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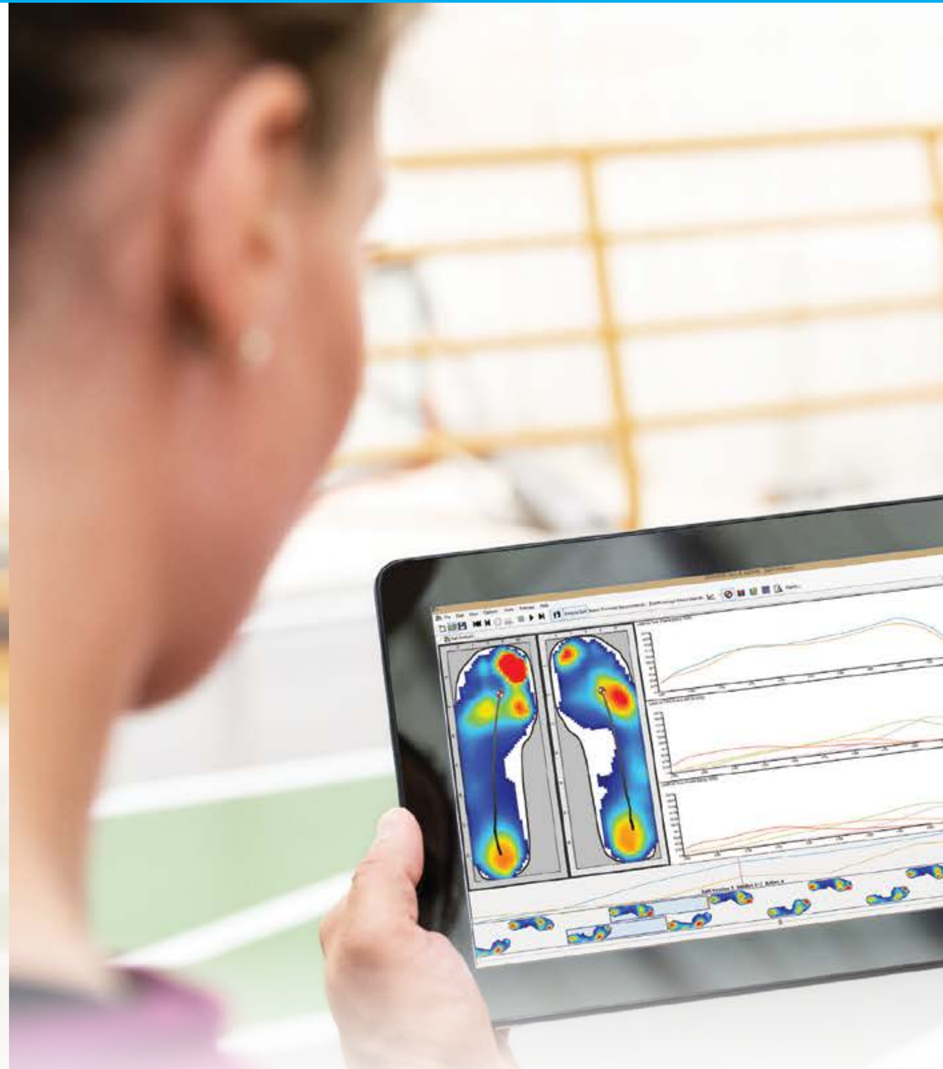

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Lower Extremity Review Mission

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

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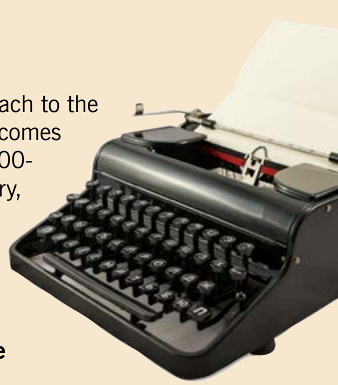

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INCIDENCE OF AND RISK FACTORS FOR HOSPITALIZATIONS AND AMPUTATIONS FOR PEOPLE WITH DFU

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Diabetic Foot Ulcers (DFU) are a serious complication of diabetes and often lead to hospitalizations. This study sought to assess the incidence, risk factors and length of stay for hospitalizations, with and without amputations. Among 4709 people with DFU in Queensland (median age, 63 years, 3275 men, type 2 diabetes, DFU-related hospitalizations were recorded for 977 people : 669 without amputations (68.5%), 258 with minor amputations (26.4%), and 50 with major amputations (5.1%). The incidence of first DFU-related hospitalizations was 50.8 per 100 person-years lived with DFU before healing, death, or loss to follow-up. The incidence of first DFU-related hospitalization with no amputation was 39.0 with minor amputation, 18.0 and with major amputation 5.3 per 100 person-years with DFU. The median length of stay for DFU-related hospitalizations was 6 days with no amputations, 10 days with minor amputations, and 19 days with major amputations. The incidence of DFU-related hospitalizations among people with DFU was high, and most did not involve amputations. These findings could assist services to determine which people with DFU would benefit most from intensive interventions, potentially averting large numbers of diabetes-related hospitalizations.

***Source:** Zhang Y, Cramb SM, McPhail SM, et al. The incidence of and risk factors for hospitalisations and amputations for people with diabetes-related foot ulcers in Queensland, 2011-19: an observational cohort study. Med J Aust. 2025 4;223(3):149-158. doi: 10.5694/mja2.52703.*

ASSESSMENT OF PERONEAL MUSCLES USING ULTRASOUND IN CAI

Ultrasound imaging was conducted in side-lying, bilateral standing, and single leg standing positions. (a) Side lying position: This setup shows the peroneal muscles imaged in a non-weight bearing state in side-lying position. (b) Single-leg standing: This image captures the peroneal muscles during weight bearing in single leg standing. Similar position was use for bilateral standing with both feet planted with an equal distribution of weight on both limbs. (c) Probe placement: The ultrasound linear transducer is positioned at 50% of the fibular length, measured from the midpoint between the fibular head and the lateral malleolus. (d) Cross-sectional area measurement: The cross-sectional area (CSA) of the peroneal muscles is measured along the fascial borders indicated by a yellow line.

Lateral ankle sprains (LAS) result in chronic ankle instability (CAI), causing ongoing instability. Although peroneal muscle weakness is documented in CAI, surface electromyography shows similar activation patterns between CAI and healthy individuals, suggesting structural rather than neural deficits. Ultrasound imaging (USI) uniquely enables noninvasive assessment of muscle morphology and quality through cross-sectional area and echogenicity measurements. However, previous USI studies examined peroneals only in non weight-bearing positions, potentially missing functional deficits. This study examines peroneal muscle characteristics in CAI versus healthy individuals specifically during weight-bearing functional positions using USI.

A case-control study was conducted with 58 participants (29 CAI and 29 healthy controls), aged 18-30 years. Cross-sectional area

(CSA), echogenicity (grayscale analysis where higher values indicate fatty infiltration/fibrosis), and functional activation ratio (FAR) of the peroneal muscles were assessed using USI in non weight-bearing (side lying) and weight-bearing positions. CSA images were averaged from 3 measurements for each position. The CAI group had significantly smaller CSA in BLS ($P < 0.01$) and SLS ($P < 0.01$) but not lying ($P = 0.06$), higher echogenicity indicating poorer muscle quality (69.7 ± 10.3 vs. 61.3 ± 7.0, $P < 0.01$), and lower FAR in both BLS (0.99 ± 0.13 vs. 1.13 ± 0.16, $P < 0.01$) and SLS (1.01 ± 0.17 vs. 1.12 ± 0.22, $P = 0.03$) compared to healthy controls. Individuals with CAI showed reduced peroneal muscle CSA, lower activation, and poorer muscle quality specifically in weight-bearing positions compared to healthy controls. These findings suggest altered muscle function in CAI especially in functional weight-bearing positions. This demonstrates the need to assess peroneals in functional weight-bearing position compared to resting.

Source: *Jaffri A. Functional assessment of peroneal muscles using ultrasound imaging in chronic ankle instability. J Foot Ankle Res. 2025;18(4):e70088. doi: 10.1002/jfa2.70088.*

THE EFFECT OF FOOT ORTHOTICS ON DYNAMIC STABILITY IN FEMALES WITH PES PLANUS FOOT POSTURE

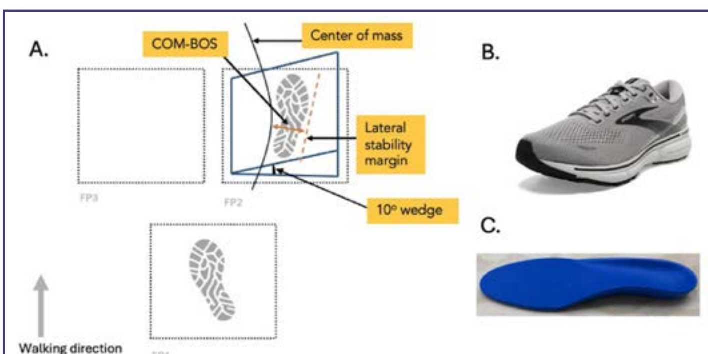

Fig. 1. An example of the walking trajectory, lateral stability margin, and wedge that altered the stepping orientation of the foot placement during the stance phase of gait (A). The 10-degree wedge is increasing ankle eversion in this illustration. The foot orthotics (C) were inserted into the Brooks Ghost shoes (B) for all orthotics conditions.

Foot orthotics, a device which can modify the mechanical interaction between foot and the external environment, are commonly prescribed for individuals with pes planus foot postures. The purpose of this study was to investigate the role of foot orthotics on controlling dynamic stability when females with pes planus foot posture experience a modified foot placement orientation during walking.

Kinematic data were collected from 18 healthy young females (21.8 ± 3.2years) walking in prefabricated foot orthotics under 3 different stepping orientations. Outcome measures included gait parameters and dynamic stability.

Results suggest that changing the orientation of the foot significantly challenges the balance control system, as evidenced by a reduction in step length, increased step width, and increased antero-posterior center of pressure of support (AP-COP) maximums. In orthotics, inverting the foot significantly reduced the center of mass-base of support (COM-BOS) range and AP COM-COP maximum whereas everting the foot increased the AP COM-COP maximum

As the foot becomes more flexible the reduction in COM-BOS range suggests an increased balance control resolution when walking in foot orthotics.

Source: *Robb KA, Tameer R, Crowley P, Perry SD. Investigating the effect of foot orthotics on dynamic stability in females with pes planus foot posture. Gait Posture. 2026;124:110057. doi: 10.1016/j.gaitpost.2025.110057.*

EFFECT OF FOOT ORTHOSES ON PERSONS WITH POSTERIOR TIBIALIS TENDON DYSFUNCTION STAIR CLIMBING

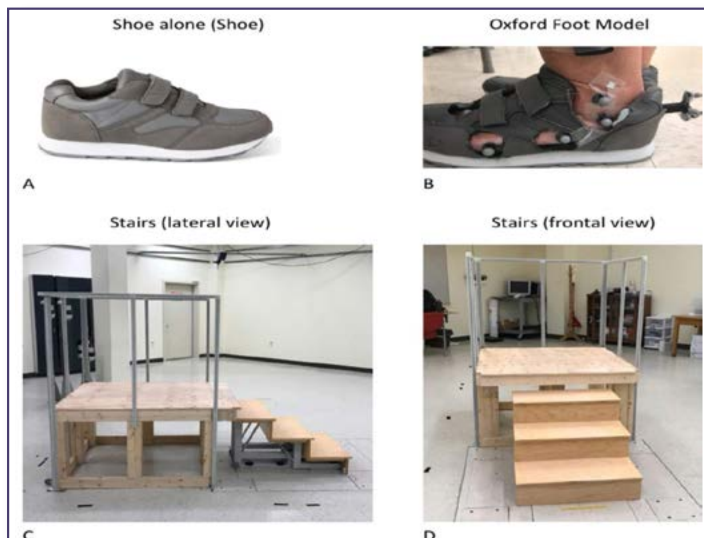

Fig. 1 Panel A shows the neutral athletic shoe worn by participants during all conditions. Panel B shows the kinematic markers attached to the lateral and posterior parts of the foot. Panel C and D respectively show the lateral view and frontal view of the instrumented stairs used in this study.

Posterior tibialis tendon dysfunction is a chronic musculoskeletal disorder characterized by a progressive flatfoot deformity which negatively impacts health-related quality of life. Custom foot orthoses modify walking biomechanics in individuals with posterior tibialis tendon dysfunction, but no studies have investigated their effects on stair climbing biomechanics in this population. This cross-sectional study aimed to compare the effects of prefabricated foot orthoses and 2 models of custom foot orthoses on the biomechanics of individuals with posterior tibialis tendon dysfunction during stair climbing.

Fourteen individuals with painful posterior tibialis tendon dysfunc-

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tion were recruited to undertake a stair climbing task under 4 experimental conditions: shoes alone, prefabricated foot orthoses, neutral custom foot orthoses and custom varus foot orthoses with a 5° medial wedge and a 4 mm medial heel skive. Hip, knee, ankle and foot angles and moments were compared between conditions, using one-dimensional statistical non-parametric mapping.

Forefoot dorsiflexion was decreased for neutral custom foot orthoses compared to shoes ($P < 0.001$). Both custom foot orthoses decreased hindfoot eversion compared to shoes ($P < 0.001$). Greater ankle eversion moments were observed for both custom foot orthoses compared to shoes ($P < 0.001$) and prefabricated foot orthoses (neutral custom: $P < 0.001$).

Neutral custom and custom varus foot orthoses seem appropriate to attenuate biomechanical deficits in individuals with posterior tibialis tendon dysfunction. Longer-term effects of foot orthoses on lower limb biomechanics and clinical meaningfulness of these changes remain to be determined.

Source: *Chicoine D, Moisan G, Bouchard M, Laurendeau S, Belzile É, Corbeil P. Effects of prefabricated and custom foot orthoses on the biomechanics of the lower limbs of individuals with a posterior tibialis tendon dysfunction during stair climbing. Clin Biomech (Bristol). 2025;127:106602. doi: 10.1016/j.clinbiomech.2025.106602.*

ELECTRICAL STIMULATION: NOVEL THERAPY FOR DIABETIC FOOT ULCERS

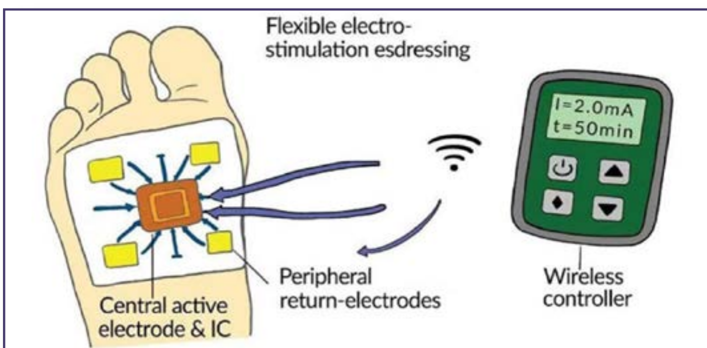

Fig. 1. A remotely controllable advanced dressing comprising a central section and a peripheral section. The central section houses an active electrode and an on-board control unit capable of receiving external commands to deliver programmable electrical stimulation. The peripheral section contains 4 reference electrodes that, together with the active electrode, complete the current loop and generate a uniformly distributed directional electric cue across the wound bed.

Diabetic foot ulcer (DFU) is one of the most severe complications of diabetes; its healing is typically protracted and marked by a high rate of recurrence. In recent years, electrical-stimulation (ES) therapy has emerged as a novel adjunct to conventional approaches such as debridement, negative-pressure wound therapy, and moist dressings. By applying an exogenous electric field that mimics the skin's endogenous wound currents, ES provides directional cues for cells and signaling molecules involved in repair, guiding them toward the wound bed. The external field reconstructs the bioelectric landscape, inducing oriented migration and proliferation of keratinocytes, fibroblasts, and endothelial cells, while up-regulating factors such as HIF-1α and VEGF to relieve local ischemia and promote neovascularization. Cathodal currents can also dampen the inflammatory cascade and facilitate the shift of macrophages from the M1 to the pro-healing M2 phenotype. The advent of nanogenerators, conductive hydrogels, and wireless "smart" bandages is gradually freeing ES from hard-wired leads, paving the way for home-based, closed-loop wound care.

Source: *Liu Y, Liu X, Lu J, Jiang Y, Wu J. Electrical stimulation: a novel adjunct therapy for diabetic foot ulcers. Front Clin Diabetes Healthc. 2026 7;6:1682871. doi: 10.3389/fcdhc.2025.1682871.*

THE NEUROMECHANICS OF THE SOLEUS FOR FALL PREVENTION IN AGING

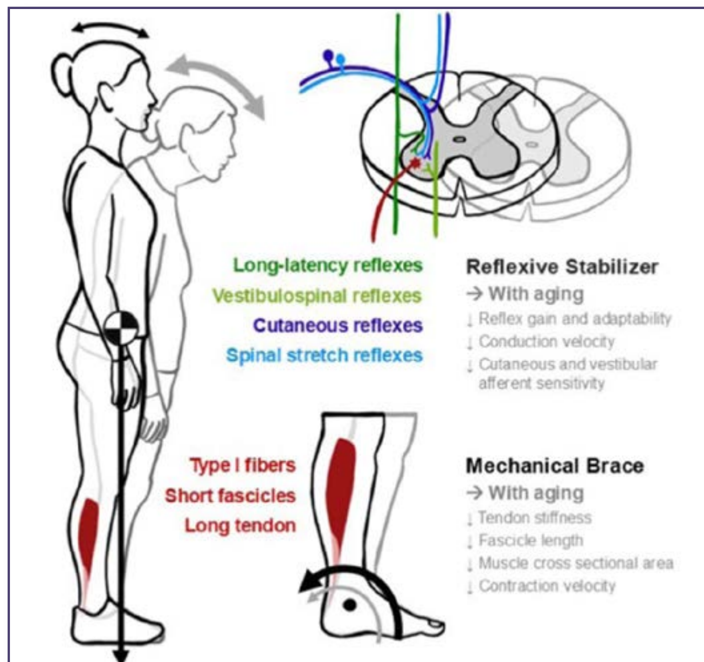

Fig. 1. Neuromechanics of the soleus in quiet stance and aging. Schematic overview illustrating how the soleus functions as both a mechanical brace and reflexive stabilizer of standing balance. With the body's center of mass (COM) lying anterior to the ankle, a continuous plantarflexor moment from the soleus counteracts the forward torque (black arrow: young adult; gray arrow: older adult)

Falls are a leading cause of injury-related hospitalization, morbidity, and mortality in older adults, with impaired postural control serving as a key predictor of fall risk. The triceps surae, and particularly the soleus, plays a central role in maintaining upright stance by generating continuous plantarflexion moments that stabilize the body's center of mass. This summarizes evidence for the neuromechanical contributions of the soleus to postural stability and how these functions decline with age. Mechanically, the soleus acts as a brace for balance, providing sustained torque

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through fatigue-resistant type I fibers and a compliant Achilles tendon that buffers perturbations and contributes to ankle stiffness. Age-related reductions in tendon stiffness and rate of torque development compromise these stabilizing properties, increasing fall susceptibility. When passive stiffness is insufficient, the soleus compensates through active contraction, trading energy cost of activation for joint stability. Reflexively, the soleus serves as a stabilizer of balance through strong coupling to spinal, cutaneous, vestibular, and transcortical pathways that rapidly adjust muscle activation in response to perturbations. These reflex mechanisms also degrade with aging, leading to delayed, less adaptable responses. Together, age-related mechanical and neural deterioration reduce the soleus' ability to sustain balance and contribute to fall recovery. Preserving soleus strength, tendon stiffness, and reflex adaptability through targeted neuromuscular and perturbation-based training may represent an underrecognized but effective strategy to mitigate fall risk and maintain postural control in older adults.

Source: *Fletcher JR, Strzalkowski NDJ. The neuromechanics of the soleus for fall prevention in aging. Front Physiol. 2026;16:1743559. doi: 10.3389/fphys.2025.1743559.*

PERCUTANEOUS ELECTROLYSIS FOR MUSCULOSKELETAL DISORDERS IN REHAB

Percutaneous electrolysis (PE) is a minimally invasive procedure that utilizes galvanic current delivered through a needle. PE is increasingly employed for musculoskeletal disorders, despite the scarcity of scientific evidence supporting its use. The aim of this systematic review is to synthesize the existing evidence and explore the applications of PE in rehabilitation. In line with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, a systematic search was conducted across the PubMed, Web of Science, Scopus, and PEDro databases from inception to July 2025. The search strategy employed the term "Percutaneous Electrolysis" without applying additional filters or time restrictions, ensuring a comprehensive search. The evidence suggests that PE appears effective in reducing pain and improving function, particularly when combined with exercises such as eccentric training or stretching, though inconsistencies in protocols and patient characteristics, along with unclear mechanisms, show that it warrants further investigation. In conclusion, while PE emerges as a promising therapeutic strategy for musculoskeletal disorders, its full integration into rehabilitation practice necessitates further rigorous research to standardize treatment protocols, elucidate the underlying mechanism, and validate its cost-effectiveness. These steps are essential to establish PE as a robust and evidence-based option within the field of rehabilitation.

Source: *Pirri C, Manocchio N, Sorbino A, Pirri N, Foti C. Percutaneous electrolysis for musculoskeletal disorders management in rehabilitation settings: a systematic review. Healthcare (Basel). 2025 23;13(15):1793. doi: 10.3390/healthcare13151793.*

MITOCHONDRIAL TRIFUNCTIONAL PROTEIN DEFICIENCY MASQUERADING AS CHARCOT-MARIE-TOOTH DISEASE

Mitochondrial trifunctional protein deficiency (MTPD) is an inherited disorder of fatty acid β-oxidation caused by mutations in HADHA or HADHB genes. It typically presents with cardiomyopathy or hepatic failure in early childhood; however, it may rarely present in adulthood with the neuromyopathic form. Researchers describe a patient with MTPD with isolated neuropathy mimicking Charcot-Marie-Tooth disease (CMT) as the first and only presenting symptom. Clinical and electrophysiological examinations were conducted, including nerve conduction studies, needle electromyography, muscle and nerve biopsies. The diagnosis was confirmed with genetic testing and enzymatic analysis of cultured skin fibroblasts. Researchers report a 40-year-old man diagnosed with axonal CMT2 in childhood. He had pes cavus and hammer toes, mild distal lower limb weakness, and loss of vibration sense with areflexia. He later developed fatigability, improved exercise tolerance with alcohol and an episode of chest infection causing neurological decompensation without evidence of rhabdomyolysis. Neurophysiology showed non-length-dependent axonal sensorimotor neuropathy without myopathic features. Genetic testing confirmed that he was compound heterozygous for two HADHA variants, one of them novel, and enzymatic analysis of cultured skin fibroblasts confirmed MTPD. Researchers report a very rare isolated neuropathic phenotype of MTPD and confirm the pathogenicity of the novel variant c.1003G>A, p.(Glu335Lys). This case also highlights the need for HADHA and HADHB to be included in neuropathy gene panels as MTPD may present as CMT. Given that dietary management may prevent some complications of MTPD, achieving a diagnosis early is important.

Source: *Qaiser F, McHugh J, Mullins G, et al. Mitochondrial trifunctional protein deficiency due to hadha variants masquerading as charcot-marie-tooth disease. J Peripher Nerv Syst. 2025;30(3):e70048. doi: 10.1111/jns.70048.*

Closing the Loop on "Frequent Flyers"

My Structured Post-Wound Healing Protocol to Prevent Reulceration, Hospitalization, and Amputation in Diabetic Patients

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By Mikel D. Daniels, DPM, MBA, President and Chief Medical Officer, WeTreatFeet Podiatry

I used to think that my job ended when the wound closed. Document the healing, schedule a routine follow-up, and move on to the next case. But after over 2 decades managing diabetic foot wounds at high volume, I've learned that the months immediately following epithelialization are (counterintuitively) when my patients need me most.

The "frequent flyers" in my practice are diabetic patients who cycle in and out: ulcer, healing, discharge, recurrence, ulcer again. Some have already lost part of a foot to amputation. Others carry multiple comorbidities–vascular disease, renal insufficiency, and poor glycemic control. These are the patients who have the deck stacked against them. Their decline follows a predictable path. Without a rigorous, closed-loop post-healing protocol, these patients almost always reulcerate. Studies show that reulceration rates hover around 40% at 1 year and up to 65% at 5 years [1]. Hospitalization for cellulitis or abscess becomes routine. Amputation often feels inevitable.

But it doesn't have to be.

The Multidisciplinary Foundation

My turning point came when I stopped viewing post-wound care as a solo endeavor. Now, every healed foot receives regular scheduled touchpoints with a dedicated team. The team includes me as I often think of myself as a traffic cop for these patients as I direct them to other specialists. It also includes a specialist on bracing, offloading, and footwear (usually me, but recommend a good pedorthist if you can't do it), a vascular surgeon (all they do is turn back the clock; the disease progresses and they must follow up before the next catastrophe), and a diabetes specialist to manage blood sugar, diet, and other cardiovascular concerns.

The published evidence supports this approach decisively. Multidisciplinary teams reduce major amputation rates by 50–80% compared to usual care, and they systematically lower reulceration risk [2]. I schedule high-risk patients (those with prior ulcers, amputations, severe neuropathy, or significant arterial disease) for in-person visits at a minimum of every 3 months, not just annually, for a regular diabetic foot exam. For lower-risk patients, every 6 months is the minimum to which I'll commit. Telemedicine can also fill the gaps, as often these patients have transportation issues. This is also useful for remote wound checks and educational reinforcement. While it cannot replace the clinical foot exam, the muscle testing, the palpation of pedal pulses, or the careful inspection of shoe wear patterns, it is a stopgap for some patients.

Risk Stratification and Active Surveillance

At each visit, I perform a standardized foot risk assessment. I test for loss of protective sensation using the 5.07 monofilament, vibration perception with a 128 Hz tuning fork, and light touch. I look closely for new callus formation, nail pathology, fungal infection, swelling, and any sign of pressure ulceration. I palpate for pedal pulses and assess skin temperature and color. I have been utilizing the LEAP protocol from Arche Healthcare, and I find it an invaluable addition to my practice[3].

When I have a patient with findings that put them in the high-risk category, such as those with complete loss of sensation, absent pulses, or significant deformity, I do more than just note them. I act! I increase visit frequency. I may order imaging or vascular studies. I flag the patient for preventive interventions. I make sure they have the correct shoes, inserts, offloading, and compression if needed. This proactive stance has been central to reducing crisis presentations and emergency amputations in my patient population.

The Power of Patient Education and Habit Formation

I have learned that knowledge alone does not prevent ulcers. Instead, I focus on building daily habits. Every patient receives a printed foot-care protocol and website references they can use at home. They learn to inspect their feet each morning and evening, checking for cuts, blisters, redness, or swelling. I tell these patients that nothing new on their feet is good; we need to know about it before it turns bad. They learn to feel the inside of their shoes before putting them on (a surprisingly effective screen for hidden dangers, and it's free!). They are provided our direct phone number and our on-call number and told explicitly to call if they notice anything amiss.

The ones who succeed are those who treat daily foot inspection like brushing their teeth or washing their hair, and this is non-negotiable. The ones who slip back into old habits, such as going barefoot, ignoring small redness, waiting to see if something gets better, are the ones who recur. I've learned to ask patients not just whether they inspect their feet, but how many times last week they did so. The gap between intention and behavior is where regulation happens.

Footwear and Offloading: The Bedrock of Prevention

Here is where most practitioners fall short, in my experience. If patients leave your office with a prescription for "diabetic shoes" and nothing else, that is insufficient.

What I do instead is provide the durable medical equipment myself. I prescribe custom-molded, pressure-relieving inserts, with appropriate either over-the-counter or custom footwear. These are fitted in my office. Like anything these days, there are a few insurances that I can't do this, and I have to refer to a specialized clinic. Either way, the shoe is measured against the patient's foot and gait pattern. High-risk zones, like a prominent first metatarsal head following ulceration, receive extra cushioning or depth accommodation. For patients with recurrent plantar ulcers or amputations, I may prescribe non-removable offloading devices (removable cast walkers or removable total contact 3D printed casts during the highest-risk window). When patients get their equipment elsewhere, I tell them to bring it in so we can examine (and if needed, adjust) it to meet my standards.

Crucially, I ask the patient to bring the shoes to every follow-up visit. I inspect them for wear patterns, areas of breakdown, delamination, or compression. We educate the patient on shoe inspection and replacement schedules. We adjust inserts as needed. We reinforce wearing the prescribed shoes every day, not just for special occasions.

The data on this are robust. Patients wearing appropriate offloading footwear experience roughly a 50% reduction in reulceration compared to standard care[4]. When combined with patient adherence to daily inspection and rapid reporting of changes, the effect is synergistic.

Vascular Assessment and Optimization

Let me start by saying I love my vascular colleagues! Diabetic patients with significant peripheral arterial disease face a far grimmer prognosis after foot wounds. Ischemia impairs healing and increases infection risk. If I detect absent pedal pulses, cool feet, or slow capillary refill, I do not assume the wound will heal unaided. I involved them immediately.

I coordinate vascular imaging, typically starting with an ankle-brachial index (ABI) and follow up with an arterial duplex ultrasound. I do this as a first step, not after I encounter a problem. If the ABI is borderline (<0.9 or >1.4) or if vascular history suggests chronic ischemia, I refer to our vascular surgery colleagues for further evaluation and, when appropriate, revascularization. Successful vascular treatments can transform a patient's trajectory from amputation toward limb preservation and healing.

Selective Preventive Surgery

For certain patients, anatomical deformity is the primary culprit for recurrence. I am thinking of a patient with severe claw toes, creating a prominent first metatarsal head or plantar MPJ wound, or a Charcot foot with rocker-bottom deformity that concentrates pressure on the plantar arch. In these cases, I do offer elective surgical corrections. This may include tendon lengthening, minor bone resections, and osteotomies, and if indicated, arthrodesis. This is sometimes done with an open wound that won't heal, or during the window of time when the foot is healed, infection-free, and vascular status is stable. I am always careful and tell myself that making a new wound to heal an old wound is always problematic.

These are not emergency procedures. They are planned, prophylactic interventions, often performed in an outpatient setting. The surgical risk is low when done in the right patient at the right time. And the payoff, like elimination of a specific high-pressure ulcer site, can be profound. Patients who undergo preventive foot surgery alongside the other elements of my protocol experience markedly lower recurrence rates than matched controls.

Glycemic Control and Systemic Management

I cannot heal a diabetic foot in a vacuum. If a patient's HbA1c is 10% or higher, wound healing will be slow, infection risk will climb, and reulceration will follow[5]. I work closely with the primary care team and endocrinology to optimize glycemic control. This includes targeting an HbA1c of 7–8% in most diabetic patients, being cautious not to overcorrect and cause hypoglycemia, which paradoxically also impairs wound outcomes[6].

Similarly, I work with my medicine colleagues to address other systemic factors: blood pressure, lipid levels, renal function, and nutritional status. Patients with severe renal disease or malnutrition are at sky-high risk for poor wound outcomes. I screen for these conditions and escalate care when needed.

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Documentation, Tracking, and Continuous Quality Improvement

Every interaction is documented in a standardized way. I record the location and size of any previous ulcers, current risk category, footwear status, whether the patient met their inspection and care goals, and any new findings or interventions. I track reulceration rates, hospitalizations, and amputations in my patient cohort. This has been aided greatly by the use of Ambient AI Technology.

Quarterly, I review these metrics. Are reulceration rates rising? I look for patterns, such as whether certain cohorts (eg, patients with prior amputation) are doing worse. Are there discernible patterns in these patients, such as those who stop coming to appointments or who don't wear their shoes? I use these insights to refine my protocol, reach out to high-risk patients, and sometimes adjust.

This closed-loop mindset–measuring, reflecting, adjusting–is what separates practices that merely comply with guidelines from those that actually achieve better outcomes. I tell my patients how the population is doing during their visits. Many of them will discuss this with friends and family who don't receive this care. One guess where they often end up!

The Psychosocial Piece

Finally, I have come to recognize that the feet I treat are attached to whole humans. A patient struggling with depression is less likely to inspect their feet daily. A patient with unresolved trauma from prior amputation may sabotage their own care out of despair. A patient with limited health literacy may not understand the difference between a blister and the start of an ulcer. Patients who are socioeconomically challenged might not be able to afford higher-quality foot care, medicine, or even transportation to the office for appointments.

At each visit, I screen for depression using a brief tool. I ask about social support, barriers to care, and adherence challenges. For patients flagged as high-risk, I proactively offer referrals for mental health support, social work, and peer support groups. I do fall screening to prevent traumatic wounds, and spend time doing balance and gait training if indicated. I have seen these "soft" interventions transform outcomes.

Closing the Loop

The metaphor of "frequent flyers" is how I think about my patients who cycle through emergency departments, wound clinics, and operating rooms. I want to keep them from falling into this trap. With a structured, multidisciplinary, evidence-based protocol enacted immediately when they have a wound and followed closely after wound healing, I have broken that cycle in many of them.

Reconstruction is no longer an inevitability in our practice. However, it is a failure of my post-healing protocol. Hospitalization for foot infection can often be prevented with early detection and rapid escalation. Amputation, while still sometimes necessary, is far less frequent when we commit to rigorous surveillance, offloading, patient education, and timely intervention.

The key is recognizing that wound healing is not the finish line. It is the starting gate. What we do in the months after epithelialization will determine whether a patient preserves their limb, maintains function, and reclaims quality of life. It is all about breaking the cycles back to ulceration and amputation.

I have made it my mission to close that loop. The data, and my patients' feet, tell me it works.

Dr. Mikel Daniels is a board-certified podiatrist and healthcare executive with more than 2 decades of experience in foot and ankle surgery, wound care, and medical economics. As President and Chief Medical Officer of WeTreatFeet Podiatry, he has grown the practice from 1 office into a regional network of surgical centers, a medispa, and retail health services across Maryland, Pennsylvania, and Washington, D.C.

Dr. Daniels earned his Doctor of Podiatric Medicine from Temple University and an MBA in Healthcare Administration, combining clinical expertise with business strategy to deliver efficient, patient-centered care. His work focuses on complex reconstructive procedures, diabetic limb salvage, sports injuries, and minimally invasive techniques designed to accelerate recovery.

A Fellow of the American College of Foot and Ankle Surgeons and the American Professional Wound Care Association, Dr. Daniels also consults for biomedical technology firms and serves as a principal investigator in clinical research. His insights have appeared in Forbes, Parade Magazine, and CNN, and through his writing and mentorship, he continues to advance innovation and value-based care in podiatric medicine.

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Cutting Edge Treatment of Chronic Mid-substance Achilles Tendinosis

By Mark J. Mendeszoon, DPM

Introduction: The Clinical Problem

Chronic mid-substance Achilles tendinosis is a common and challenging condition encountered by foot and ankle specialists. Unlike acute Achilles rupture, this disorder develops insidiously from repetitive microtrauma and progressive degeneration. Patients frequently report vague posterior ankle pain or a minor “tweak” that evolves into chronic dysfunction. Because successful management depends on accurate diagnosis and biomechanical correction, a firm understanding of Achilles anatomy, vascularity, and pathophysiology is essential. This piece synthesizes these foundational principles to clarify the nature of chronic mid-substance Achilles tendinosis.

Anatomy and Vascular Considerations

Gross and Functional Anatomy

The Achilles tendon is formed by the confluence of the gastrocnemius and soleus muscles. The gastrocnemius, a biarticular muscle, contributes lateral rotational force, while the soleus, a monoarticular muscle, contributes medial rotation. These opposing forces create inherent torsion within the tendon during gait. The plantaris tendon, when present, plays a minimal role and is congenitally absent in approximately 7% of individuals.

Microscopic Structure

The Achilles tendon is composed of a hierarchical collagen arrangement designed for tensile strength. Collagen fibrils bundle into fibers, which form fascicles bound by endotenon. In healthy tendon, approximately 70% of the tissue consists of Type I collagen, arranged in parallel, linear, and characteristically wavy fibers that allow elasticity and load absorption.

Paratenon and Tendon Environment

Unlike tendons that change direction sharply and require a synovial sheath, the Achilles tendon follows a relatively straight course and is surrounded by a paratenon. This structure facilitates gliding but predisposes the tendon to paratenonitis rather than tenosynovitis, an important clinical distinction.

Vascular Supply and the Watershed Zone

The Achilles tendon has a limited blood supply, receiving circulation proximally from the musculotendinous junction and distally from the calcaneal insertion. Its most important vascular contribution arises from mesotenial vessels on the ventral surface. The area of poorest perfusion—the watershed zone—lies approximately 2–6 cm proximal to the calcaneal insertion. This hypovascular region corresponds to the most common site of degeneration and represents a biological weak point that limits healing capacity and predisposes the tendon to chronic tendinosis.

Pathophysiology of Achilles Tendinosis

Terminology Clarification

Chronic Achilles pain is frequently mislabeled as tendinitis, implying inflammation. Histopathologic evidence demonstrates that chronic mid-substance pathology is degenerative rather than inflammatory. The correct terminology is:

- **Tendinopathy:** A general term describing tendon pathology
- **Tendinosis:** A chronic intra-substance degenerative condition characterized by collagen disorganization and scar formation

Histopathological Changes

Healthy tendon demonstrates uniform, parallel collagen fibers with a wavy configuration. In chronic tendinosis, this structure is lost. Collagen fibers become disorganized, intersect irregularly, and stain basophilic, reflecting scar tissue formation. Notably, inflammatory cells are absent, confirming the degenerative nature of the condition.

Collagen Degeneration

A hallmark of tendinosis is the replacement of strong, organized Type I collagen with inferior Type III collagen. This transformation results

This article summarizes Dr. Mendeszoon’s presentation, “Cutting Edge Treatment of Chronic Mid-Substance Achilles Tendinosis,” delivered at the 2025 No-Nonsense Seminar (March 7–9). To view the full presentation with audience questions and answers–and to see the complete agenda for the 3-day program–visit https://nononsense2025.lerexpo.com. Continuing education credits are available for this and many other lerEXPO programs.

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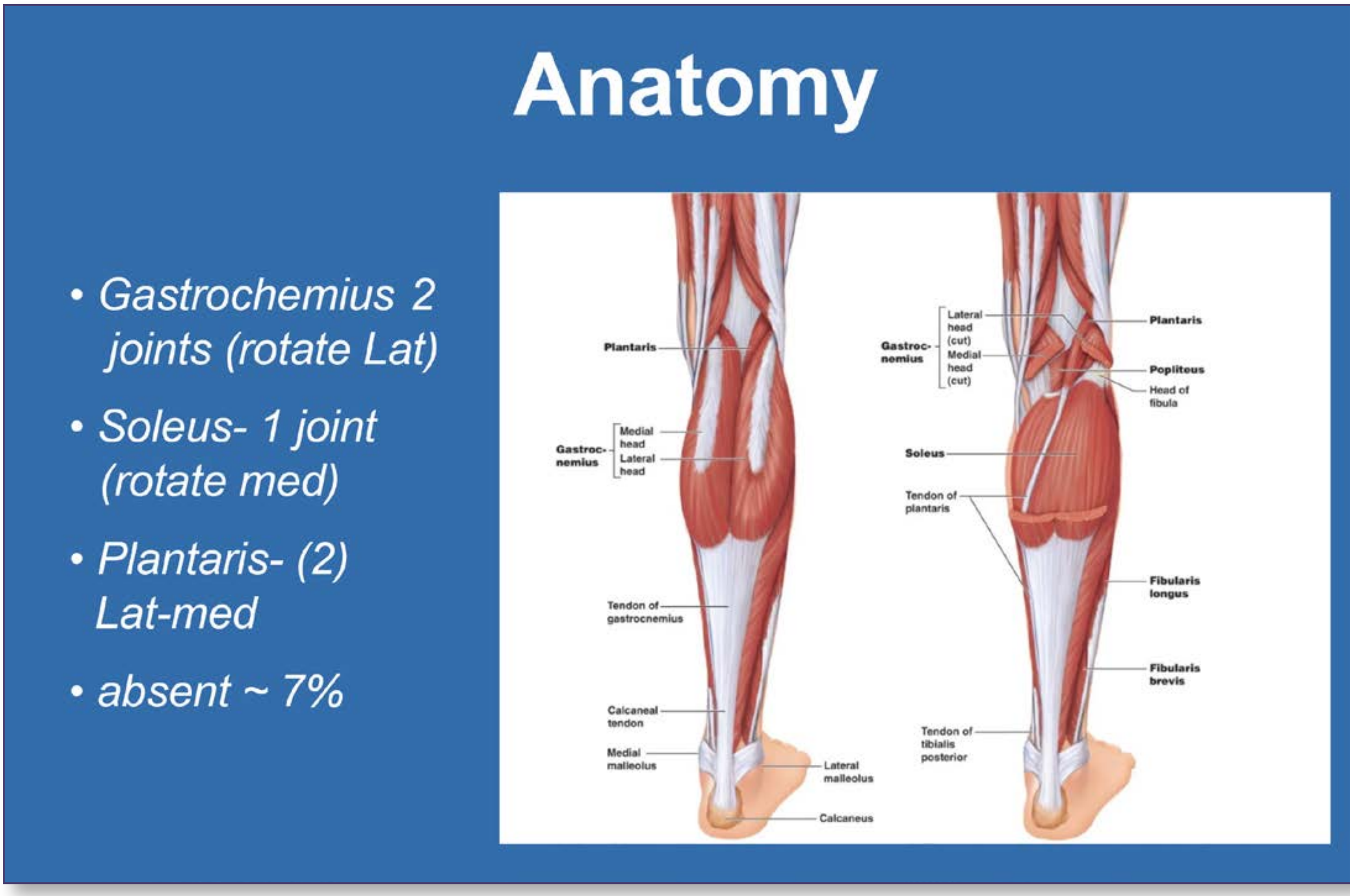

in tendon thickening, reduced tensile strength, and diminished ability to tolerate physiologic loads. The structurally compromised tendon is therefore more susceptible to further injury and potential rupture.

Biomechanics and Etiology

Intrinsic Risk Factors

Intrinsic factors weaken tendon integrity and predispose individuals to degeneration. These include genetic collagen disorders (eg, Ehlers-Danlos syndrome) and exposure to medications such as fluoroquinolone antibiotics and systemic corticosteroids, both of which are associated with increased risk of tendinopathy and rupture.

Extrinsic and Mechanical Factors

Extrinsic factors are often the primary initiators of tendon injury and include repetitive overload, abrupt training changes, and inappropriate footwear. Runners who rapidly increase mileage or intensity are particularly vulnerable. These factors overwhelm the tendon's adaptive capacity, leading to cumulative microtrauma.

Equinus as a Primary Deforming Force

Equinus, or tightness of the gastrocnemius–soleus complex, is a central contributor to Achilles tendinosis. Chronic tensile stress eliminates the tendon's protective wavy collagen configuration, reducing flexibility and increasing strain. Accurate assessment requires examination with the foot locked in neutral or slight supination to avoid peroneal substitution. Management must include consistent static stretching, while ballistic stretching should be avoided due to the risk of further tissue damage.

Torsional and Pronatory Stress

The Achilles tendon functions in multiple planes. Due to opposing rotational forces from the gastrocnemius and soleus, the tendon experiences torsion with each step. Pathomechanics such as overpronation amplify this torsional stress, creating a sharp angle between the leg and foot during gait. Repetitive pronaetory torque places excessive rotational load on the tendon fibers, accelerating degeneration in the vulnerable mid-substance region.

Clinical Evaluation and Diagnosis

Patient Presentation

Patients with chronic mid-substance Achilles tendinosis typically present with:

- Localized mid-substance tendon pain
- Visible or palpable tendon thickening
- Decreased athletic or functional performance

Symptoms are often ignored initially, allowing progressive degeneration and scar formation.

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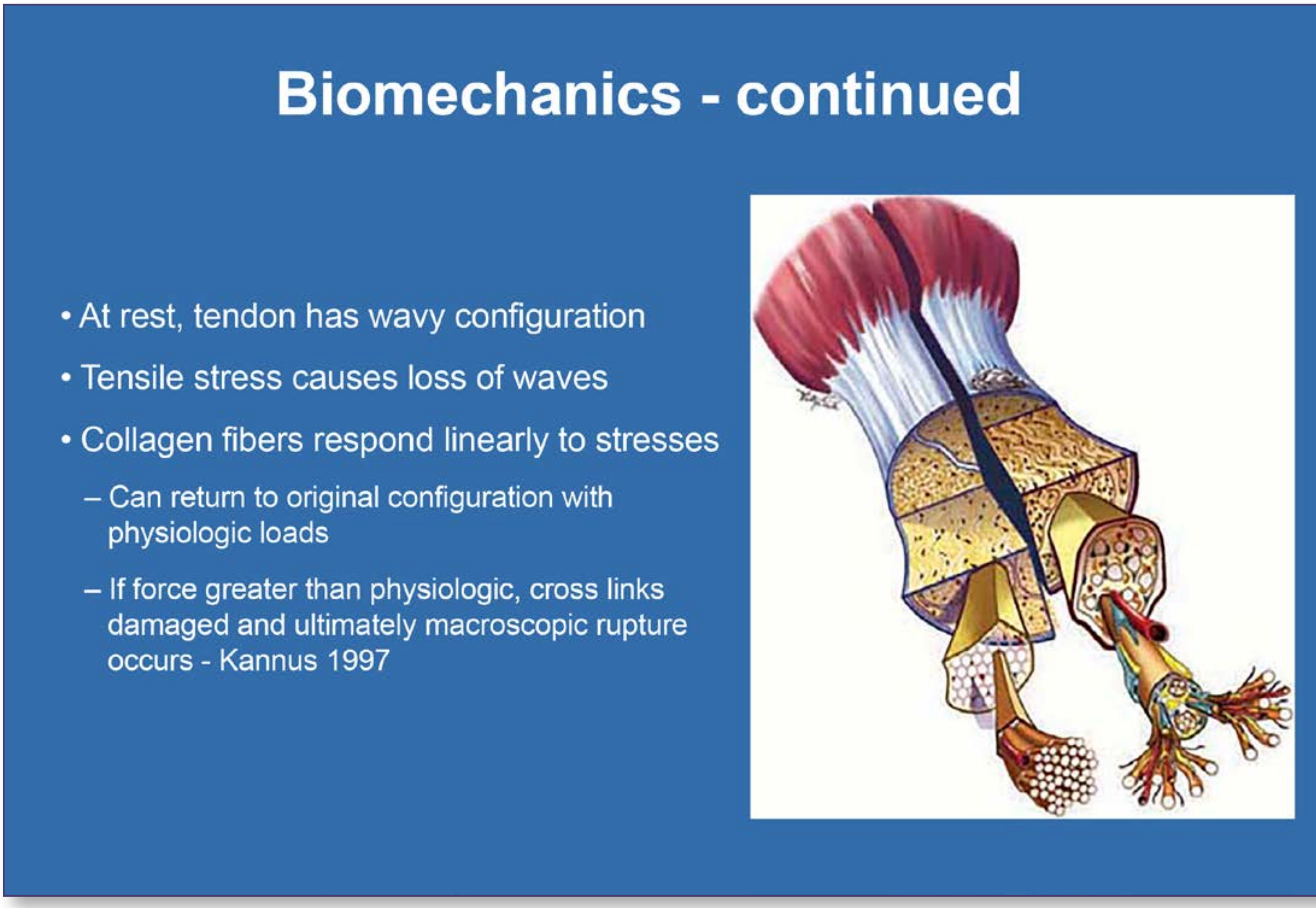

Physical Examination

On examination, chronic tendinosis is characterized by thickened, fibrotic tendon tissue with minimal warmth or inflammation. This contrasts with acute injury, which presents with tenderness, crepitus, and inflammatory signs.

Imaging

Imaging supports clinical diagnosis and assesses severity:

- **Radiographs** may reveal intratendinous calcifications or ossification.
- **Ultrasound** effectively demonstrates fiber disruption and allows dynamic assessment.
- **MRI** provides detailed evaluation of tendon structure and is considered the gold standard, though often reserved for refractory cases due to insurance constraints.

Conclusion

Chronic mid-substance Achilles tendinosis is a degenerative condition arising from the interaction between compromised vascularity, intrinsic tendon structure, and repetitive biomechanical stress. The hypovascular watershed zone, collagen degeneration from Type I to Type III, and the cumulative effects of equinus and pronatory torsion form the foundation of this pathology. Recognizing tendinosis as a non-inflammatory process is essential for appropriate management. A thorough understanding of anatomy, biomechanics, and etiology allows clinicians to design targeted treatment strategies aimed at reducing pathological load, restoring function, and preventing progression or rupture.

Mark J. Mendeszoon is a multi-board-certified podiatrist who treats all surgical and non-surgical conditions of the leg, ankle, and foot in both adults and children. Specializing in trauma, sports medicine, diabetic foot and ankle conditions, and reconstructive foot and ankle surgery including Total Ankle Joint Replacement Surgery.

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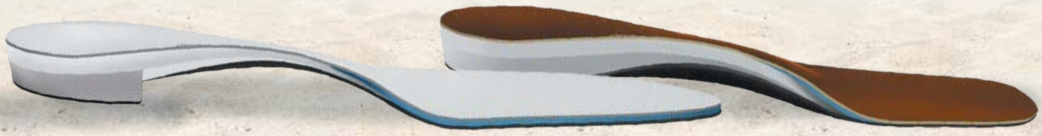

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Minimally Invasive Zadek Osteotomy

By Tyler Gonzalez MD MBA FAAOS

Introduction: The Achilles' Heel of Achilles Pain

For millions of people, chronic heel pain is a relentless and frustrating battle. Conditions like insertional Achilles tendinopathy and Haglund's deformity make every step a painful reminder of a problem that refuses to go away. For decades, the standard surgical solution has been an open procedure involving a large incision, cutting away the problematic bone spur, debridement and repair of the tendon and a long recovery.

But what if the conventional wisdom was wrong? What if the key to fixing the pain wasn't removing the spur at all? A minimally invasive procedure, the MIS Zadek osteotomy is gaining traction among leading surgeons for its surprisingly effective and counter-intuitive approach. It challenges the very foundation of how we think about treating heel pain.

As a fellowship-trained board-certified orthopedic surgeon and leading expert in the procedure, Dr. Gonzalez is focusing his research to unravel the biomechanical mysteries behind its success.

1. The Biggest Surprise: You Can Leave the Bone Spur

The most radical concept behind the MIS Zadek procedure is what it doesn't do. It succeeds by deliberately leaving behind the very tissues—the bone spur and the diseased "crab meat" tendon—that surgeons have spent decades learning to cut out. But do we really need to?

The core premise of the Zadek procedure is to change the biomechanical environment to allow the body to heal itself. By making a small cut in the heel bone and removing a wedge, the surgeon alters the angle by which the Achilles tendon inserts on the calcaneus. This decompresses the entire area, alleviating the tension and strain that caused the inflammation and pain in the first place, while allowing the tendon to heal naturally.

To answer the critical question of whether the spur needs to be removed to provide patients with relief of their posterior heel pain, Dr. Gonzalez's team studied over 100 patients who underwent the MIS Zadek procedure. That found improvement in functional outcomes in over 94% of patients with IAT–all without ever touching the spur or Achilles tendon itself. To piggyback on these findings, they compared outcomes following the MIS Zadek procedure with the traditional open procedure where the spur is removed and Achilles debrided and repaired. They found that patients in both groups had equivalent functional outcomes.

Perhaps this anecdote from one of his patients illustrates this point best. A 52-year-old marathon runner with a massive bone spur and debilitating heel pain came to Dr. Gonzalez for a third opinion. Other surgeons had offered her a large open procedure including removal of her spur and a tendon transfer, which she did not want. Instead, Dr. Gonzalez did an MIS Zadek osteotomy Just 7 months after surgery, she was running 7 miles a day, completely pain-free. One year out from surgery she came in first place in her first half marathon since surgery!

"Your spur is not going to go away, but your pain is going to go away. And that's what

This article is a summary of Dr. Gonzalez's presentation, "Minimally Invasive Calcaneal Osteotomies," from the 2025 Gait Keepers Journal Club on May 27. To view the full presentation with questions and answers–and see the agenda for the program, visit https://gaitkeepers.lerexpo.com/en/#agenda . Continuing education credits are available for this and many of the lerEXPO programs.

they care about, right?"

2. The "Goldilocks" Principle: Wedge Size is Everything

The technical key to the Zadek osteotomy is a dorsal closing wedge osteotomy to change its angle and decompress the Achilles tendon. But how big should that wedge be? It turns out that size is critical.

To determine just how much size matters, Dr. Gonzalez and his colleagues launched a cadaveric study. The data revealed a surprising truth: a small 7.5 mm wedge was not effective in producing any significant change in ankle dorsiflexion following the MIS Zadek osteotomy, while a larger, 15 mm wedge produced a significant gain in dorsiflexion. They were able to describe a direct correlation between the size of the wedge removed, and the functional improvement the Zadek procedure can offer.

During their discussion, Dr. Jeff Dykis offered a perfect analogy for this concept: "Goldilocks and the 3 bears." This has led researchers to ask what the sweet spot for the wedge size is perhaps not too big, or not too small–but "just right." It is now generally accepted that a wedge usually 10 mm is to be removed from the calcaneus to allow patients the maximal biomechanical advantage postoperatively, however not smaller than this. Based on current data and extensive clinical experience, the guesstimated sweet spot is somewhere between 10 mm and 12 mm. If < 10 mm is removed, there is likely not enough wedge removed from the calcaneus to allow for adequate decompression on the Achilles which may result in a poor outcomes.

3. A Biomechanical Reset: It Can Make You Stronger, Not Weaker

A common and logical fear among patients and surgeons is that a procedure designed to functionally lengthen the Achilles tendon complex, such as the Zadek, may lead to weakness. After all, if you give the tendon more slack, wouldn't the patient lose push-off power?

To this, Dr. Gonzalez offered a compelling counterargument rooted in foundational biomechanics. The Zadek procedure is not weakening the muscle; instead, it is "restoring the normal length-tension relationship in the muscle-tendon-bone complex." In essence, it's not creating slack but rather returning an overly taut system to its optimal, more efficient state.

To scientifically test this theory, Dr. Gonzalez's team completed a gait analysis study at the University of South Carolina. The study compared postoperative gait mechanics and push-off strength in patients 1 year following the MIS Zadek procedure compared to traditional open Haglund's surgery. The findings are remarkable: the data shows that patients who underwent the MIS Zadek procedure do not lose any push-off strength or propulsion. In contrast, patients who had the open procedure have demonstrated some measurable, statistically significant weakness and push off in their operative limb in comparison to their contralateral side. This suggests the MIS approach may not only resolve pain but also better preserve the foot's natural biomechanical function.

4. Back to the Future: A 1930s Surgery, Reinvented

While the minimally invasive technique is modern, the biomechanical principle behind the Zadek procedure is not new at all. It represents a brilliant revival of a long-forgotten surgical concept.

The procedure was first developed and published by Dr. Isadore Zadek in 1939. However, this original technique involved a large, open incision on the side of the heel. While the biomechanical concept was effective and patients had resolution of their posterior heel pain, this procedure was largely abandoned due to high rates of wound complications associated with such a significant incision in an area with delicate blood supply.

Today, modern MIS techniques have allowed surgeons to bring this effective concept

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back from the history books. Using specialized tools like a Shannon burr through incisions barely a few millimeters long, surgeons can now perform the osteotomy and achieve the same powerful biomechanical correction without the historical drawbacks of an open approach.

5. The Ultimate Safety Net: No Burned Bridges

A critical consideration for any surgery is what happens if it doesn't work. What are the options for revision? This is where the MIS Zadek procedure offers one of its most significant advantages.

If the MIS Zadek procedure were to fail, a surgeon can still perform a traditional open Haglund's resection as a next step. You never burn that bridge. The initial, less-invasive surgery does not preclude the more traditional approach if it later becomes necessary.

Perhaps even more surprising is the discovery that the MIS Zadek procedure can be successfully used to revise a failed open surgery. Some patients who underwent the traditional, open resection did not get better after surgery; these same patients have since seen significant improvement after a revision with the Zadek osteotomy says Dr. Gonzalez. This is quite a profound finding: a minimally invasive procedure designed to correct the biomechanics of the foot and ankle is able to succeed when the direct, open removal of tissue has already failed. Again, we find ourselves asking "why" or perhaps "how" this correction is so powerful; there is much that we continue to learn about the Zadek procedure. Nevertheless, using the MIS Zadek as a revision intervention does continue to yield promising results.

This versatility makes the MIS Zadek a lower-risk primary intervention for treating insertional Achilles tendinopathy.

Conclusion: A Shift in Thinking

The MIS Zadek procedure represents more than just a new technique; it signals a fundamental shift in surgical philosophy. We are moving the focus away from cutting out potentially "pathological" tissue, and toward correcting the underlying biomechanics that caused the problem in the first place. By restoring the body's natural function through a minimally invasive procedure, surgeons are finding they can achieve superior results, with lower wound complication rates and faster recoveries.

As technology and our understanding of biomechanics continue to evolve, it prompts a thought-provoking question: Could the future of surgery be less about what we remove and more about what we restore?

An Elderly Golfer

Tyler A. Gonzalez, MD, MBA, is a fellowship-trained and board-certified orthopedic foot and ankle surgeon at Prisma Health Orthopedics in Columbia. After completing his bachelor's degree at the University of California, Berkeley, he received a Master of Business Administration and his MD from UCLA in Los Angeles. He completed his residency in orthopedic surgery at Harvard Medical School in Boston and his fellowship in foot and ankle surgery at Cedar Sinai Medical Center in Los Angeles.

Throughout his career, Dr. Gonzalez has focused on improving patient care, medical education and research. His interest and passion in translational, clinical and biomechanical research has prompted over 100 peer-reviewed scientific publications and presentations. He routinely lectures at regional, national and international forums on foot and ankle topics and on improving value-based patient care.

Dr. Gonzalez is an active reviewer for publications, including Foot and Ankle International, Foot and Ankle Orthopaedics, and Foot and Ankle Specialist. He is a member of various foot and ankle surgery societies and is president and co-founder of Orthopaedic Foot and Ankle Society, Inc., a collaboration of foot and ankle surgeons to improve the delivery of healthcare, innovate on current surgical technologies and advance overall patient care.

He has a clinical interest in minimally invasive surgery, minimally invasive bunion correction, ankle replacements, ankle arthroscopy, foot and ankle arthritis, Charcot Marie Tooth disease, sports-related injuries, cartilage preservation and replacement surgery, bunion and hammertoe surgery, ligament/tendon disorders, dance medicine, and orthopedic trauma and fracture care.

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Hemophilia: Guidance on Socks and Footwear

By Teresa Alpert

For someone with hemophilia, foot blisters can be a significant concern because their blood clotting disorder makes it difficult for even small injuries to stop bleeding, potentially leading to larger, more painful blood blisters on the feet. Foot blisters of the skin can be caused by friction from poorly fitting socks and shoes and be compounded with excessive activity.

Key Points About Hemophilia and Foot Blisters

Increased risk of blood blisters: People with hemophilia are more prone to developing blood blisters on their feet compared to the general population due to their inability to clot blood effectively.

- **Causes of foot blisters in hemophilia:**
  - **Poorly fitting shoes:** Shoes that are too tight or rub against the feet can easily cause blisters, especially on pressure points. Hard stiff fabrics that rub against the ankle area or toe box.
  - **Excessive activity:** Strenuous exercise or prolonged walking can put added pressure on the feet, leading to blister formation.
  - **Foot deformities:** Conditions like bunions or hammertoes can increase friction and blister risk.
- **Appearance of blood blisters:** These blisters may appear red, single or in clusters, with clear fluid or pooled blood inside, and can be more painful than regular blisters.

Management Strategies for Foot Blisters in Hemophilia:

Preventative Measures

- **Proper footwear:** Wear well-fitting shoes with good support and cushioning.
- **Regular foot care**: Inspect your feet daily for any signs of irritation or potential blister formation.
- **Sock selection:** Choose moisture-wicking socks to prevent excessive sweating. Socks are the first line of defense. They are the interface between your skin and the footwear. A properly fitting sock that grips the heel and has room in the toe area that holds your foot shape is best.
- Blister socks are often made from materials that are breathable and moisture-wicking to help keep feet dry and prevent blisters:
  - **Natural fibers**

    Mohair can keep feet cool in the summer and warm in the winter, while wool is highly hygroscopic and can hold 30–50% of its weight in moisture. Cotton absorbs and holds onto moisture.
  - **Synthetic fibers**

    Acrylic, polyester, and polypropylene are hydrophobic, meaning they repel water and dry quickly. They also provide cushioning when wet and hold their shape better than natural fibers.
  - **Moisture-wicking fabrics**

    COOLMAX® is a polyester blend that's designed to move moisture away from the feet.
  - **Bioceramic fibers**

    When combined with recycled polyester fibers, bioceramic fibers can reduce friction and bacteria.
- **Activity modification:** Gradually increase activity levels and avoid activities that put excessive stress on your feet.

Treating Foot Blisters:

- **Protect the blister:** Apply a soft bandage or padding to protect the blister from further irritation.
- **Do not pop the blister:** Leave the blister intact to allow it to heal naturally.
- **Consult a healthcare professional:** Discuss any foot concerns with your hemophilia treatment center to develop a personalized foot care plan.
- **Early intervention:** Addressing foot problems early can help prevent complications and minimize discomfort.

Teresa specializes in lower extremity biomechanics. She is a respected leader in her industry, lecturer, and educator. She holds a faculty appointment at the University of Colorado as the Orthotist at the Foot and Ankle Institute. She created and implemented the DME, O&P division for the orthopedic department. She is responsible for training the Residents and Fellows, working with the Gait Lab, and researching and directing patient care. Teresa Alpert completed her orthotics and prosthetics coursework at Northwestern University in 1987. In addition, she attended Ball State University, Apex University, and Eneslow Pedorthic training. Certified by both the ABC and BOC as an Orthotist and Pedorthist, Alpert has been in private practice for over 30 years. Teresa was the past Chairwoman for (BOC) the Board of Orthotist, Prosthetists, Pedorthics Certification, and Education Chairwoman for the National Shoe Retailers Association. She was past president of Pedorthic Footcare Association (PFA) and currently is the Executive Director. Teresa is passionate about helping people each step of the way.

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Dirty Truth: #7 You Can't Avoid It, Repetitive Microtrauma

Figure 1: Joint subluxation with asymmetric narrowing.

By Jay Segel, DPM; Sally Crawford, MS

Our linear mechanical degradation equation, outlined in our last installment, highlighted the challenges to the kinetic chain during weight-bearing and locomotion. It displays the all too real journey from imbalances and soft tissue disturbances with their causes and conditions to the more erosive destruction of cartilage and bony interaction that is the result of wear and tear, which is called, diagnostically, degenerative joint disease.

Like a gate, a lower limb musculoskeletal joint is made up of interactive parts, has an axis of rotation, an ideal position, a defined range, and a preferred plane of motion. It also needs a space to allow the desired function. As our problematic anatomy undergoes the burden/trauma of impact, weightbearing, and motion, joint integrity is compromised, alignment is lost, and the space needed between parts succumbs to wear and tear. This joint space narrowing and destruction of neutrality causes the bones to wear unevenly, leading to cartilage scarring and the formation of bone spurs, often referred to as osteophytic lipping. As this paradigm continues to play out, the interaction of bone spurs that have been created and occupy the joint space continues to occur. The joint continues to degrade until we are left with "bone on bone" and eventual debilitation. Simply put, loss of form leads to loss of function, but we can take steps to understand, communicate, and correct these issues that, left unchecked, lead to locomotion system failure.

Timing and positioning are small details that explain big changes. They can be both predictive and diagnostic when seen through the illumination of a computer-aided gait analysis (CAGA).

Walking and running are repetitive collisions of 2 dissimilar structures of differing mass, the foot and the support surface. These actions

Summary Table: Key Variables for Microtrauma Management

Variable	Clinical Significance
Pressure Maps	Load distribution, "At risk" zones
Ground Reaction Forces	Shock absorption, compensatory load
Center of Pressure (COP)	Symmetry, compensatory movement, trajectory of gait events, timing
Step Width & Rotation Angles	Stability, alignment
Contact Area & COP Shape (Center of Pressure Excursion Index, CPEI)	Asymmetry, arch collapse, foot shape–dependent loading, pronation/supination tendencies
Functional Mobility Tests	Joint/tissue vulnerability
Quantitative MRI/CEST	Subclinical tissue changes
Pain & Symptom Tracking	Functional impact, progression
Longitudinal Data	Trend identification, prevention

produce propagating shock waves, which, in turn, create repetitive microtrauma that has a net negative effect on the entire musculoskeletal system, as stated in our aforementioned chain of destruction. The prime movers of the kinetic chain, pointedly the foot, ankle, knees, hips, and lower back, pay the highest costs. Given this trauma, it is advantageous to consider the surface interactions, including forces, shock management, positioning, and timing parameters, along with postural kinematic data. Those comprise the center of the wheelhouse for a well-outfitted CAGA system, such as the ones we use in research and patient care.

CAGA allows us to quantitatively spot trouble early and make smart changes.

Microtrauma may not be possible to pinpoint to a single parameter alone. Still, with the cohesive and coordinated comprehensive analysis of measures and changes, both spatial and temporal, we can better explain and validate a subject's concerns. At the same time, we can design a personalized care plan to include treatment of present issues and prevention. So, yes, degenerative microtrauma is a normal part of moving through life, but with the right CAGA tools and training, we can measure it, understand it, and manage it. A "see this in the data, do this" approach to health care, which can be easily monitored by follow-up CAGA testing.

So, yes, degenerative microtrauma is a normal consequence of moving through life, but, with the right CAGA tools and training, we can measure it, understand it, and manage it. A "see this in the data, do this" approach to health care in general, and orthotic/therapeutic treatment evaluation, in particular, can be easily monitored by follow-up CAGA testing, allowing us to stay on top of these ever-occurring insults to our pedal structures. When considering possible outcomes from our care plans and the conveyance of prognosis, we take this in a step-by-step approach, explaining that there are 3 measurable levels of success: slowing down the progression of musculoskeletal degradation, arresting it, and reversing it, but that the elements of systemic structural deformation and fatigue exist in normalcy. These are demonstrable issues that don't get better with time but are manageable with keen understanding, clear diagnosis, and a treatment plan aimed at our structural reality, our functional reality, and simple wear and tear over time.

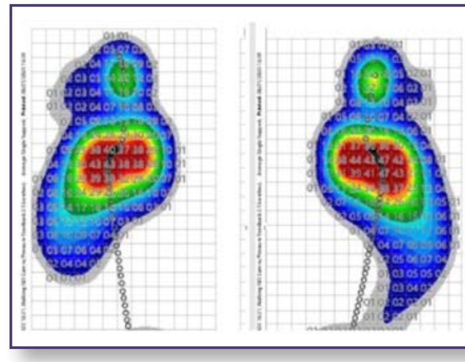

Figure 2: 1 to 1 pressure plots where, when, and also how loading occurs. COP excursion and shape, step width, and rotation angles provide insight into stabilization efforts and potential joint strain.

A Foot Forward for Optimum Health

"A Foot Forward for Optimum Health" is a column designed to enlighten the old guard in a new way about lower extremity impairment as it pertains to foot drop. The intent is to challenge evidence-based research and practice so that it addresses real world issues shaped by social determinants of health. For every common issue is an uncommon response that will provide insight to improve health outcomes by putting one foot forward at a time–efficiently and effectively.

Sensory Input is Needed for Motor Output–The Foot of the Matter

By Dr. Jennifaye V. Brown

Introduction

The somatosensory system is responsible for processing information from the skin and the musculoskeletal system to determine body position and movement. Particularly for the lower extremity when impaired by stroke, somatosensory loss is detrimental to walking which is considered as the highest level of function to be achieved post-stroke.[1-4] Somatosensory information is associated with vertical perception and the subsequent ability to balance oneself and therefore, impairment to this system may increase the risk of falls and limit the ability of safe walking.[5-6] Often, the focus is on motor recovery post-stroke; however, somatosensory information is critical for motor output.[7-9] The focus of this article is to review standardized measures used for testing somatosensation post-stroke and more importantly, interventions to optimize processing of sensory neurons in the penumbra and those not impacted by the stroke.

Clarifying and Defining the Somatosensory System

Somatosensation comprises tactile sensation (commonly assessed as pin prick, light touch, and dull), pressure, proprioception, and pain.[10-11] Specifically, Merkel cells detect light touch, pressure (indentation), and texture in the soles of the feet.[11-12] Proprioception and kinesthesia have been commonly used interchangeably but they are distinctly different.[13-14] Proprioception is the ability of sensory receptors to provide the central nervous system (CNS) with information regarding posture, position or kinetics. These proprioceptors are in the muscles (muscle spindle), tendons (Golgi tendon body), and joints, specifically the fibrous capsules (Ruffini corpuscles-detecting joint position and angle; slow responding and Pacinian corpuscles-detecting joint movement and speed; fast acting).[11,14] The stroke itself does not directly impact these structures in the periphery but rather structures by which impulses travel from these sensory organs to get processed in the brain. Kinesthesia is being aware of the body movement in space.[13-14] Movement quality as represented by duration, direction, amplitude, speed, acceleration, and timing across joints should be detected.[15] For purposes of gait-focused interventions, healthcare practitioners (HCPs) should assess somatosensory impairments that focus on tactile sensation, pressure, proprioception, and kinesthesia.

Assessment

For the best guided treatment interventions, assessment should take into consideration stroke lesion location, size, and severity. One would not perform a detailed tactile sensory exam if the lesion was in the lateral hemisphere of the cerebellum. Research indicates that the Semmes Weinstein Monofilament Test (loss of protective sensation in diabetic neuropathy–pressure), the sensory subscale of the Fugl-Meyer Assessment (light touch and proprioception), and the Nottingham Sensory Assessment (light touch, pin prick, pressure, tactile localization, bilateral simultaneous touch, and proprioception–the latter is not done in the foot) are used with individuals with stroke but have nuanced psychometric problems that render them problematic.[16-17] However, the revised version of the Nottingham Sensory Assessment (EmNSA) which includes

Figure 1

1. Thumb lateral to Achille's tendon
2. Index finger over cuneiforms with tip toward navicular
3. Digits 3 & 4 spread across forefoot
4. Opposite hand input is forward & down at distal thigh

Figure 2

1. First metacarpal base at lateral dome of talus with finger pointed toward direction of navicular
2. Medial portion of third finger facilitates heel eversion
3. Thumb lateral to Achille's tendon
4. Opposite hand provides internal rotation force at tibia

Note: With both techniques, as tibia moves forward pronation occurs and tibia internally rotates. During lift off into knee extension, the tibia internally rotates.

Figure 3

Fabrics of different textures are cut and placed on top of the insole of shoes regularly worn.

Figure 5

The red dot signifies a toe grasping stimulus and the purple, dorsiflexion.

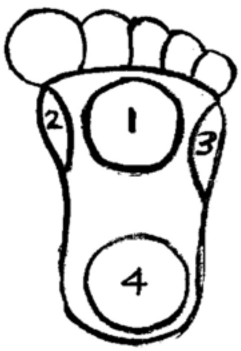

Figure 4

Stimulation Points

1. Toe Grasping
2. Inversion
3. Eversion
4. Dorsiflexion

the assessment of toes has been cited for being an optimal assessment tool.[18-19] Individuals with stroke must be able to understand and respond to the directions of the HCP and assume the position or be placed in the position for the test. Furthermore, the HCP must perform the test consistently each and every time. Which may mean, for example, supporting or positioning the lower extremity and how the toe or foot is held for an assessment of joint proprioception or kinesthetic awareness. HCPs perform what they have been taught and document as absent, impaired (decreased [hyposensitive] or increased [hypersensitive] for tactile sensation) or intact. Rarely is "impaired" documented with descriptive markers that could be a part of goal setting for treatment, such as time to respond to a stimulus. One has to preface during the exam, what may be the cause of the delay, such as cognition or mode of response (verbal or nonverbal). If tactile sensation, pressure, and proprioception are impaired, the latter requiring the activation of isometric, eccentric, and concentric muscle activity in weightbearing (WB) and nonweightbearing (NWB) positions during walking to maintain balance, then interventions should target these sensory systems.

Treatment Interventions–Practical Applications to Improve Gait

There is a 3-step process known as priming, augmentation, and practice which can be utilized to drive motor output through somatosensory treatment interventions.[20] Priming is the step of preparing the sensorimotor system prior to tasks-specific training (practice).[20] Augmentation is combining somatosensory intervention to task-specific training in order to enhance the feedback of tactile and pressure stimulation.[20-22] In this case, priming will be through 2 specific sensory techniques known as mobilization and tactile stimulation (MTS).[23] However, I do incorporate task-specific training of functional activities prior to gait (practice).[24]

PRIMING

Mobilization: The premise is to stabilize the hindfoot with the foot and ankle placed in the available range of close chain dorsiflexion and have the person:

1. Complete the horizontal phase of sit to stand holding various positions 3 to 5 seconds through the range of trunk movement forward and backward
2. Unweight the buttocks during scooting forward and backward and hold positions in the increment of ranges for both activities 3 to 5 seconds
3. Come to partial stand clearing the buttocks from the surface 1 to 5 inches and holding the position at various heights 3 to 5 seconds; I place different diameter objects under the buttocks to assure there is a change in height difference for lift off

These activities increase load on the ankle joint to stimulate proprioceptors and movement through a variety of muscle contractions. Load and movement enhance balance reactions and ankle strategies. Muscles of the leg and foot are activated isometrically, eccentrically, and concentrically during various movements. As more range of motion is gained at the talocrural joint to increase close change dorsiflexion in sitting, this simulates what is required for sit to stand and terminal stance during gait (10°–20°).[25-26] The key difference is that proprioceptive assessment is done in open chain whereas this treatment intervention focuses on close chain to prepare for the stance phase of gait in which the body weight has to come from behind to in front of the ankle. See Figures 1 and 2

Tactile Stimulation: Individuals with stroke have impaired tactile stimulation which can be hyposensitive or hypersensitive. I heighten or calm these impaired sensations of touch with the use of cloths on the sole of the foot. I start in NWB rubbing the sole of the foot as if the person is drying their foot with a towel in a tailor sit position or the heel supported on a stool. Then I cut the different materials in the shape of the insole of the shoe worn the most. I have them put on both shoes without socks and add the material to the hemi foot.

AUGMENTATION

Then the person completes weight shifting activities as described above. This added pressure and proprioceptive input using a tactile stimulus may and often improves the perception of maladaptive tactile stimulation depending on lesion location, size, and severity. Then I repeat the sequence with the material in the less impaired or unaffected foot. I ask at the end of the session does the material feel the same under both feet and if different, how so. I document the intensity of noxiousness on a scale of 0–10 with the goal of it to decrease as somatosensation improves. See Figure 3.

I often test for pathological reflexes of the foot as described by Duncan.[27] See Figure 4. As seen on the insole in Figure 5, I denoted stimulation points for toe grasping, inversion, eversion, and dorsiflexion among other things such as the location of the navicular bone and the lateral arch in proximation to the cuboid. For example, if the foot tends to invert when stimulated in WB, I add a stimulus (glue a bead the size of a split pea) under the base of the 5th metatarsal to stimulate eversion bringing the foot to neutral which will allow for pronation as the tibia moves forward. See Figures 6–9.

PRACTICE

Now on to task-specific training of walking, I simply follow the principles of gait training that simulate the literature in this article to drive motor recovery.

1. The hemi lower extremity is in WB and I stabilize the ankle as previously described as the opposite extremity steps backward, forward and perhaps to increase intensity, the foot is placed on steps of different heights in front of the hemi foot. To further build on intensity, the steps are placed further away from the hemi foot requiring more dorsiflexion of the ankle and eccentric activity of the calf muscles.
2. The stepping sequence is repeated with different types of paired cloths on the insole of the shoes. During this phase of activities, I add:
   a. stepping out to the side with the less affected lower extremity
   b. facilitated hemi heel rise isolating terminal stance (30° metatarsal head [MTH]) and preswing (60° MTH hyperextension with 40° of passive knee flexion) of the hemi lower extremity
   c. stepping backward with hemi lower extremity first focusing on loading the toes then heel
   d. walking short distances on different flooring; I have rolled reams of carpet that may be similar to that which is in the home
   e. incline walking up and down, sideways, and backward
   f. stair training step over step up and down
3. I conduct intermittent assessment of somatosensory system impairments to demonstrate any improvement, which in turn will guide treatment intervention modifications. At this time, I also assess gait speed (10-foot walk test, 5- or 10MWT) and gait quality (Rancho Los Amigos Medical Center, Physical Therapy Department Gait Analysis: Full Body).[28]

If you are asking what should be done if a therapist is not present to do the hands-on mobilization? I have an answer. Get ready to read part 2: Sensory Input is Needed for Motor Output–Self Work for the Best Foot Work Matters.

If you have any questions regarding this article, leave them in the comment box.

Jennifaye V. Brown, PT, MSPT, PhD, NCS, CAPS is an American Physical Therapy Association 4-time 10-year board certified neurologic physical therapist in Charleston, South Carolina, specializing in stroke rehabilitation, specifically gait analysis and treatment, AFO design, and the redesign of lived spaces allowing individuals with disabilities to age in place. She is the author of the book, Brace Yourself: Everything You Need to Know About AFOs After Stroke.

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Figure 6
Toe Grasping: Stimulation point is #1


Figure 7
Inversion: Stimulation point is #2


Figure 8
Eversion: Stimulation point is #3


Figure 9
Dorsiflexion: Stimulation point is #4

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Transforming Sneaker Performance

By Jeffrey S. Rich

Modern athletic shoes, with their increased stack heights and very soft midsoles, tend to collapse quickly. Compounding the problem, true shoes designed specifically for pronators, extreme pronators, supinators, or extreme supinators are essentially no longer available on the market. As a result, many patients lack adequate frontal-plane control from footwear alone.

The Pedorthic technique to fix these problems is mechanical modification of the shoe itself–specifically reinforcing the midsole to limit collapse. As a board-certified pedorthist, this is how I transform shoes from a neutral, "2-question" shoe into either a pronator shoe or a supinator shoe, based on the patient's biomechanics.

In shoes that already have midsole voids, such as in-style designs, the voids are located along the medial and lateral sidewalls of the midsole, rather than on the plantar surface. Stability can be added by selectively filling these sidewall midsole holes with hot-melt adhesive. For a pronator, the medial midsole holes are filled; for a supinator, the lateral midsole holes are filled. Because these voids are accessed from the side of the midsole, care is taken to prevent adhesive migration by taping the inner voids plantar surface as needed. If any void communicates through to the opposite side, foam can be placed 1 inch deep distally as a dam to prevent adhesive migration.

Traditional running shoes typically do not have sidewall midsole voids. Instead, access to the midsole is created from the plantar aspect of the shoe, through the outsole. In these cases, half-inch diameter holes are drilled from the bottom of the shoe to reach the midsole–along the medial border for pronators or the lateral border for supinators. These plantar access holes are drilled 1 inch deep in the heel and midfoot and half inch in the forefoot. You can add tape to the drill bit to make the depth.

Care must be taken when drilling through the outsole, as outsole rubber often does not drill cleanly. When possible, drilling should be performed in areas with minimal or no outsole coverage, such as split-sole designs where the midsole is exposed. Many performance shoes include such windows; for example, in split-sole models like Brooks Hyperion access can be gained through exposed midsole areas rather than forcing the drill through dense outsole rubber.

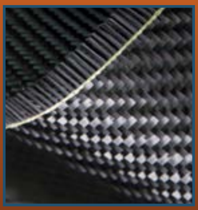
After access is created, hot-melt adhesive is injected into the midsole to create localized reinforcement. The hole is filled completely. When cooled, the hotmelt will form a slight recess. When hot melt cools there may be a slight depression which may require additional filling. If you prefer, you can insert a half-inch EV plug to fill the hole before the hot melt cools.

Biomechanically, this approach increases localized midsole stiffness, slows excessive pronation or supination, and preserves cushioning elsewhere in the shoe, effectively creating custom posting within the footwear itself.

Jeff Rich is a Board-Certified Pedorthist and the owner of the U.S. Orthotic Center in New York City, which specializes in orthotic manufacturing and shoe modification. For the past 46 years, he has employed a unique orthotic fabrication method that combines traditional craftsmanship with modern technology and serves professional athletes, including teams from the NBA and the US Olympic team. Additionally, he co-founded Masterfit Enterprises, which focuses on orthotic and footwear solutions, and has contributed significantly to the snowsports industry through training programs and product innovations. Rich holds 7 US patents, including 3 for orthotic designs. Jeff is the President of PFA and serves on several committees. He also heads the Pedorthic lab and teaches Pedorthics at Hamad Hospital in Qatar.

EMERGING DEVELOPMENTS IN AFOS

What Podiatrists Need to Know About Carbon Composite AFOs Part II



By Keith Loria

Advances in ankle-foot orthoses (AFOs) are revolutionizing how podiatrists, physical therapists and O&P clinicians support lower-limb mobility and rehabilitation. In this 3-part series, we explore the latest evidence, cutting-edge materials, and innovative design strategies that are shaping the future of AFOs. This short series offers a look at how today's breakthroughs are improving function, comfort and compliancy in the lower extremity world. Check back each month for the next installment.

Identifying the Right Patients for Composite Bracing

While carbon composite AFOs can be appropriate for a wide range of podiatric patients, certain groups benefit particularly strongly. Neuromuscular conditions, including stroke, post-polio syndrome, peripheral neuropathy and some forms of muscular weakness, often respond well because these patients need support without added bulk. Eric Weber, LCPO, FAAOP, who co-chairs the American Academy of Orthotists & Prosthetists' Lower Limb Orthotic Society explains that for smaller steps or cautious gait patterns, composites can be tuned to encourage more natural movement by adding the exact amount of flexibility required.

Suzanne Fuchs, DPM, a podiatrist at Luxe Podiatry in Jupiter, Florida, noted advances in carbon composite AFO design have enhanced patient management by providing lightweight, more durable options that improve gait stability and reduce fatigue.

"These AFOs contribute to better alignment and biomechanics, enabling greater mobility in patients with gait instability or neuromuscular weakness," she said. "Carbon composite AFOs benefit patients with post-stroke foot drop, diabetic partial-foot amputations, and chronic ankle instability. They address specific biomechanical challenges in these populations, enhancing ambulation and quality of life."

From her experience, patients using carbon composite AFOs generally show higher compliance and improved long-term outcomes compared to traditional AFOs.

"The comfort, reduced weight, and enhanced functionality of carbon composite designs encourage more consistent use," she said. "The ability to fine-tune stiffness or flexibility in various regions of a carbon composite AFO allows for customized solutions based on an individual's needs. This fine-tuning can help optimize support and movement patterns, making it a critical consideration in the brace selection and prescription process."

Orthopedic and limb-salvage patients form another key population. Individuals recovering from trauma, fractures, partial-foot amputations or severe arthritic pain may require highly controlled stiffness to reduce strain on compromised joints. Composites provide that stability more effectively than plastics, particularly when the goal is to bypass painful segments or limit motion in a specific region. Many of these techniques originated in military medicine, where protecting fragile or reconstructed limbs demanded materials capable of absorbing significant loads without excessive flex.

Podiatrists managing diabetic patients with forefoot amputations or chronic ulcer risk can also benefit from the energy-return properties of composite AFOs. These devices support rollover, protect the residual foot, and assist with propulsion in ways traditional designs cannot achieve.

Improving Collaboration Between Podiatry and O&P

Choosing the right carbon composite AFO requires strong communication between podiatrists and orthotists. Weber noted that podiatrists should describe the functional problem they want solved, rather than prescribing a specific device. For example, a referral that outlines balance difficulties, fall frequency, gait endurance, or pain thresholds gives the orthotist the information needed to design or select the appropriate stiffness and structure.

Clear documentation is useful not only for clinical precision but also for streamlining authorization. Podiatrists can help ensure smoother approvals by tying medical necessity to functional goals rather than device type. A description of a patient who cannot navigate uneven surfaces, loses balance during mid-stance, or cannot maintain endurance during activities of daily living is far more compelling than a simple request for a specific AFO model.

Ultimately, the rise of carbon composite AFOs represents a meaningful step forward in podiatric bracing. As materials engineering continues to evolve and digital design tools become more precise, clinicians have more opportunities to align bracing with biomechanical goals. For podiatrists, understanding these advances and working closely with orthotists to apply them offers an expanded toolkit for improving mobility, safety and long-term quality of life.

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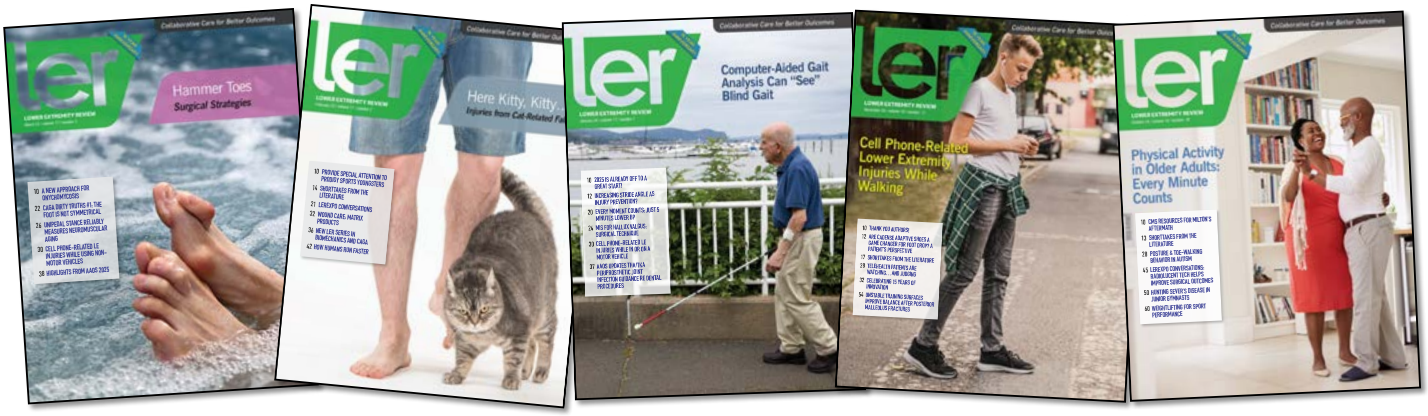

LOWER EXTREMITY REVIEW

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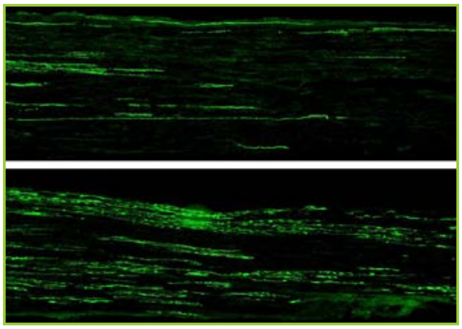
POSSIBLE THERAPEUTIC APPROACH TO TREAT DIABETIC NEUROPATHY DISCOVERED



Longitudinal sections of 2 injured nerves with regenerating nerve fibers. Both specimens are from diabetic animals; in the lower image, the animal was treated with a peptide. Regeneration can be seen in the green-stained nerve fibers. Image courtesy of Dietmar Fischer.

A research team led by Professor Dr. Dietmar Fischer, professor of pharmacology at the University of Cologne's Faculty of Medicine, and director of the Center for Pharmacology at University Hospital Cologne, both in Germany, has identified a central mechanism that explains limited regeneration in diabetes. Building on this, the researchers have developed a promising therapeutic approach that can be used to increase regeneration.

Using mouse models of type 1 and type 2 diabetes mellitus, the team demonstrated a high accumulation of the p35 protein in nerve cells. This protein activates an enzyme that triggers a signaling cascade, which in turn blocks the regrowth of nerve fibers. This considerably restricts the nerves' natural regenerative capacity. Through targeted interventions in this signaling pathway–either using genetic methods or, pharmacologically, with newly developed small protein building blocks (peptides) that can be administered systemically–the scientists succeeded in removing the block. In the preclinical models, the nerve fibers then grew again at a similar rate to that observed in healthy animals. This was accompanied by significant motor and sensory improvements.

The study thus opens up new perspectives for the treatment and, potentially, the prevention of diabetic neuropathy.

FAU RESEARCHERS MAKE STRIDES IN GAIT ANALYSIS TECHNOLOGY

Microsoft's Azure Kinect depth camera captures 3D data, color images, and body movements for motion tracking. Image courtesy of FAU.

A study from the College of Engineering and Computer Science and the Sensing Institute (I-SENSE) at Florida Atlantic University (FAU), Boca Raton, reveals that foot-mounted wearable sensors and a 3D depth camera can accurately measure how people walk–even in busy clinical environments–offering a powerful and more accessible alternative to traditional gait assessment tools.

To overcome barriers of electronic walkways–their high cost, large footprint, and limited portability–the team conducted the first known study to simultaneously evaluate 3 different sensing technologies: APDM wearable inertial measurement units (IMUs), Microsoft's Azure Kinect depth camera, and the Zeno™ Walkway–under identical, real-world clinical conditions. The depth-sensing camera captures 3D data, color images, and body movements for use in AI, robotics, and motion tracking.

The study recruited 20 adults age 52–82, who completed both single-task and dual-task walking trials. Each participant's gait was captured by the 3 systems at the same time. Researchers evaluated 11 different gait markers, including basic metrics like walking speed and step frequency, as well as more detailed indicators such as stride time, support phases, and swing time. These markers were analyzed using statistical methods to compare each device's measurements with those from the Zeno Walkway.

The study findings revealed that foot-mounted IMUs and the Azure Kinect not only showed near-perfect agreement with the walkway across nearly all gait markers, but also enabled scalable, remote, and cost-effective gait analysis. The Azure Kinect also performed impressively, maintaining strong accuracy even in the complex, real-world clinic setting where multiple people were present in the camera's field of view.

Importantly, the study is the first to benchmark the Azure Kinect against an electronic walkway for micro-temporal gait markers, filling a gap in the literature and confirming the device's potential clinical value.

STRATEGIC PROTECTION FROM SHEAR FORCES

Tamarack Protection Socks utilize GlideWear™ Technology to create a slippery, low-friction zone that protects at-risk areas of the feet from shear forces, which are a major factor responsible for soft tissue damage such as diabetic foot ulcers, calluses, blisters, and other painful wounds. This patented, medical-grade, low-friction fabric technology allows the skin to gently glide back and forth with bone movement in the at-risk areas, reducing friction forces by 50%–80%. These socks are also gas- and vapor-permeable, allowing the skin to breath and maintain its natural microclimate. The socks come in multiple sizes, cuff lengths, colors, and a variety of styles designed to protect specific locations on the feet: the forefoot (diabetic neuropathy); partial foot, especially for metatarsal amputations (diabetic neuropathy); heel and ankle (primarily for someone in bed for long periods); and midfoot (diabetic neuropathy–such as for the common Charcot foot).

Tamarack Habilitation Technologies
866/795-0057
tamarackhti.com

ORTHOTIC-DRIVEN PLUSH, SUEDE BOOT

The Revitalign® brand recently released the Aspen Fireside. This plush, cozy boot is designed with genuine, water-resistant suede and features an ultra-soft sherpa lining, ensuring that feet remain warm and dry. The style incorporates the Full Contact Comfort® footbed, which delivers orthotic support and promotes proper body alignment with every step. The boot also features COMFORTPRO™ lightweight outsole-grade EVA technology, which provides orthotic support along with articulated flex zones. The slip-on design is complemented by stretch gore panels, allowing the boot to move naturally with the wearer for consistent comfort throughout the day. This podiatrist-designed technology is a hallmark of the Revitalign brand. The Aspen Fireside boot is an ideal choice when looking for stylish, orthotic-driven footwear that enhances well-being. It is available in various sizes, widths, and colors.

Waco Shoe Company
844/827-0439
wacoshoecompany.com

FULGENT GENETICS TO ACQUIRE BAKO DIAGNOSTICS AND STRATADX

Fulgent Genetics Inc., El Monte, California, a technology-based company with a laboratory services business and a therapeutic development business, announced that it has entered into a definitive agreement to acquire selected assets of Bako Diagnostics, Alpharetta, Georgia, and to acquire StrataDx, Lexington, Massachusetts. The proposed acquisition will add new anatomic pathology services, proprietary PCR tests, and a national client base. Fulgent will acquire certain assets of Bako Diagnostics and will acquire StrataDx for a total combined purchase price of about $55.5 million, subject to adjustments, to be paid from cash on hand. The acquisition is expected to close during the first half of 2026, subject to satisfying customary closing conditions, including regulatory approvals. With these additions, Fulgent will further strengthen its laboratory services business by adding new products and services and further expand its national client base, national sales team, and team of expert pathologists.

Bako Diagnostics is a national provider of specialty laboratory testing services, which offers a comprehensive testing menu, including complete anatomic pathology services, proprietary molecular genetic testing, and peripheral neuropathy immuno-histochemical testing. Bako Diagnostics is CLIA certified, CAP accredited, and licensed by the Georgia Department of Public Health.

StrataDx is a premier national provider of dermatopathology testing services. StrataDx is CLIA certified, CAP accredited, and licensed by the State of Massachusetts.

3D-PRINTED PEDIATRIC SUPRAMALLEOLAR ORTHOSIS

Surestep has announced the launch of the SMO3D, a next generation supramalleolar orthosis (SMO) designed to support children with hypotonia and other mobility challenges. Building on Surestep's clinically trusted, compression-based approach, the SMO3D reimagines this foundation through advanced 3D-printing technology. Lightweight and flexible, the device provides targeted support to improve balance and coordination without restricting natural movement. Its innovative design features include auxetic structures that flex around the malleoli for added comfort, variable wall thickness for customized support, breathable perforations, and durable color-dyed materials. A low-profile silhouette and narrower heel post allow for easier shoe fit, encouraging consistent wear. This device represents the company's first 3D-printed pediatric lower-limb orthosis and expands its growing 3D portfolio. Backed by Surestep's trusted expertise, warranty guarantee, and streamlined ordering, the SMO3D reflects the company's ongoing commitment to helping children build mobility and confidence at every stage of development.

Surestep
877/462-0711
surestep.net

RUNNING SNEAKERS ENGINEERED FOR SHORTER, EVERYDAY DISTANCES

ALLSWIFIT's Active5K is a streamlined running shoe purpose-engineered for shorter, everyday distances. At the core is an advanced midsole system that delivers a measured balance of softness and responsiveness, producing a 67% high-rebound energy return that absorbs impact on landing, efficiently redirects energy into toe-off, reduces vibration at ground contact, and helps limit cumulative stress on joints and muscles. The rocker geometry promotes smoother heel-to-toe transitions and reduces abrupt, braking-style landings. A built-in EVA stability plate supports balanced landings and controlled toe-off, paired with a mesh-covered foam insole that provides contoured arch support throughout the gait cycle. A high-traction, slip-resistant rubber outsole enhances control on wet pavement and variable road conditions. The upper combines breathable jacquard mesh with targeted TPU reinforcement, delivering airflow, structure, and durability without unnecessary weight. Inside, a mesh-covered foam insole adds comfort and impact reduction while maintaining a secure, adaptive fit.

ALLSWIFIT
609/831-4566
allswifit.com

RESEARCHERS DISCOVER TENDON DISEASE TRIGGER

A team of researchers led by Jess Snedeker, PhD, a professor of orthopedic biomechanics at ETH Zurich and Balgrist University Hospital in Zurich, both in Switzerland, and by Katrien De Bock, PhD, professor of exercise and health at ETH Zurich, has reached a new milestone in their studies of tendinopathy. In the HIF1 protein, they have identified a central molecular driver of tendon problems of this kind. A part of HIF1 acts as a transcription factor, which controls the activity of genes in cells.

This protein was already known to be at elevated levels in diseased tendons. Now, in experiments in mice and with tendon tissue from humans, the team of researchers has shown the conditions are actually triggered by the protein. Both in the mice and in the experiments with human tendon cells, they were able to show that elevated HIF1 levels in the tissue leads to a pathogenic remodeling of the tendons: More crosslinks form within the collagen fibers that make up the basic structure of the tendons.

"Our study not only provides new insight into how the disease develops," said Snedeker. "It also shows that it's important to treat tendon problems early … [as] the damage caused by HIF1 in tendon tissue can accumulate and become irreversible over time."

The fact that HIF1 has now been identified as a molecular driver raises the question whether it is possible to develop medicines that deactivate HIF1 and therefore can prevent or cure tendon disease. It is not quite that easy, though, as in many organs of the body, HIF1 is responsible for detecting a lack of oxygen and activating a physiological adaptation, explained De Bock. However, it may be possible to look for methods that specifically deactivate HIF1 only in the tendon tissue.

COMPRESSION THERAPY SYSTEM FOR PAD

The U.S. Food and Drug Administration 510(k)-cleared ARTAIRA® Arterial Compression Device is a non-invasive intermittent pneumatic compression device that increases blood flow and circulation to the lower limbs to treat patients with some symptoms of peripheral arterial disease (PAD) in the comfort of their own homes. The prescription-only device uses air compression and tubing to inflate and deflate 2-chamber garments worn on the legs. One chamber inflates behind the calf and the other chamber inflates under the foot. The device delivers 120 mmHg of pressure to each garment chamber in a timed sequence and then repeats. This process of squeezing the legs, ankles, and feet increases blood flow and circulation. The 2-button device is easy to use, weighs only 7 pounds, and features a large color LCD screen that displays pressure and treatment times.

AIROS Medical
866/991-6956
airosmedical.com

CMS UPDATES PRIOR AUTHORIZATION CODES FOR LOWER-LIMB ORTHOSES

The Centers for Medicare & Medicaid Services (CMS) recently published updates in the Federal Register regarding Healthcare Common Procedure Coding System (HCPCS) codes on the Master List that will require prior authorization effective April 13, 2026. The following are the codes on this list that pertain to lower-limb orthoses:

- **L1844:** Knee orthosis, single upright, thigh and calf, with adjustable flexion and extension joint (unicentric or polycentric), medial-lateral and rotation control, with or without varus/valgus adjustment, custom fabricated

- **L1846:** Knee orthosis, double upright, thigh and calf, with adjustable flexion and extension joint (unicentric or polycentric), medial-lateral and rotation control, with or without varus/valgus adjustment, custom fabricated
- **L1852:** Knee orthosis, double upright, thigh and calf, with adjustable flexion and extension joint (unicentric or polycentric), medial- lateral and rotation control, with or without varus/valgus adjustment, prefabricated, off-the-shelf
- **L1932:** Ankle foot orthosis, rigid anterior tibial section, total carbon fiber or equal material, prefabricated, includes fitting and adjustment.

The following codes pertaining to the lower limb are eligible to be added in the future:

- **L-2999:** Lower extremity orthoses, not otherwise specified
- **L-5783:** Addition to lower extremity, user adjustable, mechanical, residual limb volume management system
- **L-5841:** Addition, endoskeletal knee-shin system, polycentric, pneumatic swing, and stance phase control

To read the update, visit www.federalregister.gov/documents/2026/01/13/2026-00487/medicare-program-updates-to-the-master-list-of-items-potentially-subject-to-face-to-face-encounter.

FIXATION DEVICE FOR ACL RECONSTRUCTION

The QuadLock™ is a new knotless, bidirectional tension-adjustable fixation system for anterior cruciate ligament (ACL) reconstruction. It is designed to securely fixate sutures and tapes, helping surgeons fine-tune graft tension and maintain stability across several graft configurations commonly used in ACL procedures, including quadriceps tendon, quadrupled semitendinosus/gracilis, and bone–patellar tendon–bone. In biomechanical testing under

high-demand cyclic loading, QuadLock demonstrated control of cyclic displacement (less than 0.5 mm)–a 500%+ improvement compared to the 3–6 mm reported for conventional fixation methods such as cortical buttons and interference screws and also achieved a pullout strength of >1,000 N, combining high fixation strength with minimal displacement. Avoiding loss of tension under repeated loading is critical in early recovery, when fixation stability directly influences the restoration of functional joint stability. 501(k) clearance has been granted by the U.S. Food and Drug Administration.

ABANZA
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abanzamed.com

RESEARCHERS USING CONTINUOUS-FIBER 3D PRINTING TO PRODUCE PEDIATRIC PROSTHESES

George Mason University, Fairfax, Virginia, researcher Quentin Sanders is part of a collaborative research team working to make high-performance prosthetic limbs more affordable, accessible, and better tailored to the needs of active children. Sanders, along with Jonathon Schofield, an associate professor at the University of California, Davis, and Garrett Melenka, an associate professor at York University, Toronto, Canada, received a 3-year, $500K grant from the National Science Foundation to support the project.

The research team has several goals, starting with identifying what children truly need from an activity-enabling prosthesis. The researchers are examining how motivation to be active, physical growth, and different types of movement influence prosthetic performance in everyday settings. They are also analyzing how children move while using their current running blades, studying activities such as running, jumping, and changing direction to better understand the biomechanics and physical demands involved. Finally, the team will take a close look at how today's running blades perform under real-world demands.

A 3D-printed running blade prototype, created using the technique Sanders and his colleagues are developing.

Sanders and his collaborators are using an advanced additive manufacturing approach known as continuous-fiber 3D printing, in which carbon fibers are embedded within the printed plastic to reinforce the prosthetic structure. This method enables the creation of strong, lightweight devices that can be tailored to a child's size, growth, and activity needs. The technique is already used to produce strong, lightweight components in the aerospace and automotive industries, but it has seen limited adoption in prosthetic design. This project represents one of the first efforts to apply it systematically to activity-enabling prostheses for children.

Think you need a gym, machines, or heavy weights to get strong?

Despite what many people think, the science says otherwise.

Recent data shows older adults can get stronger using almost any resistance training approach - as long as the fundamentals are in place.

A 2025 network meta-analysis pulled together data from 102 studies involving 4,754 adults around age 70. It compared different resistance training modalities and found something surprising.

Source: Wiedenmann T, Held S, Morat T, Rappelt L, Isenmann E, Berndsen E, Hopp NH, Donath L. The effects of different resistance training modalities on muscle strength in community-dwelling older adults: a network meta-analysis. Gerontology. 2025;71(7):576-588. doi: 10.1159/000546346.