, Technical Lead-First Responders, at the NFPA.*

# Targeted Hip Muscle Strengthening Improves Lower Extremity Kinematics in Runners

BY SHREEN AHMED LASHIEN, AHMED OMAR ABDELNAEEM, AND EBTESSAM FAWZY GOMAA

Dynamic knee valgus, a highly reliable measure of this alignment assessed in the frontal plane, is a valuable tool for identifying this pathomechanical dysfunction.

The purpose of this study was to investigate the effectiveness of functional hip abductor strength training on reducing contralateral pelvic drop angle (hip frontal plane projection angle (FPPA)), and dynamic knee valgus (knee frontal plane projection angle) in runners with medial tibial stress syndrome (MTSS)—shin splints.

## Methods

The study cohort for this single-blind randomized controlled trial included 26 male and 14 female recreational runners (age 25–35 years; body mass index between 18.5 and 25 kg/m<sup>2</sup>) were diagnosed with MTSS for at least 1 month. Participants were randomized into 2 groups: a control group (Group A, n = 20) received a selected physical therapy exercise program, and an experimental group (Group B, n = 20) received the same program plus functional hip abductor strength training (Figure 1).

Both groups ceased running activity for 3 weeks during the exercise program, followed by a gradual return to running at < 50% of



their previous training volume, with continuity practicing their exercise program. Dynamic knee valgus (FPPA) and contralateral pelvic drop angle were measured using 2D video and analyzed at baseline and after 8 weeks.

## Results

After 8 weeks, Group B (intervention) demonstrated a significant decrease in FPPA, indicating improved knee alignment after treatment compared to baseline ( $P < 0.001$ ). Conversely, Group A (control) exhibited a significant increase in FPPA, worsening knee alignment, post-treatment compared to baseline ( $P < 0.001$ ). Both groups showed a significant decrease in contralateral pelvic drop angle (improved pelvic stability) post-treatment compared to baseline ( $P < 0.01$ ). The percent change of FPPA and contralateral pelvic drop angle in group A was 28.41% and 19.42%, respectively, and that of group B was










42.05% and 49.85%, respectively.

## Discussion

The significant decrease in dynamic knee valgus (FPPA) in group B represents the critical value of hip abductors' added functional strength training, accurate clinical reasoning, and proper lower limb biomechanical assessment, taking into consideration the hip abductors' weakness as the main reason for the dynamic knee valgus and contralateral pelvic drop.

The anatomical explanation of the study's findings lies in the femur's obliquity anatomical (longitudinal) axis, which angulation creates a physiological valgus of up to 5 degrees from the vertical line. In contrast, the lower limb's mechanical axis (weight-bearing line) travels from the center of the hip joint to the center of the ankle joint, passing through the midpoint of the tibiofemoral joint. This mechanical axis rep-

This article has been excerpted from "Effect of hip abductors training on pelvic drop and knee valgus in runners with medial tibial stress syndrome: a randomized controlled trial." *Journal of Orthopaedic Surgery and Research*. 2024;19:700. <https://doi.org/10.1186/s13018-024-05139-3>. Editing has occurred, including the renumbering or removal of tables and figures, and references have been removed for brevity. Use is per CC Attribution 4.0 International License.

Selected Physical Therapy Exercises		Functional Hip Abductor Strength Training Exercises	
3 sets of 15 repetitions, 15 seconds rest between sets, 3 times per week, & weeks, for the following exercises:		3 sets of 15 repetitions, 15 seconds rest between sets, 3 times per week, 8 weeks, for the following exercises:	
 <p>1. Strength training for ankle dorsiflexors using a resistance band</p>	 <p>2. Eccentric calf exercise (calf raise)</p>	 <p>1. Pelvic drop</p>	 <p>2. Side-leg bridge</p>
 <p>3. Balance and proprioceptive exercises on a balance board</p>	 <p>4. Static plantar flexor stretches</p>	 <p>3. Side-lying hip abduction with internal rotation</p>	 <p>4. Lateral step-up</p>
Each exercise 30 seconds per leg: legs were alternated during a 30-second rest between sets, 3 sets each leg	30 seconds duration hold, 3 sets, 30 seconds rest in between sets	 <p>5. Standing hip abduction on stance or swing leg with extra resistance</p>	
<p><b>Figure 1:</b> Both groups received a selected physical therapy exercise program for 8 weeks, consisting of 3 sets of 15 repetitions, 15 seconds rest between sets, 3 times per week, for the assigned exercises.</p>			

resents the ground reaction force as it transmits up through the lower extremity. In a neutrally aligned limb, the weight-bearing forces distribute equally between the medial and lateral condyles of the knee joint.

However, during single-leg stance (the stance phase of gait and running), the mechanical axis shifts toward the medial part of the knee joint to accommodate the narrower base of support below the center of mass, amplifying the compressive stress on the medial compartment and the tensile stress on the lateral compartment. Thus, any altered or abnormal anatomical alignment increases the lateral compressive force as the weight-bearing line shifts onto the lateral compartment of the knee (genu valgus), increasing the lateral compressive force. Conversely, a medial shift of the weight-bearing line (genu varum) increases the medial compressive force. Furthermore, recent studies support that MTSS arises from an overload of the medial tibia.

The running cycle includes 2 phases: the stance phase accounts for 40%, while the swing

phase accounts for 60%. During single-limb support in running, the hip abductors, particularly the gluteus medius contracts eccentrically to control contralateral pelvis drop, hip adduction, internal rotation, and knee abduction (dynamic knee valgus), which occurs as the ground reaction force falls medial to the hip and the hip abductor moment is less than the external adduction moment due to gravity and acceleration load. While in the propulsion phase, the gluteus medius contracts concentrically to abduct the hip and generate power. Weakness in the gluteus medius can lead to excessive hip adduction and contralateral pelvic drop.

To achieve sufficient strength improvements, functional training should target the gluteus medius with an intensity of at least 60% of its maximum voluntary contraction, which explains the importance of the 5 exercises in the study authors' functional training.

After identifying the baseline repetition maximum (RM) for a particular training-induced adaptation in strength, a percentage of

an exercise program ranges from 60–70% of the baseline RM for healthy, untrained adults, and > 80% of the baseline RM for highly trained athletes is needed.

## Conclusions

This study demonstrates that 8 weeks of functional hip abductor strength training, combined with traditional physical therapy, effectively improves lower extremity kinematics in recreational runners with MTSS by reducing dynamic knee valgus and contralateral pelvic drop. This targeted approach likely addresses underlying muscle weakness and movement dysfunction, offering hope for potentially reducing MTSS recurrence.

*Shreen Ahmed Lashien, Ahmed Omar Abdelnaeem, and Ebtessam Fawzy Gomaa are affiliated with the Department of Orthopedic Physical Therapy, Faculty of Physical Therapy, Cairo University, Egypt.*

# Wound Care Game Changer

Help More Patients Relieve Plantar Pathologies  
— Offload In Their Shoes!



## Introducing New PressureOFF™ Customizable Offloading Insoles from PediFix®

Reduce Pressure, Friction & Pain  
in Everyday Footwear

With the proven 'removable  
pegs' offloading design  
you know, PressureOFF™  
insoles help prevent, relieve  
and promote healing of  
common plantar pathologies  
— **in ordinary shoes** — for  
higher compliance and  
better outcomes.

If pressure and friction  
offloading will benefit  
your patients, get them  
onto PressureOFF™ Insoles.  
Order today, request a free  
Sample Pack, or get more  
information. This is an  
offloading innovation with  
instant benefits for you, your  
patients and your practice.

### Offload —

Calluses  
Bursitis  
Capsulitis  
Sesamoiditis  
Warts  
Prominences  
Lesions  
IPKs  
Fat Pad Atrophy  
Bone Spurs  
Metatarsalgia  
Sensitive Areas  
Friction Zones  
Diabetic Hot Spots  
Diabetic Ulcers  
Ulcers in Remission  
Wounds  
Surgical Sites  
More



Removable Pegs  
Unload Targeted Areas

Distribute Weight  
Away from  
Sensitive Lesions

Offload Sore Spots to  
Relieve Pain, Pressure

Choose  
Plastazote®  
or Poron®  
Top Layers

To order, get a free sample\*  
or more information, mention code LER822-P

Call: 1-800-424-5561

Fax: 845-277-2851

E-mail: [info@pedifix.com](mailto:info@pedifix.com)

Return this Coupon to:

PediFix, 301 Fields Lane, Dept. LER822-P, Brewster, NY 10509

Visit: [www.pedifix.com/t-POIOffloading.aspx](http://www.pedifix.com/t-POIOffloading.aspx)

### Introductory Trial Sample Pack Offer!

**PediFix**  
Medical Footcare

Yes, I'm interested in PressureOFF™ Insoles  
for offloading in patient footwear. Please send me:

- More information  
 FREE Sample Trial Pack (while supplies last)

Your Name \_\_\_\_\_

Practice Name \_\_\_\_\_

Shipping Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_

Fax \_\_\_\_\_

Email \_\_\_\_\_

In our practice, we see approximately \_\_\_\_\_ (#) patients each week.

My favorite supplier is \_\_\_\_\_

I prefer:  to Dispense  to Prescribe  Patient Direct Order

Mail to: PediFix, Dept. LER822-P, 301 Fields Lane, Brewster, NY 10509

Fax to: 845-277-2851

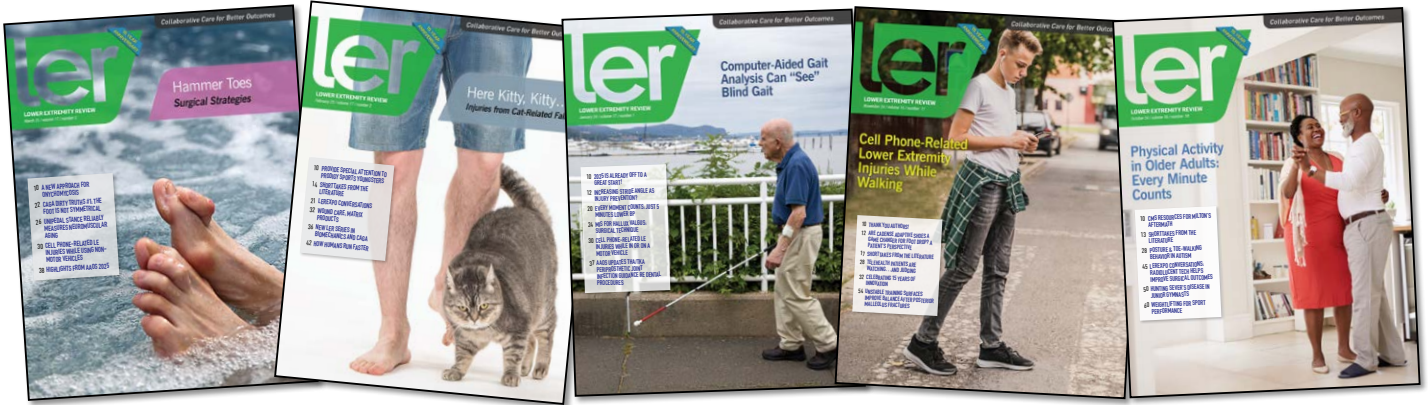
Please provide all information requested.

\*This offer is for healthcare professionals only. Limit one free sample per customer.

**PediFix**  
Medical Footcare

Please Support our Advertisers...  
Visit us online at [lermagazine.com](http://lermagazine.com)

Because of them, we are able to provide you with this  
unique, informative and invaluable magazine!



<b>Allard USA</b>	<b>23</b>	<b>lerMARKETPLACE</b>	<b>inside front cover</b>
800/289-3632	<a href="http://allardusa.com">allardusa.com</a>	518/221-4042	<a href="http://lerMARKETPLACE.com">lerMARKETPLACE.com</a>
<b>Arizona AFO</b>	<b>27</b>	<b>Orthotica Labs</b>	<b>6, 18</b>
877/780-8382	<a href="http://arizonaafo.com">arizonaafo.com</a>	888/895-1305	<a href="http://orthoticalabs.com">orthoticalabs.com</a>
<b>Footmaxx</b>	<b>4-5, 33</b>	<b>Pedifix</b>	<b>38</b>
800/779-3668	<a href="http://footmaxx.com">footmaxx.com</a>	800/424-5561	<a href="http://pedifix.com">pedifix.com</a>
<b>GaitRite</b>	<b>45</b>	<b>XSENSOR</b>	<b>8</b>
888/482-2362	<a href="http://gaitrite.com">gaitrite.com</a>	403/266-6612	<a href="http://xsensor.com">xsensor.com</a>
<b>Hospital for Special Surgery</b>	<b>34</b>	<b>The Western</b>	<b>11, 45</b>
<a href="http://tinyurl.com/3t5p38hv">tinyurl.com/3t5p38hv</a>		<a href="http://thewestern.org">thewestern.org</a>	
<b>lerEXPO</b>	<b>15</b>		
518/221-4042	<a href="http://lerEXPO.com">lerEXPO.com</a>		

# New & Noteworthy

Noteworthy products, association news, and market updates

## REVITALIGN MAIA SNEAKER FOR WOMEN



The Revitalign® Maia is a new women's athletic walking shoe offering comfort and style for daily use. The Maia sneaker is made with PURE WALKING technology offering advanced cushioning, articulated flex zones, and 360-degree orthotic support. The design includes an EVA midsole that enhances the lightweight comfort and stability of the shoe. The sneaker features computer 2-tone engineered Ortho-Stretch 3D knitted upper and stretch gore lace to provide superior support for both stretch and rebound. These materials are breathable to keep feet cool and comfortable and add support around the foot. Available now in a variety of stylish colors, the Maia offers dependable performance paired with the signature Revitalign® Full Contact Comfort® footbed designed for long-lasting support and relief. Plus, the slip-on design means the walking shoe can be easily taken on and off, and its forgiving design offers wearers relief from foot problems such as bunions.

### Waco Shoe Company

844/827-0439

WacoShoeCompany.com

## ORTHOTIST RECEIVES THE ACADEMY'S LIFETIME ACHIEVEMENT AWARD

Tom DiBello, LO, CO, is the recipient of the prestigious Titus Ferguson Lifetime Achieve-

ment Award, which was awarded during this year's Annual Meeting & Scientific Symposium of the American Academy of Orthotists and Prosthetists (The Academy). This honor is the highest recognition for an outstanding academician whose accomplishments and contributions have made a significant impact on the growth and development of the orthotics and prosthetics (O&P) profession.

DiBello has been actively practicing for over 40 years in the O&P field, and his primary interest is in the management of patients with lower limb disability and weakness. He has lectured extensively on lower extremity orthotics throughout the United States, Central and South America, Africa, China, and Southeast Asia. He is a Fellow of the Academy and received the Academy's Distinguished Practitioner Award in 2007.

## COLD AND HEAT FOOT THERAPY WRAP



Tuli's Foot Therapy Wrap is a versatile solution for relieving plantar fasciitis, heel pain, and foot fatigue using both cold and heat therapy. Designed for targeted relief, it reduces inflammation, soothes stiffness, and enhances comfort. Benefits include the following: Dual-therapy design provides both cold and heat therapy for versatile treatment options. The wrap is ergonomically shaped to contour to the heel and arch for targeted therapy. Made from high-quality, durable ma-

terials for long-lasting use. Simple to heat in the microwave or cool in the freezer for quick, convenient relief. Effectively alleviates symptoms of plantar fasciitis, heel pain, and foot fatigue. Cold therapy helps to calm swelling and irritation after a long day. Compact and portable, it's perfect for use at home, work, or on the go.

### Medi-Dyne® Healthcare Products

800/810-1740

medi-dyne.com

## ROBOTICS FOR ADAPTIVE GAIT TRAINING

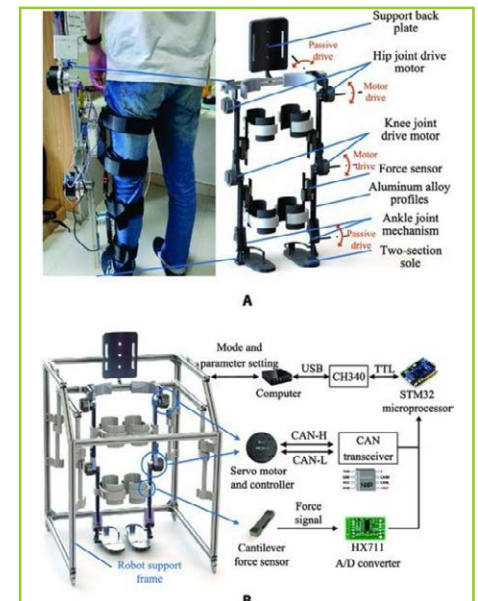


Image courtesy of Fuyang Yu, School of Artificial Intelligence, University of Chinese Academy of Sciences.

A gait training robot, developed through collaborative efforts from institutions including the University of Chinese Academy of Sciences and the Institute of Automation at the Chinese Academy of Sciences, is designed to significantly improve the safety and effectiveness of gait training through a novel method based on human-robot interaction force measurement: The robot dynamically adjusts its gait in real-time to match the user's intent and

capabilities, a significant shift from the more common, passive training approaches.

The innovation features an array of sensors and a sophisticated control system. These components work together to measure the forces exerted by a patient's movements and adjust accordingly, ensuring that the robot's support is neither too little nor too excessive. The core innovation lies in its adaptive gait training capability. By using face-to-face mounted cantilever beam force sensors, the robot can accurately detect and interpret the subtle forces exerted by the patient during a training session. This data informs a dynamic model that predicts and adapts the robot's movements in real-time, significantly enhancing the training's responsiveness and effectiveness.

Results from interactive experiments demonstrated that the robot could significantly improve the training experience by responding to the patient's muscle inputs. This adaptability not only maximizes engagement but also helps to prevent muscle atrophy and improves overall recovery outcomes. Moreover, this robot represents a promising solution for remote or underserved areas where professional medical and rehabilitation support may be scarce. Its ability to offer personalized training remotely could democratize access to high-quality rehabilitation services, making it a valuable tool in global health contexts.

### 3D-PRINTED FEMURS MAY ENHANCE BIOMECHANICAL STUDIES

Researchers at University of Texas (UT) Southwestern Medical Center have developed a breakthrough three-dimensional (3D) printing technique for generating realistic models of the human femur that could make it easier and less expensive to conduct biomechanical research. Though the work focused on replicating the femur and its unique mechanical properties, the process could be used in the future to build models of any human bone for research.

Collaborating with mechanical engineers



Weinschenk (left) and Richard Samade, MD, PhD, assistant professor of orthopedic surgery, biomedical engineering, and plastic surgery at UT Southwestern Medical Center, collaborated with mechanical engineers from UT Dallas on the research.

from UT Dallas, Robert Weinschenk, MD, assistant professor of orthopedic surgery and biomedical engineering at UT Southwestern, and the team used polylactic acid—an inexpensive, biodegradable polyester material commonly used in 3D printing—to construct a wide range of femur models with different physical attributes such as wall thickness and infill density. Those models were then tested for flexural strength using 3-point bending, and the results were compared to the biomechanical response of human femurs, enabling the team to identify the methodology that produced the most accurate replica.

Researchers at UT Dallas focused on the mechanical evaluation and characterization of the 3D-printed femur. “With 3D printing, we’re able to print out the femur bone with the same geometry of the femur inside the body,” said Wei Li, PhD, assistant professor of mechanical engineering at UT Dallas. “In our biomechanical tests, the femur performed as well as a human femur.”

### 3 RECEIVE PODIATRY MANAGEMENT LIFETIME ACHIEVEMENT AWARDS

Paul Kesselman, DPM, Lee C. Rogers, DPM, and Jeff Root were elected by Podiatry Management (PM) to receive Lifetime Achievement Awards, marking the first time 2 podiatrists tied for the honor. Kesselman is known for his expertise in billing, coding, and related aspects

of podiatry. Rogers co-founded the Amputation Prevention Centers of America. Root, who won in the category for non-podiatrists, is known for his passion for limb salvage and podiatric public health.

### ANKLE PLATING SYSTEM



The Arsenal Ankle Plating System™ consists of 37 anatomically designed plates throughout 9 plate families, offering a plating solution for any ankle fracture. The plates are stout where it matters and sleek where needed, which makes a difference when treating complex ankle and distal tibia fractures in the operating room. The variable angle locking technology, allowing a 60-degree cone of angulation and multi-lock functionality, accepting repeatable lock and relock of screw to plate interface, and dual lead screws makes for a powerful combination of patented and innovative solutions addressing all types of fracture personalities. This system features multiple solutions for malleoli fractures, including a modernized spin of the proven AO technique of tension band wiring. It also addresses intra-articular fracture patterns.

**Enovis**

800/336.6569

enovis.com

## 3-IN-1 MASSAGER FOR KNEE PAIN



Kneeflow is an at-home, personalized massaging device that can help with the recovery process, prevention, and relief. The device uses 3 methods to provide deeper penetration into joints, cartilage, and tissue for faster and more effective pain relief: Soft airbags massage the knee using a low-, medium-, or high-pressure mode to ease muscle tension; increase blood circulation; energize knee cells; and alleviate pain, inflammation, and swelling. Modes can be customized, based on a user's need, as relax, recover, or repair. Nineteen LED infrared lights provide healing red light to target damaged joints, reduce inflammation of ligaments and tendons, and improve blood circulation. A carbon fiber hot compress helps increase blood circulation in the knee with 3 temperature mode options—low 113°F (45°C), medium 122°F (50°C), and high 131°F (55°C). Kneeflow has an LCD touchscreen and is compact, portable, and cordless.

### Kneeflow

hello@flowkneemassager.com

flowkneemassager.com

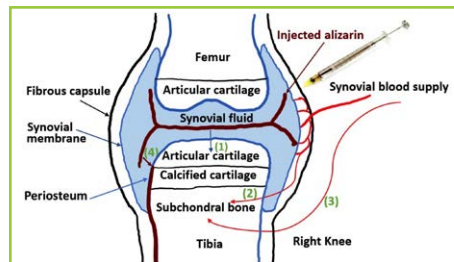
## TOOL LISTENS IN ON EARLY OA BIOCHEMICAL COMMUNICATION IN JOINTS

A fluorescent dye could help scientists listen in on biochemical conversations between cartilage and bone during the earliest stages of osteoarthritis (OA)—even before the disease causes

pain. The unexpected finding could someday lead to novel treatments for patients, according to research conducted on mice.

Bin Wang and colleagues at the Sidney Kimmel Medical College of Thomas Jefferson University wanted to know whether articular cartilage becomes calcified early in OA, so they studied a mouse model in which the right knee exhibits symptoms similar to the human disease. A fluorescent red dye called alizarin complexone binds calcium-containing crystals, and the researchers injected this dye into both knees. Surprisingly, there was no fluorescence staining on the surface of the articular cartilage layer—where the team expected to find new calcification—in early OA stages.

The tidemark area, a barrier between the articular cartilage and a layer of calcified cartilage that resides on the bone was stained in both knees. “But we found more of the alizarin dye in the calcified cartilage and subchondral bone in osteoarthritic mice compared to control,” said Wang. Increased diffusion of the dye suggests that the early-OA knee joint is more permeable than the control.



The fourth diffusion route is a novel diffusion direction showing that alizarin complexone can pass into the periosteum in the marginal transitional zone of the tidemark.

With an injection, dye first goes directly into the synovial fluid that cushions the joints. In additional experiments, the researchers found that the dye could then move throughout the joint via 3 expected pathways. However, they also observed a fourth, brand-new pathway into the blood vessels in the outer covering of the bone, called the periosteum, via the tidemark. The fluorescence signal was greater in the periosteum, as well as in the subchondral bone of early-OA mouse joints than in controls.

## IB LAB FROG: AI FOR RADIOLOGICAL/ ORTHOPEDIC ASSESSMENTS



IB Lab FROG is an artificial intelligence (AI) module that offers a comprehensive suite of automated measurements on X-rays, designed for radiological and orthopedic foot assessments. IB Lab FROG covers key foot pathologies and delivers clinicians accurate, standardized data for diagnosing and managing foot disorders. Its automated measurements are based on radiological and orthopedic standards, significantly enhancing consistency, standardization, and precision in foot diagnostics. The results are presented in a format that allows easy review by healthcare professionals. The comprehensive report can be accessed through any certified medical DICOM viewer, allowing seamless integration into existing clinical workflows. IB Lab FROG surpasses currently available algorithms by offering a comprehensive set of 17 measurements across 5 use cases, transforming the way clinicians assess foot conditions.

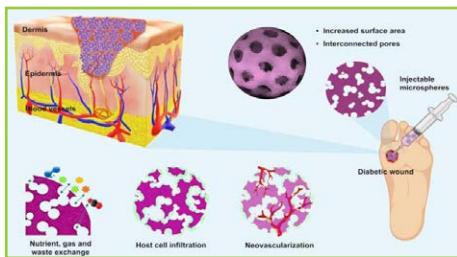
### Image Biopsy

info@imagebiopsy.com

imagebiopsy.com

## PROMISING NEW TREATMENT FOR DIABETIC WOUNDS

Researchers at the Terasaki Institute for Biomedical Innovation (TIBI) have developed a revolutionary injectable granular filler that could transform the way diabetic wounds are treated, potentially improving patient outcomes. The research team from TIBI and the University of Nebraska Medical Center



Graphical abstract of the new treatment courtesy of TIBI and UNMC.

(UNMC) developed a novel method combining electrospinning and electrospraying technologies to create porous, granular nanofibrous microspheres (NMs). These microspheres, made from biocompatible materials including poly(lactic-co-glycolic acid) (PLGA) and gelatin, can be easily injected into wound sites, making the treatment minimally invasive. .

This highly advanced approach from current treatments may potentially improve healing outcomes in a short period of time, said principal investigator Johnson John, PhD, an assistant professor at TIBI.

The study presented several significant advances in the wound-healing process. For example, the newly developed dermal fillers with tunable porous microstructures demonstrated remarkable cell migration and granulation tissue formation, and neovascularization. Moreover, the dermal fillers showed enhanced strength, and maintained their shape during the minimally invasive injection process.

Perhaps most notably, the research demonstrates promise in promoting 3 crucial aspects of wound healing: host cell infiltration, formation of new blood vessels, and skin regeneration. These findings suggest that the treatment could significantly improve healing outcomes for diabetic wounds.

## ENGINEERED CARTILAGE FROM SEPTUM CELLS HELPS TREAT KNEE INJURIES

Researchers at Switzerland's University of Basel and University Hospital Basel are developing cartilage implants using cells from

the patient's nasal septum and then allowing them to multiply in the laboratory on a scaffold made of soft fibers. Finally, the newly grown cartilage is cut into the required shape and implanted into the knee joint. Their work shows that giving these cartilage implants more time to mature significantly improved clinical efficacy, even in patients with complex cartilage injuries. This suggests that the method could also be suitable for the treatment of degenerated cartilage in osteoarthritis. Earlier studies have already shown promising results.

In a clinical trial involving 98 participants at clinics in 4 countries, the researchers compared 2 experimental approaches. One group received cartilage grafts that had matured in the lab for 2 days before implantation—similar to other cartilage replacement products. For the other group, the grafts were allowed to mature for 2 weeks, during which time the tissue acquires characteristics similar to native cartilage.



Human articular cartilage defects can be treated with cells taken from the nasal septum. Photo courtesy of University of Basel, Christian Flierl.

For 24 months after the procedure, the participants self-assessed their well-being and the functionality of the treated knee through questionnaires. While both groups showed a clear improvement, patients who received more mature engineered cartilage continued to improve even in the second year following the procedure, overtaking the group with less mature cartilage grafts. The more mature cartilage grafts also resulted in better tissue composition at the site of the implant, and even of the neighboring cartilage. The additional maturation time of the implant only requires a slight increase in effort and manufacturing costs, and gives much better results.

## RELAXATION COMPRESSION BOOTS



SoleFlux Relax Compression Boots are designed to effectively relieve leg pain and discomfort. The boots utilize intermittent pneumatic compression (IPC) technology, which simulates manual massages to enhance blood circulation and alleviate various symptoms: These air compression leg massager boots help reduce muscle soreness and tension, particularly after exercise, by improving blood flow and accelerating recovery. They are beneficial for individuals with conditions like varicose veins, as they stimulate blood flow, delivering essential nutrients and oxygen to the muscles. Improved blood circulation could help the body heal faster and become revitalized. The gentle compression helps push excess fluid back toward the heart, effectively reducing swelling and discomfort associated with conditions like lymphedema. Benefits include relief from pain and itching, enhanced recovery, improved circulation, and relaxation and comfort.

### Ublives

support@ublives.com  
ublives.com

## Common questions & misconceptions about protein supplementation

What does the scientific evidence really show?

Designed by @YLMSportScience

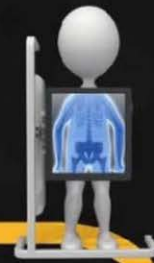
**1** There is no evidence that consuming dietary protein harms the kidneys of otherwise healthy individuals



**2** In exercise-trained men and women, consuming a high-protein diet either has a neutral effect or may promote the loss of fat mass



**3** There is no evidence that dietary protein has a harmful effect on the bones



**4** Vegans and vegetarians can consume enough protein to support training adaptations



**5** Cheese and peanut butter are inadequate sources of protein



**6** Red meat does not likely cause unfavorable health outcomes; however, processed meat may cause potential harm (e.g., increased cardiovascular disease risk)



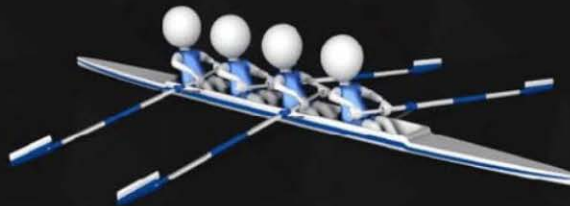
**8** Protein ingestion following ( $\leq 1$  hour) resistance training sessions is not an absolute requirement to produce an anabolic environment. What appears more important is the total daily amount of dietary protein consumed

**7** Individuals who are not physically active still need dietary protein

**9** Endurance athletes need additional protein (i.e., at least twice the RDA) to assist in a variety of issues related to the adaptive response to exercise.



**10** One does not need protein powder to meet the daily requirements of exercise-trained individuals. However, treating protein powder differently than typical protein foods (e.g., beef, chicken, milk, etc.) does not make scientific sense



**11** For most individuals, consuming 20–30 grams of high-quality protein is sufficient to induce a significant anabolic response; nonetheless, there is data to suggest that 100 grams can elicit a higher and more prolonged anabolic response

Reference: Antonio et al. JISSN 2024

**Source:** Antonio J, Evans C, Ferrando AA, Stout JR, Antonio B, Cintineo HP. Common questions and misconceptions about protein supplementation: what does the scientific evidence really show? Journal of the International Society of Sports Nutrition. 2024;21(1):2341903. <https://doi.org/10.1080/15502783.2024.2341903>



**THE WESTERN**  
Foot and Ankle Conference

**REGISTER  
NOW** at  
thewestern.org

# THE 2025 WESTERN

**JUNE 19-22**

## FOOT AND ANKLE CONFERENCE

### WELCOME BACK TO 100%

#### In-Person Meetings and Exhibits!

- **General Sessions** offering 26 CECH for DPMs – get more for your money!
- **On-Demand Fluoroscopy course** adding 4 fluoroscopy/radiology CECH included for all DPMs
- **Engaging Exhibit Hall** with even more vendors to visit over 3 days, including hands-on Innovations Hub booths and Mobile Labs
- **Risk Management program** for your PICA discount
- **2-Day program for Medical Assistants** covering front and back office – 1 day administrative, 1 day of clinical hands-on training!
- Brand new **mobile app** for an enhanced experience - no attendee login required!
- **Amazing discounts** on hotel reservations
- **Discounts** on theme park tickets for your family

**Visit [TheWestern.org](http://TheWestern.org)  
for more information  
and to register.**



**DISNEYLAND®**  
**HOTEL &** CONVENTION CENTER  
ANAHEIM, CA

**PICA**  
A ProAssurance Company

**DPMS GET  
15% OFF**

their PICA Renewal  
Premiums by  
attending the risk  
management  
sessions

