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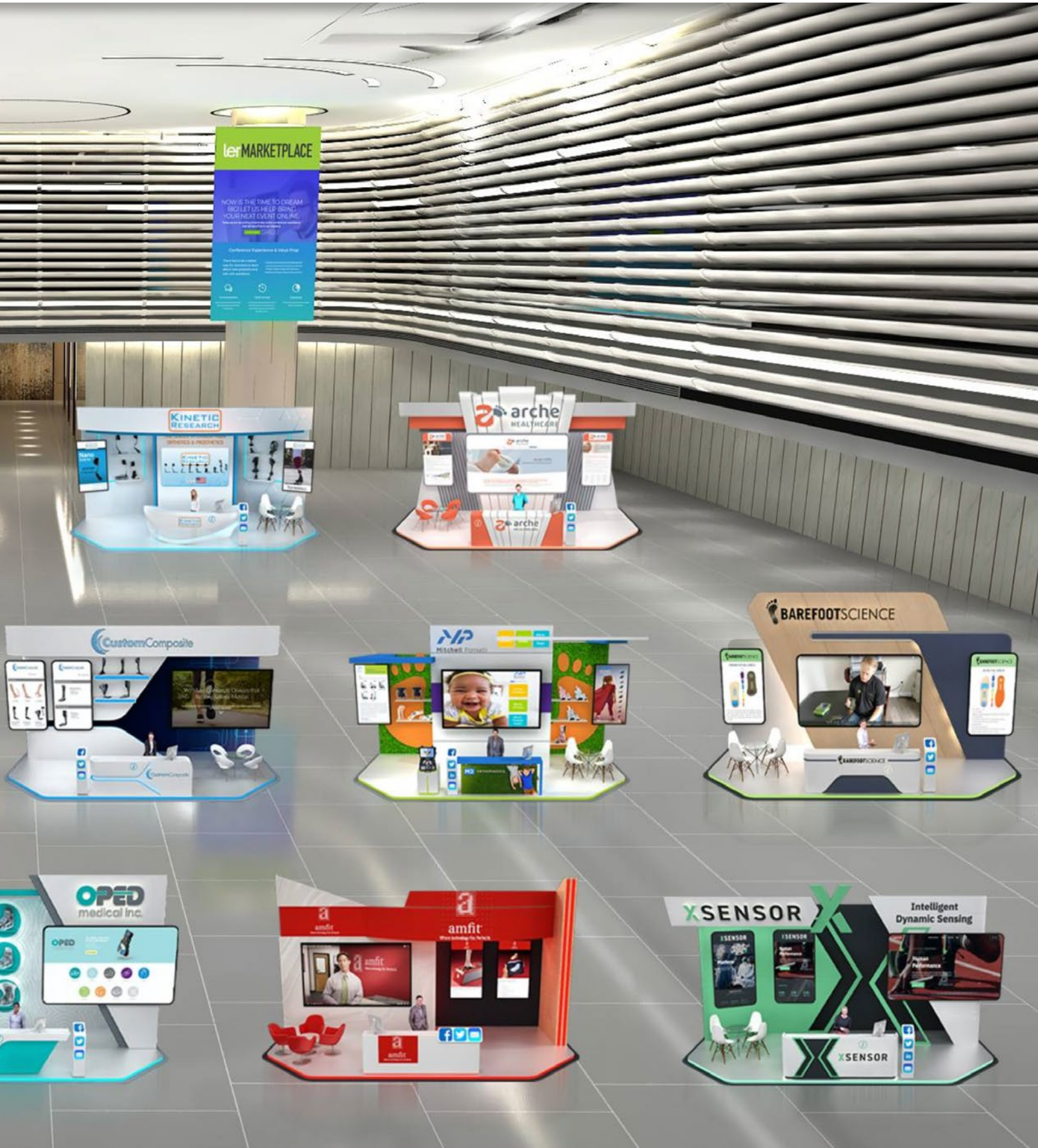

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Lower Extremity Review

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

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- Injury prevention is possible
- Diabetic foot ulcers can be prevented
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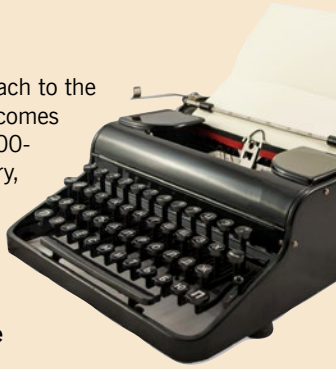

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Guest **Perspective**

Proprioception: A Primer on Balance & Aging

By Adrian Faccioni, MS

We typically lose proprioception as we age, which can negatively affect balance. But why do we lose proprioception simply because we age?

Proprioception was originally defined as "the perception of joint and body movement as well as position of the body, or body segments, in space." At present, proprioception can be defined as the cumulative neural input to the central nervous system from mechanoreceptors. The mechanoreceptors, specialized nerve endings, are located in the joint, capsules, ligaments, muscles, tendons, and skin.[1]

Normal aging is associated with slower cognitive processing, slower postural reactions, and decreased muscle strength, all of which are essential for optimal proprioception/balance.[2] Typically, age-related proprioception issues begin to present themselves in persons 50 or older. We exhibit slower reaction times and are at increased risk of falling since we respond slower under unfamiliar postural situations.

A decrease in proprioception leads to the decline of motor coordination and balance and could lead to abnormal joint biomechanics during functional activities such as walking. As such, over a period of time, degenerative joint disease may result. Colledge et al[3] studied the relative contributions to balance from vision, proprioception, and the vestibular system in different age groups. They found that all age groups were more dependent on proprioception than on vision for the maintenance of balance. Thus, impaired proprioception could be a contributing factor to falls.

Like many aspects of aging physiology, exercise has been found to ameliorate most of the effects of aging upon a person's proprioception/balance loss. Below I outline some of the key findings with proprioception/balance and aging and the 3 main decrements linked to this attribute: strength, central nervous system (CNS), and peripheral adaptation.

Strength

Research by Fukagawa et al[4] highlighted that their elderly subjects with a history of falls had less than half of the knee and ankle strength of non-falling subjects. The differences were more prominent at the ankle than the knee, and were most pronounced in the ankle dorsiflexors, where they were one-tenth that of controls.

Physical activity improving muscle strength can also improve proprioception. The improvement in muscle strength with exercise might yield better control of movement, which, as a consequence, could enhance joint proprioception under weight-bearing conditions.[5]

Central Nervous System

At the CNS level, aging induces progressive loss of the dendrite system in the motor cortex, losses in the number of neurons and receptors, and neurochemical changes in the brain. Age-related changes in spindle sensitivity decreases these mechanoreceptors in both sensing positioning change, but also in the speed at which they are able to respond to any such change (a key factor).[1]

It has been shown that the older adult has fewer, but on average larger and slower motor units, resulting in motor unit reorganization. Therefore, this age-related alteration of the number and function of motor units has profound implications in muscle force production and control. This lack of control also has repercussions in proprioceptive ability.[1]

At a CNS level, physical activity might modify proprioception by modulating the mechanoreceptor gain and inducing plastic

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changes in the CNS. Muscle spindle is the one mechanoreceptor whose gain can be modulated by the CNS.[2] Increased muscle spindle output may occur during exercise. In this way, repeated practice of a motor skill is thought to increase muscle spindle output, which could bring about plastic changes in the CNS, such as an increased strength of synaptic connections and/or structural changes in the organization and number of connections among neurons.[6] Indeed, repetitive afferent inputs from the mechanoreceptors could modify the cortical maps of the body over time. Plastic changes in the cortex can be induced by repeated positioning of body and limb joints in specific spatial positions as demanded by exercise.[7] Regular physical activity over time can increase cortical representation of the joints leading to enhanced joint proprioception.

Robbins et al[8] reported that proprioception decreases with aging in part because of changes in muscle spindle function. In addition, advancing age leads to deficits in the processing of sensory input (myelin abnormalities, axonal atrophy, and declined nerve conduction velocity).

Peripheral Adaptation

(Postural sensors within joints, muscles, tissues)

Peripheral neuropathy is a true risk factor for falls in the elderly. Relatively greater impairment in vibratory sense and ability to maintain unipedal stance may identify those within the peripheral neuropathy group who are at a higher risk for falls.[9]

Slower postural reaction and movement time and reduced medial–lateral control of the centre of mass during voluntary sway movements are associated with increased fall-risk in community-living older people.[10] Studies showed a relationship between aging and decline in several aspects of proprioceptive sensitivity, namely a decrease in joint position sense and an increase in movement detection threshold. In particular, the lower limb, knee joint position sense, and ankle joint position sense are negatively affected by aging.

Of the many receptors that mediate proprioception, only muscle spindles demonstrate an ability to modulate sensitivity to muscle stretch, thereby representing the most promising avenue for training-related improvements to occur.[1,11]

Exercise to Improve Proprioception

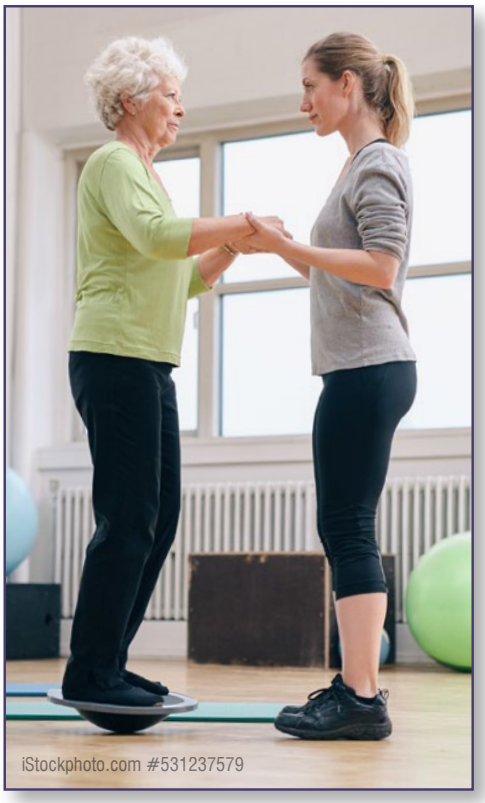
Gauchard et al[12] investigated the effects of different types of exercise on postural control and balance of adults over age 60 and concluded that proprioception can be "trained" and that regular exercise of a proprioceptive nature might be beneficial to retain or regain balance.

Peripheral level improvements in proprioception were linked to alterations in muscle spindle sensitivity. There is no evidence that training changes the number of mechanoreceptors, but there is evidence that training induces morphological adaptations in these major mechanoreceptors (muscle spindles). Training can induce muscle spindle adaptations

- At a microlevel: the intrafusal muscle fibers may show some metabolic changes, and
- At a more macro level, the latency of the stretch reflex response decreases and the amplitude increases.[13]

Tai Chi: Previous studies[14] showed that experienced Tai Chi practitioners had better joint proprioception and balance control during weight shifting despite the known aging effects in these specific sensorimotor functions.

BOSU and Swiss Ball: In a 2013 study,[15] patients (age 60–90 years) were submitted to a 12-week proprioception training program, 2 sessions of 50 minutes every week. This program includes 6 exercises with the BOSU and Swiss ball as unstable training tools that were designed to program proprioceptive training. The training program improved postural balance of older adults in mediolateral plane with eyes open and anterior–posterior plane with eyes closed. Significant improvements were observed in Romberg quotient (measurement of limb proprioceptive positioning) with speed but not with distance. These results indicate that a 12-week proprioception training program in older adults is effective in postural stability and static and dynamic balance, and could lead to an improvement in gait and balance capacity, and to a decrease in the risk of falling in adults age 65 years and older.



Wobble-board and Mini-trampoline: Two studies were found to follow traditional proprioceptive training programs focusing on wobble-board or mini-trampoline training in older adults with both demonstrating improvements in actively replicated joint positioning sense (JPS) at the ankle[16] and knee.[17]

Visuals, Variety, Velocity: Tasks within the study by Westlake et al[11] included standing or walking on various support surfaces (eg, a rocker board, foam, narrow beam) and standing in a tandem or semi-tandem position, standing on one leg, or standing with feet together. To alter visual cues, participants were instructed to close their eyes or to engage vision by reading or tracking a secondary task, or by performing balance tasks with a distracting background such as a checked pattern or moving people. To modify vestibular cues, participants were instructed to tilt their head backward or quickly move the head side to side and up and down to focus on a target. This research found that velocity sense

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was sensitive to targeted interventions and may represent an additional important consequence in terms of functional tasks. Considering that velocity information is crucial and more accurate than position information for the small postural corrections required during quiet stance, the possibility to reverse age-related changes in velocity sense is encouraging.

Moreover, impairments in postural control and fear of falling in older adults that remain unexplained by muscle weakness may potentially be alleviated by improvements in velocity discrimination following balance interventions. Nevertheless, it is important to note that despite the post-intervention improvements in velocity discrimination, these changes were not retained at the 8-week follow-up session. Thus, to maintain improvements in velocity discrimination, a regular targeted exercise regimen must be continued.

These results suggest that short-term improvements in velocity sense, but not movement and position sense, may be achieved following a balance exercise intervention.

Take Home Points

1. Maintenance of quality muscle (reducing sarcopenia) is key to maintaining many youthful aspects of physiological performance including proprioception/balance.

2. Appropriate training methods are crucial to the maintenance (or improvement) of proprioception/balance.

3. These training methods can include a combination of strength/hypertrophy training and balance training with a focus on the ankle/knee joints as key areas of weakness for balance as we age.

4. I suggest that all training programs include exercises that combine strength and balance which will lead to better functional fitness for the long term (exercises including single leg Romanian deadlifts, single leg shoulder presses, etc.). ler

Adrian Faccioni, MD, is a Senior Lecturer in Exercise Physiology and Rehabilitation at the University of Canberra in Australia. He has been involved in sport and fitness/conditioning for more than 30 years. After developing and commercializing the first Sport GPS, he ultimately moved back into strength and conditioning with a focus on translating the latest in sport science into training targeting those age 40+. This Perspective is an edited update of a recent blog post from his website, fatchfitness.com.

Reference

1. Ribeiro F, Oliveira J. Aging effects on joint proprioception: the role of physical activity in proprioception preservation. Eur Rev Aging Phys Act. 2007;4:71–76.
2. Morrison S, Colberg SR, Mariano M, Parson HK, Vinik AI. Balance training reduces falls risk in older individuals with type 2 diabetes. Diabetes Care. 2010;33(4):748-50.
3. Colledge NR, Cantley P, Peaston I, Brash H, Lewis S, Wilson JA. Ageing and balance: the measurement of spontaneous sway by posturography. Gerontology. 1994;40(5):273-8.
4. Wolfson L, Judge J, Whipple R, King M. Strength is a major factor in balance, gait, and the occurrence of falls. J Gerontol A Biol Sci Med Sci. 1995;50(Spec Is):64-7.
5. Petrella RJ, Lattanzio PJ, Nelson MG. Effect of age and activity on knee joint proprioception. Am J Phys Med Rehabil. 1997;76(3):235-41.
6. Schumway-Cook A, Wollacott MH. Motor Control: Theory and Practical Applications. Lippincott Williams & Wilkins. Baltimore, MD: 2000.
7. Tsang WW, Hui-Chan CW. Effects of tai chi on joint proprioception and stability limits in elderly subjects. Med Sci Sports Exerc. 2003;35(12):1962-71.
8. Robbins S, Waked E, McClaran J. Proprioception and stability: foot position awareness as a function of age and footwear. Age Ageing. 1995;24(1):67-72.
9. Richardson JK, Hurvitz EA. Peripheral neuropathy: a true risk factor for falls. J Gerontol A Biol Sci Med Sci. 1995;50(4):M211-5.
10. Tucker MG, Kavanagh JJ, Morrison S, Barrett RS. Voluntary sway and rapid orthogonal transitions of voluntary sway in young adults, and low and high fall-risk older adults. Clin Biomech (Bristol, Avon). 2009;24(8):597-605.
11. Westlake KP, Wu Y, Culham EG. Sensory-specific balance training in older adults: effect on position, movement, and velocity sense at the ankle. Phys Ther. 2007;87(5):560-8.
12. Gauchard GC, Jeandel C, Tessier A, Perrin PP. Beneficial effect of proprioceptive physical activities on balance control in elderly human subjects. Neurosci Lett. 1999;273(2):81-4.
13. Hutton RS, Atwater SW. Acute and chronic adaptations of muscle proprioceptors in response to increased use. Sports Med. 1992;14(6):406-21.
14. Tsang WW, Hui-Chan CW. Effects of exercise on joint sense and balance in elderly men: Tai Chi versus golf. Med Sci Sports Exerc. 2004;36(4):658-67.
15. Martínez-Amat A, Hita-Contreras F, Lomas-Vega R, Caballero-Martínez I, Alvarez PJ, Martínez-López E. Effects of 12-week proprioception training program on postural stability, gait, and balance in older adults: a controlled clinical trial. J Strength Cond Res. 2013;27(8):2180-8.
16. Waddington GS, Adams RD. The effect of a 5-week wobble-board exercise intervention on ability to discriminate different degrees of ankle inversion, barefoot and wearing shoes: a study in healthy elderly. J Am Geriatr Soc. 2004;52(4):573-6.
17. Diracoglu D, Aydin R, Baskent A, Celik A. Effects of kinesthesia and balance exercises in knee osteoarthritis. J Clin Rheumatol. 2005;11(6):303-10.

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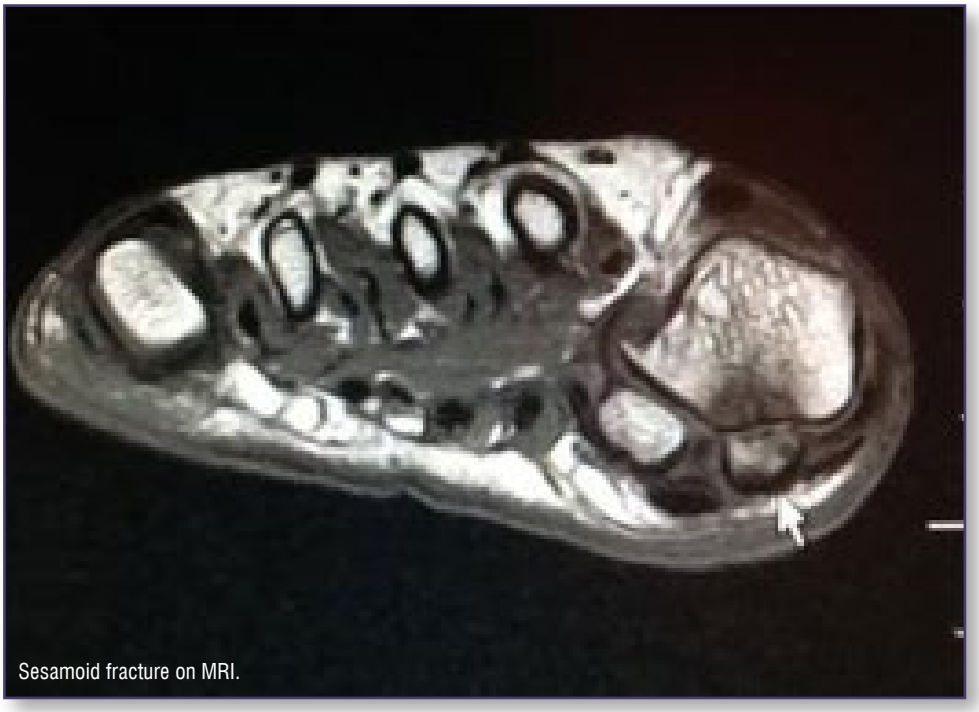
Practical Biomechanics for the Podiatrist – Book 1

By Richard Blake, DPM, MS

Biomechanics are foundational to podiatry, physiotherapy, and the study of orthotics and prosthetics. Here we provide an excerpt from the author's recently released Book 1 of the 4-part series, *Practical Biomechanics for the Podiatrist*.



Sesamoid fracture on MRI.

…Rule of 3

One of the general rules I use in practice is the Rule of 3. This is a rule that most overuse injuries are caused by at least 3 factors colliding together to overstress an area (a "perfect storm" sort of speak). If you go back to the basic fact that a single abnormal motion can produce a myriad of injuries, ask yourself why the injuries vary from patient to patient. For example, why would abnormal pronation produce knee pain in one patient, neuroma pain in another, and posterior tibial tendon pain in another? And, why would abnormal supination cause peroneal tendonitis in one patient, a fibular stress fracture in another, and sacroiliac joint inflammation in another? And, why would limb length discrepancy cause iliotibial band syndrome in one patient, low back pain in another patient, and hip arthralgias in another? I try to discover the answer to these questions by applying the Rule of 3. It typically takes 3 things to cause a problem especially because we tend to pick on the weakest link in the chain.

I love the example of a runner with wide feet and bunions and overpronation. Because of the bunions, they were in shoes longer than the actual shape of their feet. Therefore, the shoe does not bend where it should at the ball of the foot. It was also wintertime and most activities were indoors, leading to a transient Vitamin D deficiency. During this time, while running on the treadmill for the first time, pain developed under the big toe joint. The initial diagnosis was bunion pain from pronation, but the pain lingered. X-rays were taken on the second visit noting a tibial sesamoid fracture and appropriate treatment of removable boot for 3 months was started. During the following visits, as the cause(s) was investigated, 5 (not 3) causes were eventually found, treated and discussed with the patient, as correction of the causes could hopefully prevent this from happening again and again. These 5 causes and their treatments were therefore part of a successful rehabilitation program. The causes (with treatment in parentheses) were:

1. Excessive pronation leading to an overload of big toe joint (orthotic devices used along with dancer's padding and cluffy wedges)

2. Vitamin D deficiency with initial blood level 17 (32-80 normal range attained with 2000 units vitamin D daily over the next 6 months)

3. Improper metatarsal bending point, leading to the excessive metatarsal rigidity since the too long shoe did not bend where the patient's foot should bend, leading to too much stress on the sesamoids (proper shoe selection with better forefoot width and normal length sizing)

4. Inexperience with a treadmill can make patients run faster than normal (excessive braking can cause a jerk to the foot from the treadmill) or slower than normal (excessive pronation torque to foot as the belt tries to speed you up which was the case here and the patient was educated on this)

5. Plantarflexed first metatarsal is a structural deformity that puts the first metatarsal head below the plane of the other metatarsals. Fifty percent of the time this deformity will cause excessive rearfoot supination for compensation, but this patient actually pronated due to poor shoe stability and generalized loose

Continued on page 17

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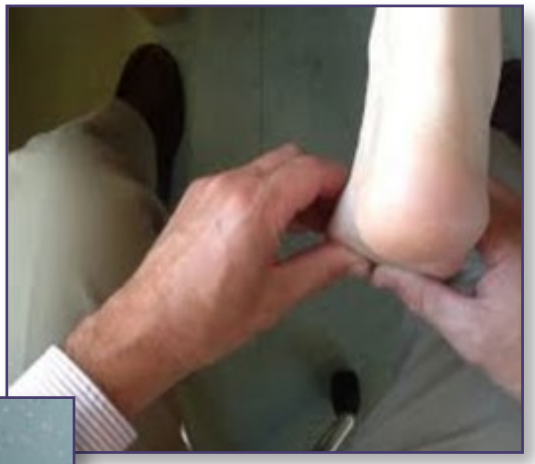
ligaments and loose midfoot on the exam. The foot pronation driving the foot to overload the medial side, along with the plantigrade position of the first metatarsal head, lead to the sesamoid overload and injury. (This was corrected with an orthotic device and the patient used dancer's pads from Dr. Jill's [drjillsfootpads.com] and Hapad [hapad.com] companies for a while).

This example is to show how looking for causes, starting simply with the Rule of 3, can help the injury rehabilitation and reverse the cause for the future. The goal is to help all the weak areas and keep the patient going and going like the old Energizer Bunny!! For me, the Rule of 3 differentiates podiatrists from all other professions. And, it is the mechanics of an injury and its treatment that also makes podiatry work. The example above shows how 5 mechanical issues involving the foot structure, treadmill mechanics, shoe gear issues, bone health, and general overpronation, all contributed to a broken sesamoid bone. In our fast and furious world of medicine, you may not have time to put this all together. Yet, I find in situations where injuries need 5-7 visits from you, and then more from a physical therapist, you can have time to put these things together to help your patient heal and avoid further problems. It takes a certain mechanical focus to achieve that.

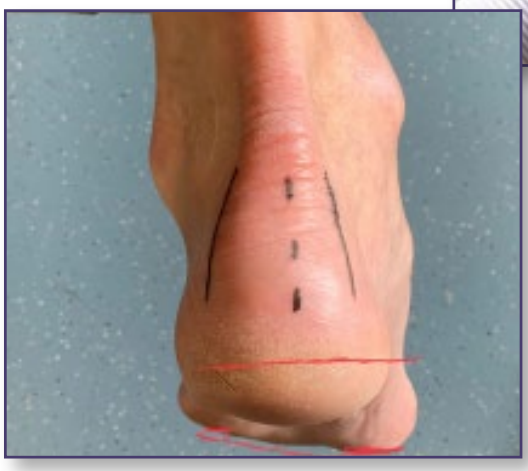
Practical Biomechanics Question #25: The Rule of 3 focuses on causes of injury to speed up rehabilitation and prevent injury recurrence. What are 3 common causes of plantar fasciitis?

Practical Biomechanics Question #26: Using the rule of 3, what are 3 common structural causes of 2nd metatarsal pain from overload?

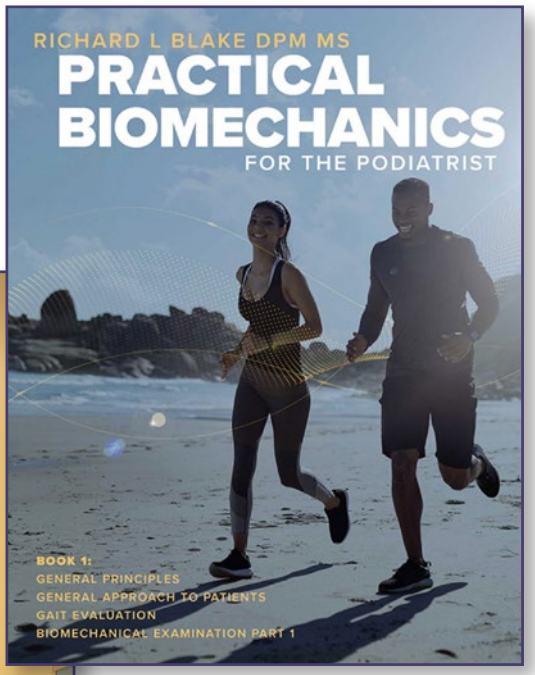
Richard Blake, DPM, MS, is adjunct faculty at the California School of Podiatric Medicine. He has practiced podiatry at the Sports and Orthopedic Institute of St. Francis Memorial Hospital in San Francisco, CA. Dr. Blake is Past President of the American Academy of Podiatric Sport Medicine. His book, Practical Biomechanics for the Podiatrist, Book 1, *is available from Amazon.com and Barnesandnoble.com.*

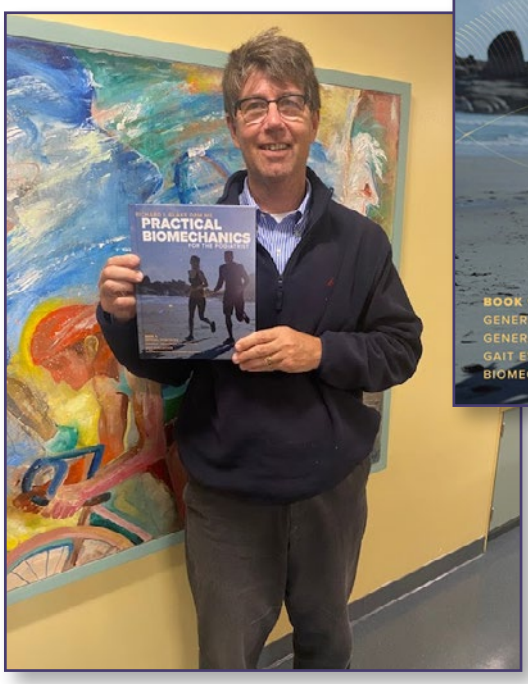


First metatarsal position being evaluated by stabilizing the 2nd metatarsal head and moving the first metatarsal head up and down to get position and range of motion.



Presence of a plantar flexed first ray makes the sesamoid more plantarly prominent.





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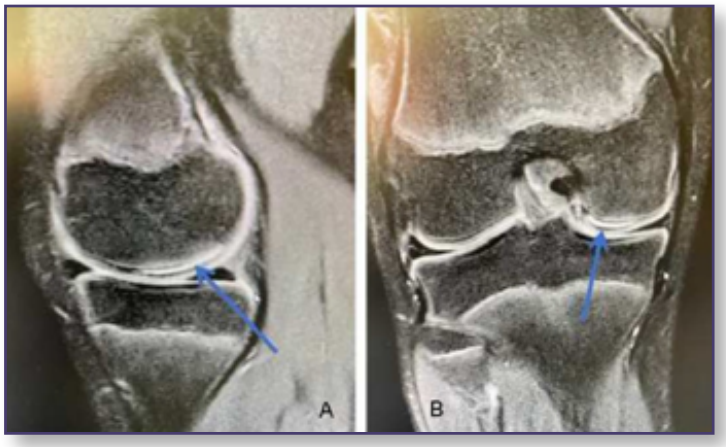

When a cartilage surface is damaged, it often occurs via a rotational movement with a force coming from the side or as a direct force. In this type of injury, the forces affect the different layers in the cartilage so that the greatest weakness lies in the layer between the calcified cartilage and other cartilage. The damage goes deep down but usually does not expose the bone plate. A crush damage more or less destroys the various layers in the vertical direction. However, most injuries are a combination of rotation and direct vertical forces. Not so well-known but important is the damage that occurs between the calcified bone (in the calcified zone) and the bone plate. This is called chondral delamination. It is difficult to diagnose and if noticed late, a more severe chondral lesion may develop with eruption to an open lesion. The intact superficial cartilage layer will be unstable and strong shearing forces on the edges of the delamination may lead to either enlargement of the delamination or fissuring. Finally, such a delamination develops into a full thickness defect ICRS grade 3c. Many full thickness defects could have been localized chondral delaminations initially.

Patients seeking orthopedic evaluation due to joint pain, post-trauma or without traumatic history are most often examined by MRI. If nothing is found on MRI, the patients are scheduled for physiotherapy. However, if in spite of long-time training, the patient still is in pain, often the next step is an arthroscopy. Prior to an arthroscopy, one may add a scintigraphic evaluation like a pure technetium scan or a SPECT. Such a scan may show an increased uptake locally in the joint which will help the surgeon performing the arthroscopy to focus on the area of scintigraphic uptake. The incidence of chondral delamination injuries of the knee has not been reported in the literature. Already in 1985, Hopkinson et al described a group of patients presenting with meniscal symptoms who, on arthroscopic examination, had chondral fractures of the medial or lateral femoral condyle. The authors felt it was important to discuss the chondral fracture so that the orthopedic surgeon could be aware of this injury type. Since then, better diagnostics have been introduced with different MRI sequences but still chondral delaminations may be difficult to diagnose. Delamination injuries of cartilage can lead to significant morbidity if they are not treated early. This means that delay in finding such lesions may lead to early osteoarthritis and more aggressive treatments. If a patient is claiming a significant pain in certain degrees of joint flexion, suspicion of local delamination is adequate and an arthroscopy is indicated, though the MRI is negative. (ler)

Source: *Brittberg M. Knee chondral delaminations and blisters. J Cartilage & Joint Preserv. 2022;2(3):100056.*

RISK FACTORS FOR RUNNING-RELATED LOWER EXTREMITY INJURIES

In a study of both trail and road runners, researchers from Belgium sought to investigate the risk factors for running-related injuries (RRIs).

They conducted an online survey of 3,669 injured and noninjured runners. Injury was defined as pain of various kinds, without attention to its consequences on running practice. The survey included 41 questions on 5 main categories—personal characteristics, daily lifestyle, training and running characteristics, practice of other sporting activities, and prevention habits—as well as information about the occurrence of RRIs over the previous 12 months. Continuous and qualitative variables were analyzed by Student t test and chi-square test, respectively.

Among the 3,669 runners, 1,852 (50.5%) reported at least 1 injury over the previous 12 months. Overuse injuries were reported by 60.6% of respondents. The variables associated with RRIs that remained signifi-

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cant in the fully adjusted model were:

- previous injury (odds ratio [OR], 1.62; 95% CI, 1.42-1.86)
- higher weight (OR, 1.006; 95% CI, 1.00-1.012)
- competitive running (OR, 1.53; 95% CI, 1.19-1.98)
- running >2 h/wk (OR, 1.28; 95% CI, 1.01-1.62)
- running >20 km/wk (OR, 1.25; 95% CI, 1.001-1.55), and
- stretching before running (OR, 1.46; 95% CI, 1.25-1.71).

The authors concluded that previous injury remains the most relevant risk factor for RRIs according to their findings and previous data. Many training characteristics seem to be involved but still have to be confirmed in view of conflicting data in the literature. Further research would help clinicians better understand RRIs and how to prevent them.

Source: *Sanfilippo D, Beaudart C, Gaillard A, Bornheim S, Bruyere O, Kaux J-F. What Are the Main Risk Factors for Lower Extremity Running-Related Injuries? A Retrospective Survey Based on 3669 Respondents. Orthopaedic Journal of Sports Medicine. 2021;9(11).*

GAIT PARAMETERS, MEDICATIONS & RISK OF FALLS IN ELDERLY

Falls are a leading cause of injury, hospitalization, and death among older adults due to a variety of factors, but 2 are key: 1) Changes to the medio-lateral margin of stability, pace, and base of support, which typically occur as part of the aging process; and 2) Increased use of multiple medications for a variety of chronic illnesses, which can lead to unsteadiness, impaired alertness, or dizziness. Given that most falls occur during ambulation, many fall prevention guidelines recommend gait assessments. This study sought to analyze factors affecting spatio-temporal gait parameters in older adults of different ages with differing risks of fall, fall history, and medications.

Researchers used the Downton Fall Risk Index to assess the risk of falls in 210 community-dwelling adults (156 females, 54 males; mean age, 72.84± 6.26 yrs), but they added a question about medication intake (all prescribed drugs). The Zebris FDM platform was used to assess gait parameters. Gait parameters and Downton Fall Risk Index, stratified by participants' history of falls, multiple medication use (0/1/2+), gender, age, and medication categories, were statistically analyzed using the Mann–Whitney U-test and Kruskal–Wallis test.

When comparing different medication categories, a Downton Fall Risk Index score indicating a high risk of falls was observed in the psychotropic medication category (3.56±1.67). A gait velocity suggesting a higher risk of falls (≤3.60 km/h) was observed in the psychotropic (2.85±1.09 km/h) and diabetes (2.80±0.81 km/h) medication categories, in the age groups 70–79 years (3.30±0.89 km/h) and 80+ years (2.67±0.88 km/h), and in participants using 2 or more medications (3.04±0.93 km/h).

These results confirm previous observations and show that higher age and multiple medications (polypharmacy) negatively affect gait, and that the higher risk of falls is associated with psychotropic and diabetes medication use. These results provide important information for future fall prevention programs for the elderly that would be especially beneficial for elderly people taking psychotropic and diabetes medication.

Source: *Gimunová M, Sebera M, Kasović M, Svobodová L, Vespalec T. Spatio-temporal gait parameters in association with medications and risk of falls in the elderly. Clin Interv Aging. 2022;17:873-883. doi: 10.2147/CIA.S363479. Use is per CC BY.*

BALANCE RECOVERY NOT AFFECTED BY COGNITIVE TASK

Most of older adults' falls are related to inefficient balance recovery after an unexpected loss of balance, i.e., postural perturbation. Effective balance recovery responses are crucial to prevent falls. Due to the considerable consequences of lateral falls and the high incidence of falls when walking, this study aimed to examine the effect of a concurrent cognitive

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task on older adults' balance recovery stepping abilities from unannounced lateral perturbations while walking. These authors sought to explore whether cognitive performance accuracy is affected by perturbed walking and between task trade-offs.

In a laboratory-based study, 20 older adults (>70 years old) performed the following test conditions: (1) cognitive task while sitting; (2) perturbed walking; and (3) perturbed walking with a concurrent cognitive task. The cognitive task was serial numbers subtraction by 7. Single-step and multiple-step thresholds, highest perturbation achieved, 3D kinematic analysis of the first recovery step, and cognitive task performance accuracy were compared between single-task and dual-task conditions. Between task trade-offs were examined using dual-task cost (DTC).

Single-step and multiple-step thresholds, number of recovery step trials, number of foot collision, multiple-step events and kinematic recovery step parameters were all similar in single-task and dual-task conditions. Cognitive performance was not significantly affected by dual-task conditions, however, different possible trade-offs between cognitive and postural performances were identified using DTC.

In situations where postural threat is substantial, such as unexpected balance loss during walking, balance recovery reactions were unaffected by concurrent cognitive load in older adults (i.e., posture first strategy). ler

Source: *Paran I, Nachmani H, Salti M, Shelef I, Melzer I. Balance recovery stepping responses during walking were not affected by a concurrent cognitive task among older adults. BMC Geriatr. 2022;22(1):289. doi: 10.1186/s12877-022-02969-w.*

UTILITY OF KAFOS POST-STROKE STUDIED

For many years, knee-ankle-foot orthosis (KAFO) therapy to improve functional mobility and activities of daily living (ADL) was considered to be effective for patients with stroke. However, evidence regarding the efficacy of KAFO use post-stroke is unclear, due to a lack of published high-quality studies. In response to recent published case reports claiming the efficacy of KAFO therapy, these authors sought to synthesize the available evidence for this therapeutic use. A systematic review was performed, which reviewed 14 case reports involving 15 patients. Improvements of functional mobility and ADL were shown in 10 and 9 of the 15 patients, respectively. However, the methodological quality of the reviewed case reports was low. These findings present the current evidence from case reports regarding KAFO therapy in patients with stroke; however, the findings are insufficient to draw clear conclusions about the efficacy of such therapy. Of value, the study revealed the optimal outcome measures for use in measuring the effect of KAFO therapy, which can be used to facilitate high-quality future studies. These include:

Focus on functional mobility: Functional mobility is important for patients, to enable participation in ADL in the real-life setting by addressing orthotic therapy.

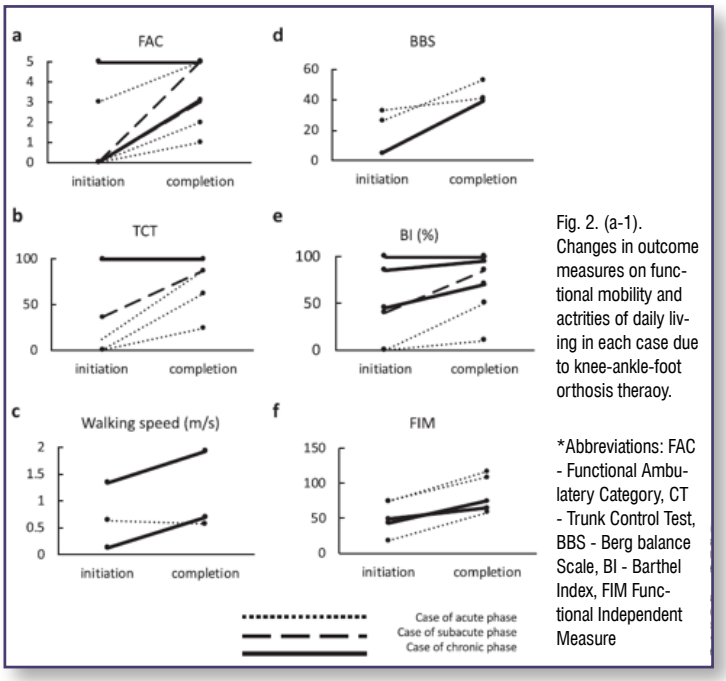

Fig. 2. (a-1). Changes in outcome measures on functional mobility and actrities of daily living in each case due to knee-ankle-foot orthosis theraoy.

*Abbreviations: FAC - Functional Ambulatery Category, CT - Trunk Control Test, BBS - Berg balance Scale, BI - Barthel Index, FIM Functional Independent Measure

Focus on phase of stroke:

- The Functional Ambulatory Category (FAC), the most frequently reported outcome measuring functional mobility, would be applicable in all disease phases. The FAC is a simple and valid functional walking test that evaluates ambulation status with a 6-point scale by determining how much human support the patient requires when walking.
- In contrast, the Trunk Control Test (TCT) would be applicable in the acute or subacute disease phase. The TCT is a reliable and valuable tool in assessing trunk movements in patients with strokes. KAFO therapy can be performed on patients in the acute or subacute phase with the expectation of improving trunk movement.

Focus on the efficacy of KAFO therapy in improving ADL by specifying which ADL items are affected by KAFO therapy.

Track patient adherence to KAFO therapy: Various reasons for non-adherence to orthotic therapy include: the patients found it unnecessary, usage difficulties, pressure sensation, not making life easier, and lack of a suitable environment. Clarifying the reasons for non-compliance with orthotic therapy may mean that the orthotic therapy plan could be modified based on patient perspectives so that the intervention would be more acceptable to patients or more effective overall. ler

Source: *Kobayashi E, Hiratsuka K, Haruna H, Kojima N, Himuro N. Efficacy of Knee-Ankle-Foot Orthosis on Functional Mobility and Activities of Daily Living in Patients with Stroke: A Systematic Review of Case Reports. J Rehabil Med. 2022;54:jrm00290. doi: 10.2340/jrm.v54.87.*

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The Association Between Step Count and Walking Intensity

The goal of walking 10,000 steps per day is not rooted in science. Rather, it came from a clever Japanese marketing campaign in 1964, for a pedometer called the Manpo-kei: "man" meaning 10,000, "po" meaning steps, and "kei" meaning meter. Despite the origin, this number became a benchmark to achieve while walking for exercise, and it has become a focus of numerous scientific studies. Here we summarize and excerpt a round-up of recent research findings that discuss the correlation of step counts and intensity of those step counts.

Walking for Good Health

Walking doesn't require any special equipment, except for decent footwear. It is free to engage in and easy to get started. It is also one of the most popular ways for adults to get exercise. The 10,000 steps per day benchmark, however, has been found to be an arbitrary number, with health benefits achieved even at lower thresholds. How low remains a question.

A research team sponsored by the National Cancer Institute, National Institute on Aging, and the Centers for Disease Control used findings from the National Health and Nutrition Examination Survey (NHANES) between 2003-2006 from people age 40 and older who wore an accelerometer for a week.[1] They then collected information on deaths for about a decade, specifically tracking deaths from cancer and heart disease. In their analysis, the researchers compared the risk of death over the follow-up period among people who took fewer than 4,000, up to 8,000, or 12,000 or more steps per day. They also tested whether step intensity, measured by cadence, was associated with better health. Compared with people who took 4,000 steps per day, those who took 8,000 steps per day at the start of the study had a 50% lower risk of dying from any cause during follow-up. People who took 12,000 steps per day had a 65% lower risk than those who only took 4,000. Step intensity did not seem to impact the risk of mortality once the total number of steps per day was considered. Only an increased number of steps per day was associated with a reduced risk of death.

Taking 4,000 or fewer steps a day is considered a low level of physical activity. So what happens below that level? A study by Lee et al found that among older women, those who took 4,400 steps per day had a lower risk of dying compared to those who took 2,700 steps per day.[2] With more steps per day, mortality rates progressively decreased before leveling at 7,500 steps per day. Thus, a more modest goal of 4,400 steps per day has been shown to

TABLE 1. AVERAGE WALKING SPEED BY AGE

Age	Meters/second	Miles/hour
20 to 29	1.34 to 1.36	3.0 to 3.04
30 to 39	1.34 to 1.43	3.0 to 3.2
40 to 49	1.39 to 1.43	3.11 to 3.2
50 to 59	1.31 to 1.43	2.93 to 3.2
60 to 69	1.24 to 1.34	2.77 to 3.0
70 to 79	1.13 to 1.26	2.53 to 2.82
80 to 89	.94 to .97	2.10 to 2.17

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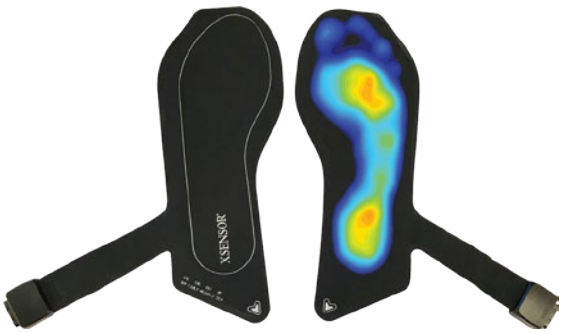

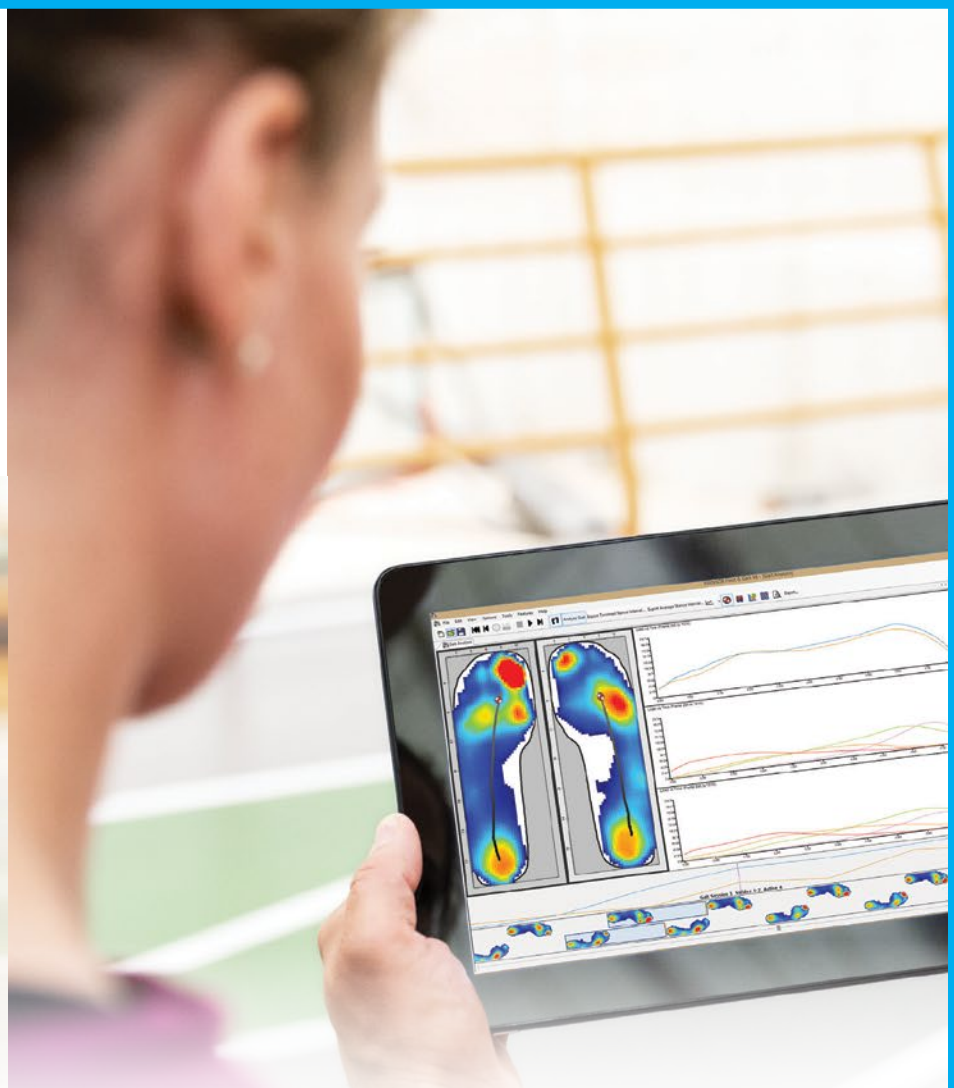

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produce health benefits. These authors saw no clear association regarding stepping intensity and lower mortality rates.

Another study, presented at the recent 2022 European Society of Cardiology focused on the amount of time spent walking rather than on the number of steps taken. The study population comprised 7,047 Korean adults, age 85 and older.[2] The researchers found that those who walked at least 1 hour per week had a 40% lower risk of all-cause mortality and a 39% lower risk of cardiovascular mortality. The takeaway, according to a press release quoting study author Moo-Nyun Jin, MD, is to keep walking throughout life. "Put simply, walk for 10 minutes every day."[3]

Walk Faster for Better Health

Walking, undeniably, produces marked health benefits. The 10,000-step-per-day benchmark that has often been cited has taken hold, in part, because step counts are an easy goal to understand. But is number of steps the only factor? In recent years, researchers have been taking a deeper look into the association between daily step count and walking intensity. Studies have reported that low walking speed, especially in older adults, is strongly associated with an increased risk of cardiovascular disease (CVD) mortality, all-cause mortality, as well as mortality in cancer survivors. Indeed, walking speed is known to decrease with age, slowing by about 1.2 minutes per kilometer at age 60, compared to age 20 (Table 1).[4]

And that slow down matters. Williams and Thompson[5] found that mortality risk decreases in association with walking intensity and increases substantially in association for walking pace ≥24-minute mile (equivalent to <400m during a 6-minute walk test) even among subjects who exercise regularly.

Aging and Telomere Length: Dempsey et al[6] conducted analyses in 405,981 UK Biobank participants for their study, in which they examined the associations of self-reported walking pace with telomere length. Telomeres, the protective caps on the ends of chromosomes, protecting our DNA, are linked to aging and

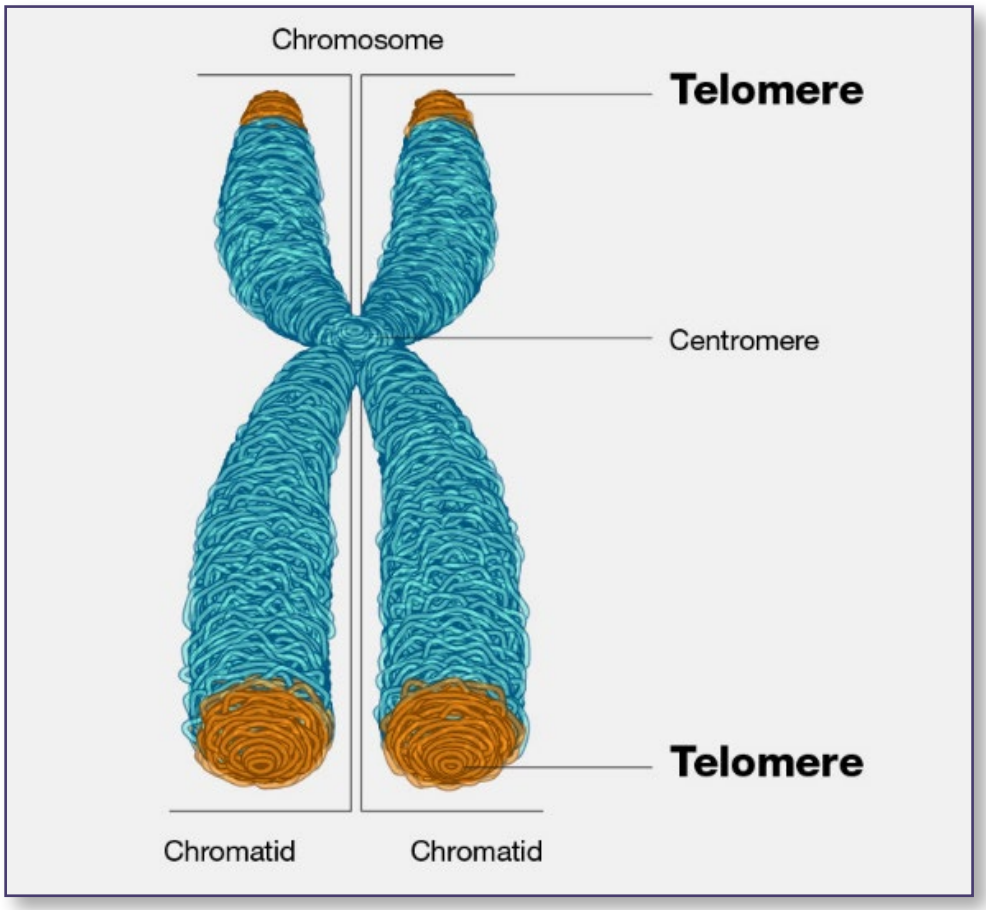

Figure 1. A telomere is a region of repetitive DNA sequences at the end of a chromosome. Telomeres protect the ends of chromosomes from becoming frayed or tangled. Each time a cell divides, the telomeres become slightly shorter. Eventually, they become so short that the cell can no longer divide successfully, and the cell dies. Image courtesy of the National Human Genome Research Institute.

disease. They shorten as we age and due to poor lifestyle choices, such as smoking, alcohol consumption, and eating red or processed meats.

About half of the cohort reported an average/steady walking pace, 6.6% reported a slow walking pace, and 41.1% reported a brisk pace.[6] Those who reported being average/steady and brisk walkers were slightly younger, were more likely to have never smoked, and were less likely to be taking cholesterol/blood pressure medications, have a chronic disease, or have mobility limitations, compared to slow walkers. And the slow walkers engaged in less physical activity overall, had a poorer quality of life, and a higher prevalence of obesity compared to average and brisk walkers.[6]

In support of the importance of walking pace, the researchers showed that more time habitually spent in higher intensity activities such as brisk walking had a stronger association with leucocyte telomere length (LTL) than total activity and overall health. Importantly, a causal link between walking pace and LTL was shown, rather than the other way around.[6]

Taking this a step further, what is the correlation between a faster gait speed and logging 10,000 steps per day?

Walking Faster and Longer for Better Health

Writing in the journals *JAMA Internal Medicine and Jama Neurology*, del Pozo Cruz[7,8] et al highlight that every 2,000 steps—up to about 10,000 steps per day—lowered mortality due to premature death, CVD, and cancer, and was associated with a lower risk of all-cause dementia. And stepping intensity showed beneficial associations for premature death, CVD, cancer,

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and dementia over and above total daily steps. Their prospective cohort companion studies, the largest to date to objectively track step count in relation to health outcomes, used UK Biobank data for 78,500 adults (age 40 to 79) with wearable trackers with a median follow-up of 7 years for the first and 78,430 adults (age 40 to 79) with wearable trackers, with 6.9 years of follow-up. Primary exposures were daily step counts, incidental steps (<40 steps/min), purposeful steps(≥40 steps/min), and step intensity, or peak-30 cadence (average steps/min for the 30 highest, but not necessarily consecutive, min/d). Secondary exposures were steps performed at light, moderate, vigorous, and moderate-to-vigorous intensity and walking steps.[7]

All Cause, Cancer, and CVD Mortality: Higher number of daily steps was associated with a lower risk of all-cause, cancer, and CVD mortality for each 2,000 steps increment. A higher number of incidental steps was associated with a lower risk of all-cause, cancer, and CVD mortality for each +10% incidental steps increment. A higher number of purposeful steps was associated with a lower risk of mortality for all-cause, cancer, and CVD mortality with +10% increase in purposeful steps increment. Consistent associations of a stronger magnitude were found for peak-30 cadences, beyond the benefits of total daily steps for all-cause, cancer, and CVD mortality. For the secondary exposures, the associations were similar except for the analyses of vigorous intensity stepping and cancer and CVD mortality.[7]

Cancer and CVD Incidence: Increasing numbers of daily steps for each 2,000 steps increments, purposeful steps (+10%), and peak-30 cadence were associated with lower CVD incidence. Similar patterns were observed for cancer incidence. Higher number of walking steps and light intensity steps were associated with a lower risk of cancer and CVD incidence. The researchers also found additional associations between moderate and moderate-to-vigorous intensity steps and risk of incident cancer.[7]

Dementia: Over the 6.9 median years of follow-up, 866 of the 78,430 participants developed dementia. Younger, healthier female participants took more steps in the sample. The optimal dose for daily steps was 9,826 steps and the minimal dose was 3,826. For incidental steps, the optimal dose was 3,677 steps. For purposeful steps, the optimal dose was 6,315 steps. For peak 30-minute cadence, the optimal dose was 112 steps per minute. Removing participants diagnosed with dementia within the first 2 years of follow-up or further adjustment for relevant biomarkers did not change the results.[8]

In their conclusion, del Pozo Cruz et al pointed out that even taking as few as 3,800 steps per day can cut the risk of dementia by 25%. Thus, less active adults are not precluded from receiving health benefits so long as step intensity is a main focus. The takeaway, they said, is that stepping intensity showed beneficial associations for all outcomes over and above daily steps.

[***Editor's Note:*** All of the articles excerpted here are available open access and readers are encouraged to use the doi numbers in the reference list to find and read them fully.]

References

1. Saint-Maurice PF, Troiano RP, Bassett DR Jr, et al. Association of Daily Step Count and Step Intensity With Mortality Among US Adults. JAMA. 2020 Mar 24;323(12):1151-1160. doi: 10.1001/jama.2020.1382. Use is per CC BY.
2. Lee IM, Shiroma EJ, Kamada M, Bassett DR, Matthews CE, Buring JE. Association of Step Volume and Intensity With All-Cause Mortality in Older Women. JAMA Intern Med. 2019 Aug 1;179(8):1105-1112. doi: 10.1001/jamainternmed.2019.0899. PMID: 31141585; PMCID: PMC6547157. Use is per CC BY.
3. Jin MN. Association of usual walking with mortality in oldest old adults aged 85 years and older: a nationwide senior cohort study. Abstract presented Aug. 28, 2022, at the European Society of Cardiology Congress 2022 held in Barcelona, Spain.
4. "What Is the Average Walking Speed of an Adult?" Healthline Media Fitness. Reviewed March 2019. Available at https://www.healthline.com/health/exercise-fitness/average-walking-speed Accessed Sept. 1, 2022.
5. Williams PT, Thompson PD. The relationship of walking intensity to total and cause-specific mortality. Results from the National Walkers' Health Study. PLoS One. 2013 Nov 19;8(11):e81098. doi: 10.1371/journal.pone.0081098. PMID: 24260542; PMCID: PMC3834211. Use is per Creative Commons Public Domain declaration.
6. Dempsey, PC, Musicha, C, Rowlands, AV, et al. Investigation of a UK biobank cohort reveals causal associations of self-reported walking pace with telomere length. Commun Biol 5, 381 (2022). https://doi.org/10.1038/s42003-022-03323-x. Use is per CC BY.
7. del Pozo Cruz B, Ahmadi MN, Lee I, Stamatakis E. Prospective Associations of Daily Step Counts and Intensity With Cancer and Cardiovascular Disease Incidence and Mortality and All-Cause Mortality. JAMA Intern Med. Published online September 12, 2022. doi:10.1001/jamainternmed.2022.4000. Use is per CC BY.
8. del Pozo Cruz B, Ahmadi M, Naismith SL, Stamatakis E. Association of Daily Step Count and Intensity With Incident Dementia in 78 430 Adults Living in the UK. JAMA Neurol. 2022;79(10):1059–1063. doi:10.1001/jamaneurol.2022.2672. Use is per CC BY.

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Chronic Venous Insufficiency and the Diabetic Patient: Is There a Connection?

By Windy Cole, DPM, CWSP

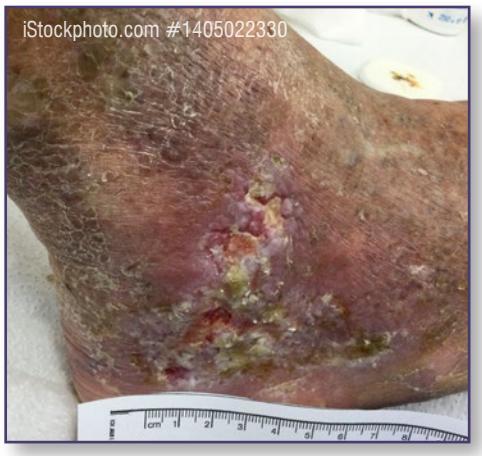
Is there a link between diabetes and chronic venous insufficiency (CVI)? Well, let's just say that relationship is "complicated." While diabetes may not directly cause venous insufficiency, it does have an effect on the tissues of the lower extremities. It has been documented that glycosylated hemoglobin is damaging to endothelium, and hyperglycemia and hyperlipidemia injure lymphatic tissue.[1] When diagnosed together, these disease states can have an overwhelming negative effect. A 2022 study published in the *Journal of Vascular Surgery* noted that higher Clinical, Etiological, Anatomical, and Pathological (CEAP; Figure 1) category patients also had a greater prevalence of diabetes.[1] Additional research is needed to establish causation and correlation.

There are many underlying health and lifestyle factors seen in patients with diabetes that can contribute to the development of venous disease. High blood glucose levels seen in uncontrolled/undiagnosed diabetes can weaken the structure of the vein walls and can cause damage over time. Additionally, weight gain associated with uncontrolled diabetes could make venous disease more likely by causing additional strain on the venous system. A study conducted by Mani and colleagues examined the point of prevalence of venous disease in the diabetic population.[2] The investigators found a significantly higher level of venous incompetence in their study cohort (64% to 70%) than had previously been reported (~43% to ~50%).[2] Furthermore, they reported that the study results suggested the presence of hemodynamic changes and morphological changes in diabetic patients with and without foot disease.[2] Conclusions can be drawn that if the hemodynamic changes seen in the venous system of diabetic patients can be controlled, there is potential to decrease the number of diabetic foot ulcers that occur. Additional studies are needed to prove this hypothesis.

CVI Management

The co-existence of diabetes and CVI impacts wound healing outcomes. Edema causes an alteration in endothelium that begins a complex cascade of detrimental events. Neutrophils become activated and adhere to capillary walls thus creating ischemia-reperfusion injury releasing free oxygen species.[3] The resulting inflammation damages the vasculature and soft tissues.[3] As hypoxia ensues, inflammation worsens, and harmful matrix metalloproteinases cause dermal tissue fibrosis and eventual ulceration.[3] Compression therapy facilitates the removal of lower extremity edema. White blood cells detach from the endothelium. Inflammation lessens. Decreasing edema improves microcirculation. As perfusion improves, the tissue environment stabilizes and tissue fibrosis decreases.

Evidence-based guidelines on managing diabetic foot ulcers and venous leg ulcers strongly advise patients undergo Ankle-Brachial Index/Toe-Brachial Index (ABI/TBI) and venous insufficiency ultrasound to confirm clinical diagnosis and to determine the appropriate treatment pathway. Appropriate vascular evaluations also aid in the proper application of compression therapy to control interstitial edema and lymphedema. Finding a compression therapy solution that is also safe and effective in the diabetic patient will have additional benefits in this at-risk patient population. This is a great opportunity in wound care research to improve outcomes in wound closure that can potentially impact the entire healthcare system.



References

1. Singh TP, Velu RB, Quigley F, Golledge J. Association of chronic venous disease with major adverse cardiovascular events. J Vasc Surg Venous Lymphat Disord. 2022;10(3):683-688. doi: 10.1016/j.jvsv.2021.08.021.
2. Mani R, Yarde S, Edmonds M. Prevalence of deep venous incompetence and microvascular abnormalities in patients with diabetes mellitus. Int J Low Extrem Wounds. 2011;10(2):75-9.
3. Mariani F, ed. Compression: consensus document based on scientific evidence and clinical experiences. The Compression Therapy Study Group. Task Force 2009. Torino, Italy: Edizioni Minerva Medica S.p.A; 2009.

FIGURE 1. CEAP CLINICAL CATEGORIES

C0	No visible or palpable signs of venous disease
C1	Telangiectasies or reticular veins
C2	Varicose veins; distinguished from reticular veins by a diameter of 3mm or more
C3	Edema
C4	Changes in skin and subcutaneous tissue secondary to CVD C4A Pigmentation or eczema C4B Lipodermatosclerosis and/or atrophie blanche
C5	Healed ulcer
C6	Open ulcer
CVD, cardiovascular disease	

Load Resolution in Runners: What Really Matters – Part I

By Simon Bartold

In this presentation, we will look at some of the great paradigms of injury prevention that have underpinned the running shoe industry for more than 40 years: motion control and cushioning. Do these paradigms stand up to scientific scrutiny, and if not, where else should we be looking?

Vibration is considered one of the key input signals in running, and yet it is one of the least investigated in the scientific literature. [In Part II, which will appear next month] we will examine the nature and effect of vibration on human systems during running and pose a possible alternative explanation for running-related injury and performance.

We've known for some time that motion control and cushioning are not mechanisms of injury prevention, but we didn't really focus elsewhere as the [running shoe] industry kept moving in that direction. Then, along comes the Nike React Infinity Run–it turns our whole philosophy on its head and looks at how we might build running shoes with a focus on injury in a completely different way.

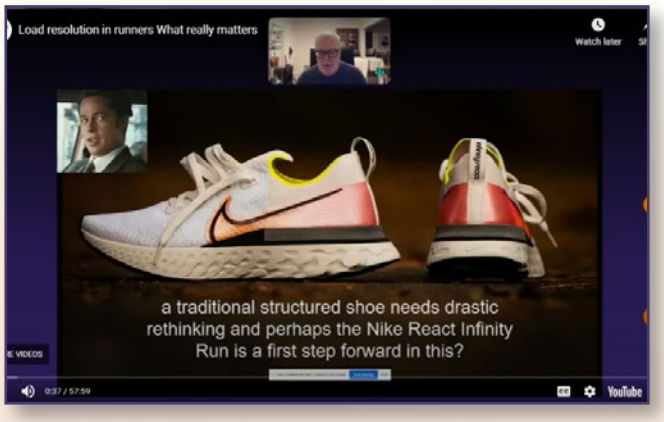
That's something I would applaud, however, I would have to say that when I first saw this data, I was pretty cynical about it all, as most people were. But the more I dive into it, the more I come to believe that this data was accurate and that Nike was actually on to something in terms of injury prevention.

The whole point of these few slides is that I think that the whole concept of a traditionally structured shoe needs to be completely rethought and maybe the Nike React Infinity Run is the first step in this journey toward rethinking the way we build athletic footwear. I do applaud Nike for doing this.

What We Have So Far

So, what have we got so far? Well, in terms of injury prevention for runners, we've basically got a house built on sand.

Confused Marketplace: We've got a very confused marketplace. Everybody is confused: retailers are confused, the consumers are confused, sports medicine is confused. It really isn't a great position to be in.



Repetitive Marketplace: The market has been pretty repetitive in terms of the product that's been presented. We have had a big shake up with the so-called super shoes. These have certainly brought a spark of interest to the marketplace, but generally there's been a real lack of innovation for decades and I would say that we were in a real innovation vacuum right up until the Nike Vaporfly 4% hit the market back in 2016. There's been a bit of a flurry since then.

Category Segmentation: Category segmentation is meaningless. This habit of trying to segment footwear into certain categories such as cushioning category, motion control/stability category—these sorts of things are really quite meaningless and I'll show you why later.

Reliance on Old Paradigms: Perhaps most importantly, our reliance on very old paradigms, in particular pronation control and cushioning. These 2 paradigms have shaped athletic footwear design for the past almost 50 years. They are really old and yet we cling tenaciously to these and say this is what we must have in

*lerEXPO hosted the recent "Pedorthic Runners Forum: A Science-Based Approach to Pedorthic Care of Runners and High-Performance Athletes." During the 5-hour CEU program, Simon Bartold, the noted sports podiatrist from Australia, gave a presentation titled, Load Resolution in Runners: What Really Matters… This edited transcript presents the first half of his talk, which focused on long-held paradigms of injury prevention. In Part II, which will run next month, the author discusses vibration as one of the key input signals in running, despite being one of the least investigated in the scientific literature. He will examine the nature and effect of vibration on human systems during running and pose a possible alternative explanation for running-related injury and performance. To hear the entire lecture plus other speakers, **check out lerEXPO.com/past-events/**.

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athletic footwear. My job is to question this and put forward some information that might open our minds a bit to some other possibilities…

Maybe we need to rethink our foundation for running. Other sports, in particular cycling, are taking a more scientific approach to how they set the athlete up with their equipment [think custom bike fit], remembering that footwear is just equipment for the athlete.

What Are We Missing?

First, we do know that runners get injured: at least 60% of runners—depending on what literature you read—will get injured. We think that at any one point in time about 25% of all runners are injured, but in the history of a runner, about 60% will get injured during the course of their running careers.

It's very high-load, very high-repetition activity. And the problem is that there are runners going on the same terrain, the same surface, in the same footwear.

So, when people ask me why do runners get injured, I say, the answer is simple: Runners get up in the morning, they put on their running shorts, they put on their running shoes, they walk out the front door, and they turn right—they always turn right. They never turn left, they turn right, and they run in exactly the same way for every single run.

That's typical of runners. That's what they do. They don't mix up the terrain, they don't mix up the surface, and they don't mix up their footwear. That induces a cumulative repetitive load and the human body does not like repetitive load, so that's one of the big issues.

What We Need to Change

We certainly need to change this course that says motion control is something we should hang our hat on. We need to understand that foot pronation is fundamental to normal human gait—and that we don't know how much is too little or too much. In other words, we just don't know where the line in the sand is here for pronation, so to be controlling it or be focusing on it just doesn't make any sense. That's because people operate within an envelope of function:

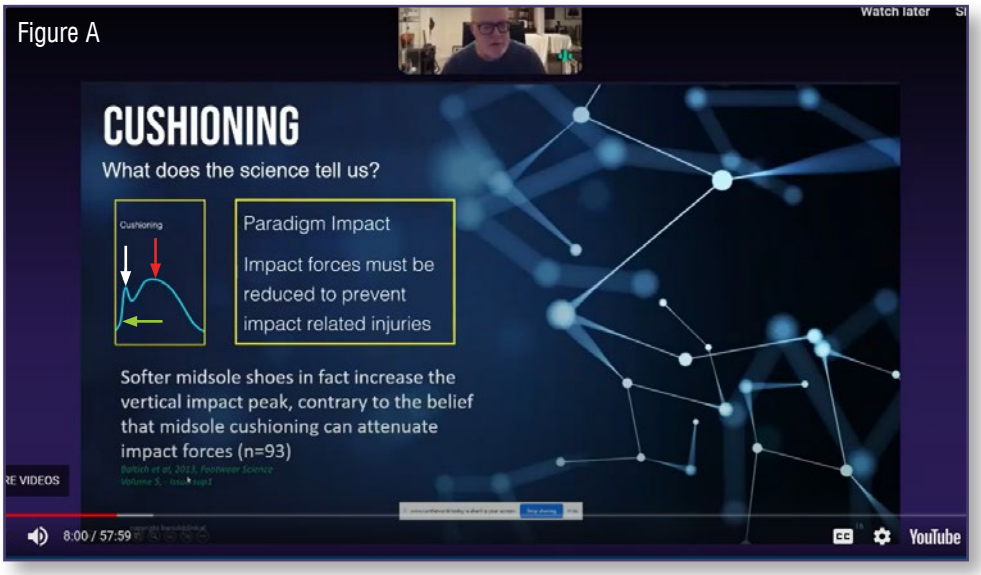
Some people deal with a lot of pronation and never get injured. Some people deal with a little bit of pronation and get injured all the time. We simply don't understand it well enough to start thinking about controlling it.

You can't control motion any way. You can influence it, you can't control it. And yet, we've got these strategies in place that are based on 40-year-old paradigms. And we find them very, very hard to give up. You can still go into a running shoe shop and see the store has categorized their shoes into motion control or stability. And we still have people, like you and I, who are talking about having to control pronation with an orthotic device and none of this is very well supported in the scientific literature. In fact, most of these paradigms have been largely debunked,v so we need to stop talking about them.

I put together this infographic [above] a while ago with a motion control shoe in the middle. If you read through, there are a couple of really interesting things in here. The bottom center one from Benno Nigg reads: *In relation to "motion control"* ***changes can occur in both directions*** *(increase or decrease), for this reason each runner should be analyzed independently.*

The one on the bottom right from Oriwol in 2011 is also interesting:

The concept of dual density as a medial support ***has barely been considered in footwear biomechanics research and lacks scientific proof of functionality****.* Yet, dual density midsoles re-



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main the mainstay of motion control in athletic footwear today.

These numerous findings show why maybe we should be moving on from those old paradigms.

Footwear Design

When you're talking about footwear design, it has to be underpinned by the science of the day—it's now September 2022. It's got to be evidence-based, and it must not be based on 40-year-old paradigms. I've been making this plea since 1999 that we need to move on because those old paradigms are not supported by the science and we've got better options.

Let's look at what the science tells us about the cushioning example (Figure A). The impact paradigm says that you have to reduce impact forces to prevent impact-related injuries. When you hit the ground, it hits you back. When you run, we know that you are enduring anywhere up to 11 body weights of load going through your system. So, this impact paradigm makes sense.

Figure A is a very typical force versus time curve for a running athlete. We've got the first peak, FZ_1, here [white arrow]. FZ_2 [red arrow] over here. FZ_1 is sometimes called the passive peak, and FZ_2 is the Active peak. This paradigm is saying we need to try to flatten off this first impact peak [FZ1] to reduce it, and we need to try to influence the steepness of this part of the curve [green arrow], which is called the loading rate. This is what we've been attempting to be doing this all this time.

Research from Baltich, which is almost 10 years old, says "softer midsole shoes in fact increase the vertical impact peak, contrary to the belief that midsole cushioning can attenuate impact forces." Let's repeat that, "softer midsole shoes increase the vertical impact forces" – this is completely counter intuitive. How on Earth can that possibly be?

This work from Benno Nigg (Figure B) looks at the vertical impact forces in Newtons. On the left, we've got an over-the-counter shoe and on the right, a cushioning shoe. The over-the-counter shoe used here was the sort of shoe

that you might wear to work, like a dress shoe, and the other is a sport shoe. What we saw is that when you went from an over-the-counter shoe to a cushion shoe, the vertical impact forces sure enough increased. This is a cohort of 33 runners running at 4 meters per second. Now, the really extraordinary thing about this study is this was done back in 1977…45 years ago.

No one took any notice. The industry didn't take any notice of this at all. So, he sat at his desk for 10 years, and then did exactly the same study in a different way using a smaller sample size. This time, he looked at midsole hardness from very soft at 25 Shore A to quite hard at 45 Shore A. He saw a systematic decrease in the vertical impact forces as the midsole got harder. Very surprising results, very counter intuitive. What was this all about?

Well, what Figure C tells us is that the brain is interpreting the collision between the ground, the shoe, and the support surface. And there must be some sort of active adaptation of the human musculoskeletal system happening as a result of this interpretation. In other words, the lower limb kinematics were changing in response to different shoe hardness: basically, the brain tells the body to modulate the lower limb stiffness. In other words, if you step from a hard surface onto a softer surface, the brain recognizes that and it says you've got to model your lower limb as a stiffer spring, so you get less knee flexion and less subtalar joint pronation.

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And the converse is true: If you go from a soft surface to a hard surface, the brain recognizes that you need a bit more compliance in the spring so you get more knee flexion and more subtalar joint pronation and that means that the peak impact force will reduce.

If this is what's really happening, it's thrown a cat amongst the pigeons for the whole concept of what the importance of cushioning is. Cushioning is of course very important, especially for comfort, but is it important to reduce peak impact forces? Probably not. So, we've turned our attention away from midsole testing towards the investigation of what sort of kinematic adaptation could be occurring and why.

What Needs to Change?

We need to change the concept that cushioning reduces injury, because it probably doesn't. It's not been proved injury is reduced simply by the human response to the input signal. Rather, injury is reduced by what the brain tells you to do.

Step-in comfort seems to be very, very important. However, the key combination for injury prevention is geometry of the shoe and the characteristics of cushioning.

And finally, on this topic of cushioning, we assume that impact is bad, but it isn't bad, not at all. We've got to understand the biomechanics. We've got to be able to understand that at the moment we can't quantify the relationship between injury in running and impact forces, something we can demonstrate quite easily: if we looked at sprinters, for example, sprinters are going much faster, they've got a double float phase so they're coming down from higher, and they've got a much higher impact than recreational joggers. If impact were important, sprinters should be injured all the time.

But they simply aren't, and we know this from the research from Wright and Nigg from quite a while ago: I think we could put it to bed and say that the exclusive causality between pronation and running injuries or cushioning and running injuries has been shown in neither cross-sectional nor longitudinal study designs with sufficient sample sizes.

As a result, we probably should start to think about other ways and stop talking about these 2 old paradigms: I guess we can say that we've buried overpronation/motion control and we've burned cushioning at the stake.

What else might be involved? In relation to the link between injury and load… the answer has got to lie elsewhere.

So if it's not motion control, or cushioning, then what might it be?

- We need to understand that midsole geometry is the key.
- Technical foams are here to stay.
- A very lightweight shoe is important.
- We've moved away from rigid footwear as a control strategy to increase flexibility and
- We've moved away from this concept of footwear segmentation.

You can see these are heavily decoupled shoes. Look at the Predict's whole back segment. This is a 2-piece upper where the whole back segment is extremely flexible. In fact, it was not built in a running shoe factory. It was built in the factory that builds the Victoria's Secrets bras. Yes, it was built in a bra factor because obviously they're experts at form-fitting. So, the Predict is extremely flexible, extremely decoupled, and the same with the Aurora. This is possibly the way of the future.

A Model Shoe?

Geometry, not additional support components, are the most important things. We've got to focus not on whether a runner is pronating or supinating, in other words, frontal plane. We've got to try to figure out how the runner moves forward, in other words, forward transition. How do you get from contact to propulsion most efficiently, economically, and effectively? That's got to be the focus. We've got to change our focus away from pronation and supination.

Now we're looking at shoes like this: Salomon Predict on the bottom and Brooks Aurora on top.

So cushioning is not so much about injury prevention due to impacts, but rather it's more about comfort. And we know that comfort equals performance and most likely affects fatigue. And when we talk about fatigue, we're going to change gears here a bit because fatigue in injury may well be the smoking gun and the thing that we really do need to have a look at. It's something that's under-researched and not very well understood. ler

Simon Bartold, an internationally renowned podiatrist, is a performance footwear consultant, researcher, educator, mentor, and innovator who currently works with Xblades footwear. His award-winning website, BartoldClinical.com, offers online clinical education in sports medicine of the lower extremity and footwear design.

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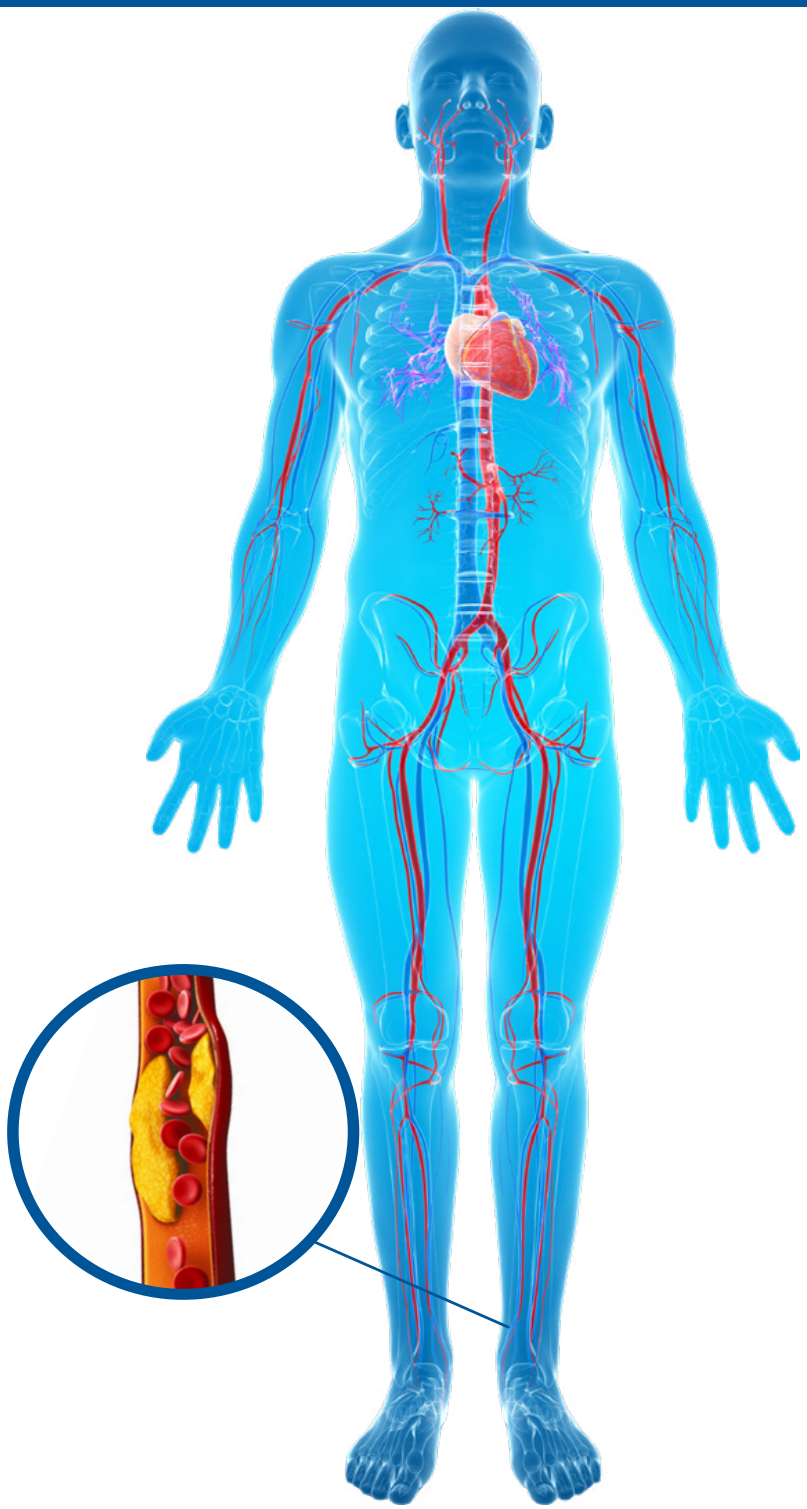

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Biomechanical Risks Associated with Foot and Ankle Injuries in Ballet Dancers

By Fengfeng Li, Ntwali Adrien, and Yuhuan He

Dancing is a special competitive sport with dancers performing moves in both open and closed kinetic chains… but is training focused on injury prevention? Is it time for a shoe re-design?

Dancing may be termed a special competitive sport and dancers perform an activity in both open and closed kinetic chains. The open chain suggests that when performing a movement, the foot is not involved in any weight bearing activity but moves freely in the air. The closed chain indicates that in a dance movement the foot is subjected to weight bearing and that all the joints are involved. All dance movements comply with biomechanical rules and laws, otherwise there are consequences in terms of injuries, including both chronic and acute injury. Kinetics analysis can also identify injury status using musculoskeletal modeling. Additionally, in a dance movement, the dancers are required to maintain full ankle plantarflexion and extend through the mid-foot to the toes. This occurs when the foot and ankle are in an abnormal position and increases the flexibility of the ankle (Figure 1). When we consider that foot joints and ligaments are not designed to accept excessive loading, the changes in a dance movement could result in the compression of the soft tissue structure and therefore joint injury.

Figure 1. Dancing in the en pointe phase (pointe shoes: the shoes worn by ballet dancers during performance or training; Box: a shoe box that wraps and supports the toes at the front of the shoe; Shank: a piece of rigid shoe bone that reinforces the sole for more support).

Injury is common in ballet dancers due to the high-intensity training required and the technical discipline needed to execute the difficult movements in performance. Indeed, all forms of dance contain highly demanding movements with an injury incidence of up to 95% over a dancer's lifetime, and ballet dancers have a higher incidence of dance injury among all dancers. This study sought to better understand the biomechanical risk factors for foot and ankle injuries in ballet dancers, who are both dance artists and competitive sports performers.

While many studies have focused on the injury of the knee joint and the upper limbs, studies are lacking on the intense physical demands of dancing that exposes dancers' feet to a high risk of injuries such as hallux valgus, metatarsal injury, and subsequent ankle pain. Among all the reported injuries, foot and ankle injuries account for a large percentage of all musculoskeletal injuries and are particularly vulnerable to secondary damage suffered by dancers. This is primarily caused by the maximum dorsiflexion or a maximum effort in a turned-out position. For example, the excess force of rotation or turnout of the en pointe (Figure 1) can lead to ankle and foot injuries

This article has been excepted from "Biomechanical Risks Associated with Foot and Ankle Injuries in Ballet Dancers: A Systematic Review," by the authors noted above, which was published online on April 18, 2022, in *International Journal of Environmental Research and Public Health* 2022;19(8):4916. doi: 10.3390/ijerph19084916. Editing and summarization have occurred, and references have been removed for brevity. Use is per CC BY 4.0.

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and cause strain of structures around the ankle. However, the full extent of the risk factors for foot and ankle injuries in dancers has not yet been summarized. The purpose of this systematic review was to provide an up-to-date biomechanical assessment of studies on injury prevention among ballet dancers.

This study searched articles in 4 electronic databases for information in peer-reviewed journals. The included articles examined the relationships between biomechanical factors and the relationship between ballet shoes and foot performance. There were 9 articles included in this review. Among these articles, 2 focused on the peak force of the foot using 2 types of pointe shoes, 3 focused on overuse injuries of the ballet dancer's foot, 1 article focused on the loading of the foot of a dancer, and 3 articles focused on the function and biomechanics of the foot in dancers including gait assessments.

Discussion

To reach a full understanding of the biomechanical risk factors associated with foot and ankle injuries in ballet dancers, knowledge of foot plantar pressure, footwear, and peak force are crucial. This systematic review identified 9 articles that appraised either the effect of pointe shoes or overuse on lower limb injuries in ballet dancers. To determine the incidence of foot injury in ballet dancers, it is important to understand ballet position compensatory strategies. This review found that: (1) the pointe shoe condition is an important factor contributing to a foot injury; (2) overuse injury is related to high-intensity training and affected the ankle and foot; (3) metatarsophalangeal joint injury is related to the function and structure of the foot and results in swelling as the demands on the foot increase; and (4) footwear is also related to overuse injuries in professional ballet dancers. Two articles identified the differences between "new" and "dead" pointe shoes. They used different methods, and a consensus emerged that a worn pointe shoe in a dance movement resulted in a significantly increased swing area, especially in the forefoot and midfoot. Previous studies have found

> Injury is common in ballet dancers due to the high-intensity training required and the technical discipline needed to execute the difficult movements in performance

that injuries in ballet dancers can result from inadequate stabilization of the foot and ankle. Pointe shoes are supportive of the foot, which provide stiffness with the compromise of the midfoot ligaments. Having a significant swing in the midfoot area may decrease stiffness and increase the lack of support in the dancer's foot, increasing the risk of lower limb injury. Previous studies suggested that during some specific dance movements, a repeated impact placed on the foot and ankle may possibly lead to a unique type of injury in a group of dance performers. Although the peak ankle plantarflexion range of motion was not significantly different between dancers and non-dancers, it should be considered that the plantarflexion function and range of motion of ballet dancers' needs measurably exceeded normative values than non-dancers (0 to 50 degrees). Thus, injury prevention is of great significance.

The human foot is an essential element of the locomotor system. It transports the power and the mass of the whole body while in contact with the ground. Ballet dancers use the foot to reach extreme external rotations and the foot and ankle need to twist in the air. As a result, the intense physical demands of dancing put dancers' feet at high risk of injuries such as hallux valgus, metatarsal injury, and ankle pain. These injuries in a ballet dancer can result in 2 categories of injury: acute and chronic injury. The structural differences among dancers may change lower limb kinetics and kinematics. The foot has been considered as a triple-arch structure, and the part of the lateral foot performs a rigid arch that supports our weight in a loaded position. Once the weight of the dancer is directed to the midfoot, there will be consequences for the other parts of the foot. Additionally, to reach an extreme position in ballet, external rotation, especially at the ankle joint, is of great importance for dancers. The limitation of range of motion in the ankle may cause foot pronation (rolling in), and subsequently cause the foot to lose medial arch support. If the stability provided by the midfoot begins to fail or decrease, dance performance will compensate to maintain the center of mass. Once the performer cannot compensate to keep the body in a correct position the dancer may fall out of the position, which can result in acute injury. Therefore, the evaluation of dancers' foot injuries and pain should be included in clinical studies, and superimposed X-rays for assessing ankle and foot contributions to the extreme positions required of female ballet dancers offer insight into how these positions are attained.

Both the first metatarsophalangeal joint and the ankle are attached to the flexor hallucis longus, and flexor hallucis longus tendinopathy is common in ballet dancers. The metatarsophalangeal joints endure a repeated large range of motion and high peak joint moments may be a risk factor that contributes to the injury of the foot and ankle joints in dancing. Mattiussi et al suggested that a greater percentage of injuries were classified as overuse injuries. In addition, Shaw et al noted in their study that older dancers in advanced groups were more likely to be injured. Additionally, the lateral ligament complex of the ankle is the most frequently injured structure of a dancer's body.

In many sports, ankle sprains do not develop into long-term disabilities, however, many patients do not resolve the problem well, which results in residual symptoms persisting for many years. In the continuous training and performance of dancers, repeatedly jumping and landing as well as the extreme plantarflexion or rotation is required. During these dance movements, the repeated shocks and pressure will impact the injured area, and the commonly reported symptoms in dancers include ankle

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re-injury and instability. All of the articles reviewed mentioned that wearing a pointe shoe and overuse on their foot may accelerate rates of muscle fatigue and ankle sprains. Once the forefoot strength decreases, the leg will externally rotate, and the support of the hip joint's muscle will be not stable when the heel is raised. As a result, all the joint chains will be affected, and ankle and foot re-injury is known to occur in many dancers.

In a ballet dance movement, executing the correct motion such as a simple heel raise of relevé when suffering frequent injuries to the lower limb is painful. Biomechanical analysis evaluating the function of muscles, bones, and tendons is essential in developing diagnostic tools to help identify the causes of injuries for any type of dancer, particularly ballet dancers. It has been suggested that ballet dance footwear manufacturers should consider biomechanical design features in shoe manufacturing. In support of this, ground reaction force analysis has been seen as a variable of interest because of its potential correlation with increased injury rates. A reasonable design of dance footwear can reduce impact force and improve the stability of a dancer.

Biernack et al suggested that lower limb strength is also an important factor leading to injuries in the lower extremities. The long-term and intense extreme demands of the musculoskeletal system are relative to plantar pressure distribution in ballet dancers. Therefore, the dancers and dance trainers should reach a consensus that enhancing the controllability of the ankle and foot can reduce ankle restrains to a certain extent. In particular, the flexor hallucis longus and muscle strength enhancement can decrease tenosynovitis probability. Dancers also create abnormal dynamic biomechanical forces when using various dance forms. A thorough determination of these forces may inform the physician about the cause of the injures, especially specific overuse injuries.

Conclusions

Our study systematically reviewed research focused on the risk factors of ankle and foot injuries in ballet dancers. The elements of pointe shoes, overuse of the lower extremity, and the biomechanics and function of the foot are associated with lower limb injury. Strengthening the lower extremity muscle is also a recommendation to improve muscle coordination and reduce injuries. Improving the design of the shoes to provide stiffness with the compromise of the mid-foot ligaments to reduce injuries seems to be important. Moreover, we suggest studying the corresponding dynamic effects for pointe shoes in further research. This will provide a better understanding of ballet and promote ballet dancing to the public while preventing the injury of ballet dancers.

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Dog Bites of the Lower Extremity Treated at Hospital Emergency Departments

By Mathias B. Forrester, BS

Background: There are millions of pet dogs in the United States (US), and thousands of people are treated at US hospital emergency departments (EDs) each year for dog bites. Approximately 20-25% of these dog bites affect the lower extremity. The objective of this study was to characterize dog bites of the lower extremity treated at US hospital EDs.

Methods: An analysis was performed of dog bites of the lower extremity using data from the National Electronic Injury Surveillance System-All Injury Program (NEISS-AIP) of the US Consumer Product Safety Commission (CPSC) during 2005-2019.

Results: A total of 18,357 dog bites of the lower extremity treated at a sample of US hospital EDs was identified during 2005-2019, resulting in a national estimate of 1,090,110 dog bites of the lower extremity. Of the estimated dog bites, 49.4% of the patients were age 0-29 years and 50.8% were male. Home was the incident location in 44.4% of the dog bites. The patients were treated or examined and released from the ED in 96.2% of the encounters. The most commonly reported injuries were puncture (33.0%), laceration (16.9%), and contusion or abrasion (10.4%). The most frequently affected body part was the lower leg (53.4%) followed by the upper leg (26.9%).

Conclusions: Patients with dog bites of the lower extremity tended to be younger, particularly age 29 years or less, and a slightly higher proportion were male. Most of the dog bites with a known incident location occurred at home. The majority of patients were treated or examined at the hospital ED and released. The most frequently reported diagnoses were puncture, laceration, and contusion or abrasion, and the most commonly affected body parts were the lower leg followed by the upper leg.

The American Veterinary Medical Association (AVMA) reported that, by year-end 2016, there were 77 million pet dogs in the United States (US), and 38.4% of US households owned a dog.[1] According to the 2021-2022 National Pet Owners Survey, 69.0 million US households owned a dog.[2]

Dog bites are a significant public health issue. Dogs bite approximately 4.5 million people in the US annually.[3] During 2005-2013, there was an estimated average of 337,103 visits to US hospital emergency departments (EDs) per year for non-fatal dog bites, and dog bites were the thirteenth most common cause of non-fatal injuries treated at US hospital EDs.[4]

Several studies have reported that 20-25% of dog bites treated at US hospital EDs were to the lower extremity.[4,5] The objective of this study was to describe dog bites of the lower extremity treated at US hospital EDs.

Methods

Data for this study were downloaded from the National Electronic Injury Surveillance System-All Injury Program (NEISS-AIP) at https://www.icpsr.umich.edu/web/NACJD/search/studies?q=national%20electronic&. In 2000, the Centers for Disease Control and Prevention (CDC) collaborated with the Consumer Product Safety Commission (CPSC) to expand the National Electronic Injury Surveillance System (NEISS) to collect data on all types and causes of nonfatal injuries treated in a representative sample of US hospital EDs, creating the NEISS-AIP.[6,7] The NEISS-AIP defines a nonfatal injury as bodily harm resulting from severe exposure to an external force, substance, or submission. This bodily harm can be unintentional or violence-related.

The NEISS-AIP collects data from a stratified random sample of 66 of the more than 5,000 hospitals with 24-hour EDs and six or more beds in the US.[6,7] The random sample is stratified by hospital size, geographic location (so that all parts of the US are represented), and hospital type (general and pediatric hospitals). Professional NEISS-AIP coders review the ED records at participating hospitals and, for patients

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Table 1. Time period and patient demographics of dog bites of the lower extremity treated in United States emergency departments, National Electronic Injury Surveillance System-All Injury Program, 2005-2019

VARIABLE	NO.		EST.		
	NO.	%	NO.	%	95% CI
3-YEAR PERIOD					
2005-2007	3,456	18.8	206528	18.9	174427-238,629
2008-2010	3,688	20.1	218286	20.0	184614-251,958
2011-2013	3,759	20.5	222984	20.5	188687-257,281
2014-2016	3,667	20.0	219789	20.2	185917-253,661
2017-2019	3,787	20.6	222523	20.4	188287-256,758
PATIENT AGE (YEARS)					
0-5	834	4.5	37,052	3.4	29,508-44,597
6-12	3,543	19.3	172,291	15.8	144,826-199,757
13-19	2,613	14.2	138,562	12.7	115,772-161,351
20-29	3,003	16.4	190,125	17.4	160,233-220,017
30-39	2,400	13.1	151,824	13.9	127,181-176,467
40-49	2,292	12.5	150,327	13.8	125,892-174,761
50-59	1,931	10.5	129,064	11.8	107,614-150,513
60+	1,738	9.5	120,796	11.1	100,523-141,070
Unknown	3	0.0	69	0.0	-
PATIENT SEX					
Male	9,732	53.0	554,108	50.8	478,288-629,928
Female	8,625	47.0	536,002	49.2	462,363-609,641
TOTAL	18,357		1,090,110		952,258-1,227,962

No. = Number

Est. = Weighted estimate (sum of the Weight numeric field in the National Electronic Injury Surveillance System-All Injury Program database). The numbers in the Weight field are not whole numbers but include decimals. As a result of rounding to whole numbers when performing analyses, the sum of the estimates for a given variable might not equal the total. The Consumer Product Safety Commission considers an estimate unstable and potentially unreliable when the number of records used is <20 or the estimate is <1,200.

95% CI = 95% confidence interval. Not calculated if the estimate is <1,200.

with injuries that meet NEISS-AIP inclusion criteria, collect and code all information in the NEISS-AIP database except for the cause of injury. The coded data and a narrative (description) are electronically transmitted to the CPSC. CPSC coders review all of the data elements and narrative for every submitted record. The CPSC coders then use the narrative and other data to assign codes for the cause (mechanism) of injury for each case. The data in the NEISS-AIP database include age, race, Hispanic origin, and sex of the injured person; diagnosis and body part affected; location where the injury incident occurred; up to two consumer products involved; disposition; cause of injury; intent of injury; and whether the injury is related to work. For transportation-related injuries, the NEISS-AIP collects data about whether the injury was related to

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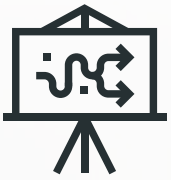

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Table 2. Disposition and type of injury of dog bites of the lower extremity treated in United States emergency departments, National Electronic Injury Surveillance System-All Injury Program, 2005-2019

VARIABLE	NO.		EST.		
	NO.	%	NO.	%	95% CI
DISPOSITION					
Treated or examined in the emergency department and released	17,559	95.7	1,048,555	96.2	915,378-1,181,733
Treated and admitted for hospitalization	371	2.0	17,604	1.6	13,464-21,745
Treated and transferred to another hospital	52	0.3	3,857	0.4	2,530-5,184
Held for observation	40	0.2	1,478	0.1	759-2,196
Left without being seen, left against medical advice	335	1.8	18,616	1.7	14,288-22,944
MOST COMMON TYPE OF INJURY					
Puncture	6,691	36.4	359,717	33.0	307,775-411,659
Laceration	3,624	19.7	184,052	16.9	154,983-213,121
Contusion or abrasion	1,936	10.5	113,587	10.4	94,347-132,826
Avulsion	105	0.6	7,480	0.7	5,338-9,621
Hematoma	41	0.2	2,910	0.3	1,815-4,005
Fracture	52	0.3	2,871	0.3	1,785-3,956
BODY PART AFFECTED					
Lower leg	9,631	52.5	582,441	53.4	503,223-661,659
Upper leg	5,059	27.6	292,991	26.9	249,543-336,439
Foot	1,236	6.7	71,921	6.6	58,842-85,000
Ankle	1,133	6.2	67,007	6.1	54,681-79,333
Knee	1,113	6.1	65,593	6.0	53,485-77,701
Toe	219	1.2	12,716	1.2	9,508-15,924
TOTAL	18,357		1,090,110		952,258-1,227,962

Please see full footnote on Table 1.

traffic and the status of the motor vehicle occupant. For assaults, NEISS-AIP collects data about the relationship of the perpetrator to the injured person and the context of the assault.

NEISS-AIP data are publicly available and de-identified. Therefore, this study did not require institutional review board (IRB) approval.

Cases were dog bites of the lower extremity reported to the NEISS-AIP during 2005-2019. (The year 2019 was the most recent year for which data could be downloaded at the time of this study.) Cases were included if either the precipitating cause of injury or immediate cause of injury fields contained the code for "dog bite" and if either the primary body part affected or secondary body part affected fields contained a code for a lower extremity body part (knee, lower leg, ankle, upper leg, foot, toe). (The secondary body part affected field only began to be used in 2019.) The variables examined were year of treatment (three-year period), month of treatment (three-month period), patient age, patient gender, location where the injury occurred, disposition of the patient, diagnosis (type of injury),

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and affected body part.

Analyses were performed using Office Professional 2007 Access and Excel (Microsoft Corporation, Redmond, Washington, US). The distribution of cases and national injury estimates were determined for the variables. National injury estimates were calculated by summing the values in the Weight numeric field in the publicly available NEISS-AIP database, and 95% confidence intervals (CIs) were calculated for the estimates. The CPSC considers an estimate unstable and potentially unreliable when the number of records used is <20 or the estimate is <1,200.[8] For those variable subgroups where the estimate was <1,200, 95% CIs were not calculated.

Results

There were a total of 18,357 dog bites of the lower extremity treated at a sample of US hospital EDs, resulting in a national estimate of 1,090,110 dog bites of the lower extremity. This represented 21.2% of the 5,151,538 estimated dog bites of any body part.

The number of dog bites tended to be stable over the study period (Table 1). By three-month period, the estimated number of dog bites of the lower extremity was 202,406 (18.6%, 95% CI 170,858-233,954) in November-January, 246,785 (22.6%, 95% CI 209,345-284,225) in February-April, 353,113 (32.4%, 95% CI 302,003-404,223) in May-July, and 287,806 (26.4%, 95% CI 245,027-330,585) in August-October. Patients age 0-29 years accounted for 9,993 (54.4%) of the cases and 538,030 (49.4%) of the estimated dog bites, and a slightly greater proportion of patients were male (Table 1). By location of the injury incident, the estimated number of dog bites of the lower extremity was 483,949 (44.4%, 95% CI 416,624-551,275) home/mobile home, 128,998 (11.8%, 95% CI 107,557-150,438) other public property, 98,736 (9.1%, 95% CI 81,653-115,819) street or highway, 31,429 (2.9%, 95% CI 24,834-38,024) place of recreation or sports/school/farm/ranch/industrial place, and 346,998 (31.8%, 95% CI 296,661-397,335) unknown.

Table 2 presents the distribution of dog bites of the lower extremity by disposition, diagnosis, and affected body part. Most of the patients were treated or evaluated at the hospital ED and released. The most frequently reported diagnoses were puncture, laceration, and contusion or abrasion. The majority of dog bites involved the lower leg with the next most common body part being the upper leg.

Discussion

This study characterized dog bites of the lower extremity treated at US hospital EDs. As shown by the current and several previous studies, dog bites of the lower extremity account for 20-25% of all dog bites treated at US hospital EDs.[4,5]

The number of dog bites remained relatively stable during the 15-year period of the study. However, the AVMA reported that 2016 was the highest rate of dog ownership in the US since the AVMA began measuring in 1982; the rate

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increased from 36.1% in 2001 to 38.4% in 2016. Furthermore, the number of pet dogs in the US increased 10% since 2011.[1] One study using data from the Healthcare Cost and Utilization Project (HCUP) Nationwide Emergency Department Sample (NEDS) distributed by the US Department of Health and Human Services Agency for Healthcare Research and Quality (AHRQ), a stratified sample of US hospital-owned EDs, reported that the prevalence of dog bites decreased during 2010-2014.[9] Another study found the rate of dog bites increased during 2005-2011 and then declined to 2018.[10] However, these latter two studies included all dog bites while the current study examined only dog bites of the lower extremity. A study of dog leash-related injuries of the lower extremity treated at US hospital EDs found that the number of injuries increased during 2000-2020.[11] The difference in time trends between the present dog bite study and the dog leash-related study could be due to differences in data sources and the circumstances under which the two types of injuries occurred.

A seasonal pattern in dog bites of the lower extremity was observed; the highest proportion of dog bites was seen during May-July and the lowest during November-January. Another study of dog bites treated at US hospital EDs found dog bites were more common in the summer.[3] It may be that, during warmer weather, people are more likely to be outside and active, thus more likely to be in circumstances that may lead to dog bites.

Patients with dog bites of the lower extremity tended to be younger, with roughly half being 29 years or less. In addition, only a slightly higher proportion of patients were male. These demographic patterns were similar to those observed in earlier dog bite studies.[4,5,9,12] In contrast, patients with dog leash-related injuries of the lower extremity tended to be older, and the majority were female.[11]

Most dog bites of the lower extremity with a known location of the incident occurred at home, with the next most common locations being other public property and street or highway. A previous study of all dog bites treated at US hospital EDs reported a similar pattern by incident location,[3] as did the study of dog leash-related injuries of the lower extremity.[11] This suggests that most dog bites involve family dogs or dogs known to the patient and not stray or unfamiliar dogs. Such information could be useful for educating the public on how to prevent dog bites.

The most common diagnoses were puncture, laceration, and contusion or abrasion, a pattern similar to earlier studies of all dog bites.[4,5] The most frequently affected body parts were the lower leg followed by the upper leg. However, the most frequently reported diagnoses among dog leash-related injuries of the lower extremity were strain or sprain, fracture, and contusion or abrasion, and the most commonly affected body parts were the knee, ankle, and lower leg.[11] The contrasts in the pattern of diagnosis and affected body part between the current study and the dog leash-related injury study could be due to differences in the circum-

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stances in which the two types of injury occur.

Since the most frequently reported diagnoses might be considered to be relatively minor, it might be expected that the majority of patients would be treated or examined in the ED and released. This study did find that over 95% of the patients were treated or examined in the ED and released. Earlier studies of all dog bites treated at hospital EDs likewise found that the majority of patients were treated or examined and released from the ED.[4,5,12]

The results of this study do not explicitly indicate ways to prevent dog bites. However, recommendations have been made by others to reduce or prevent such injuries, particularly among children. Parents, particularly those with young children, should be educated to supervise their children when near dogs and to teach their children how to properly interact with dogs, such as not disturbing dogs while the animal is eating or sleeping or with its puppies, not reaching through or over a fence when a dog is on the other side, moving slowly around a dog, not being aggressive or rough when playing with a dog, asking permission from an owner before petting their dog, and not approaching unfamiliar dogs.[13,14]

This study has limitations. The NEISS-AIP collects data from a small sample of all US hospital EDs. However, it is possible to estimate the total number of injuries based on this sample.[7] Furthermore, the NEISS-AIP database only includes injuries treated at a hospital ED. Studies that include information on dog bites of the lower extremity not evaluated at hospital EDs would provide a more complete view of dog bites.

In conclusion, the number of dog bites of the lower extremity remained relatively stable during 2005-2019. Dog bites were seasonal, with a higher proportion being reported during May-July. Patients tended to be younger, particularly age 29 years or less, and a slightly higher proportion were male. Most of the dog bites with a known incident location occurred at home. The majority of patients were treated or examined at the hospital ED and released. The most frequently reported diagnoses were puncture, laceration, and contusion or abrasion, and the most commonly affected body parts were the lower leg followed by the upper leg.

Considering the differences observed between dog bites and dog leash-related injuries of the lower extremity with regard to such factors as time trends, patient age and sex, and diagnosis and affected body part, this suggests that risk of dog-related injuries of the lower extremity depends on the exact type of the injury and the circumstances that lead to the injury. Thus, the particulars of a dog-related injury should be taken into account when trying to reduce the risk of such injuries.

Mathias B. Forrester, BS, is an independent researcher in Austin, Texas. Now retired, he previously performed public health research for various university and government programs for 34 years.

References

1. American Veterinary Medical Association. AVMA Pet Ownership and Demographics Sourcebook. 2017-2018 Edition. American Veterinary Medical Association; Schamburg, Illinois, 2018.
2. American Pet Products Association. Pet industry market size, trends & ownership statistics. Available at: https://www.iii.org/fact-statistic/facts-statistics-pet-ownership-and-insurance. Accessed September 1, 2022.
3. World Health Organization. Animal bites. February 5, 2018. Available at https://www.who.int/news-room/fact-sheets/detail/animal-bites. Accessed September 1, 2022.
4. Loder RT. The demographics of dog bites in the United States. Heliyon. 2019;5(3):e01360.
5. Gilchrist J, Gotsch K, Annest JL, Ryan G. Nonfatal dog bite-related injuries treated in hospital emergency departments - United States, 2001. MMWR Morb Mortal Wkly Rep. 2003;52(26):605-610.
6. Ehlman DC, Haileyesus T, Lee R, Ballesteros MF, Yard E. Evaluation of the National Electronic Injury Surveillance System - All Injury Program's self-directed violence data, United States, 2018. J Safety Res. 2021;76:327-331.
7. United States Department of Health and Human Services. Centers for Disease Control and Prevention. National Center for Injury Prevention and Control, and U.S. Consumer Product Safety Commission. National Electronic Injury Surveillance System All Injury Program, 2019. Inter-university Consortium for Political and Social Research [distributor], December 15, 2021.
8. United States Consumer Product Safety Commission. National Electronic Injury Surveillance System (NEISS). Available at https://www.cpsc.gov/Research--Statistics/NEISS-Injury-Data/Explanation-Of-NEISS-Estimates-Obtained-Through-The-CPSC-Website. Accessed September 1, 2022.
9. Holzer KJ, Vaughn MG, Murugan V. Dog bite injuries in the USA: Prevalence, correlates and recent trends. Inj Prev. 2019;25(3):187-190.
10. Tuckel PS, Milczarski W. The changing epidemiology of dog bite injuries in the United States, 2005-2018. Inj Epidemiol. 2020;7(1):57.
11. Forrester MB. Dog leash-related injuries of the lower extremity treated at hospital emergency departments. Lower Extremity Review. 2022;14(6): 41-42,45,47,49.
12. Holmquist L, Elixhauser A. Emergency department visits and inpatient stays involving dog bites, 2008. November 2010. Rockville, Md.: Agency for Healthcare Research and Quality; 2010. Available at http://www.hcup-us.ahrq.gov/reports/statbriefs/sb101.pdf. Accessed September 1, 2022.
13. Dixon CA, Mistry RD. Dog bites in children surge during Coronavirus Disease-2019: A case for enhanced prevention. J Pediatr. 2020;225:231-232.
14. Parente G, Gargano T, Di Mitri M, Cravano S, Thomas E, Vastano M, Maffi M, Libri M, Lima M. Consequences of COVID-19 lockdown on children and their pets: Dangerous increase of dog bites among the paediatric population. Children. 2021;8(8):620.

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SMALL		5.5-8.5	6-8	1/2", 3/4" or 1-1/4"
MEDIUM		9-11	8.5-10	
LARGE		11.5-13.5	10.5-13	
X-LARGE		14+	13.5+	

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SPORTS BOOT WITH ADAPTIVE ANKLE PROTECTION

The Terrein Ascent hiking shoe combines natural freedom of motion with effective joint protection via a mini piston, called an "adapter," which guards against twisting forces acting on the ankle. The protection system engages 3 times faster than human anatomy can, blocking further motion, and allowing the wearer to regain level footing. This is made possible by an intelligent fluid system that stiffens within a few milliseconds if critical movements are made too quickly and then immediately returns to its flexible initial state. The shoe's sock construction allows freedom of movement, while the Velcro closure provides a custom fit. The adapter is encapsulated in abrasion-resistant fabric for durability, increased comfort, and breathability. Rounded corners and edges provide for smooth foot placement, the wide platform improves traction, and the extra-grippy rubber compound outsole offers maximum control during ascents and descents

BetterGuards
www.betterguards.com

OTTOBOCK TO ACQUIRE UK'S PACE REHABILITATION

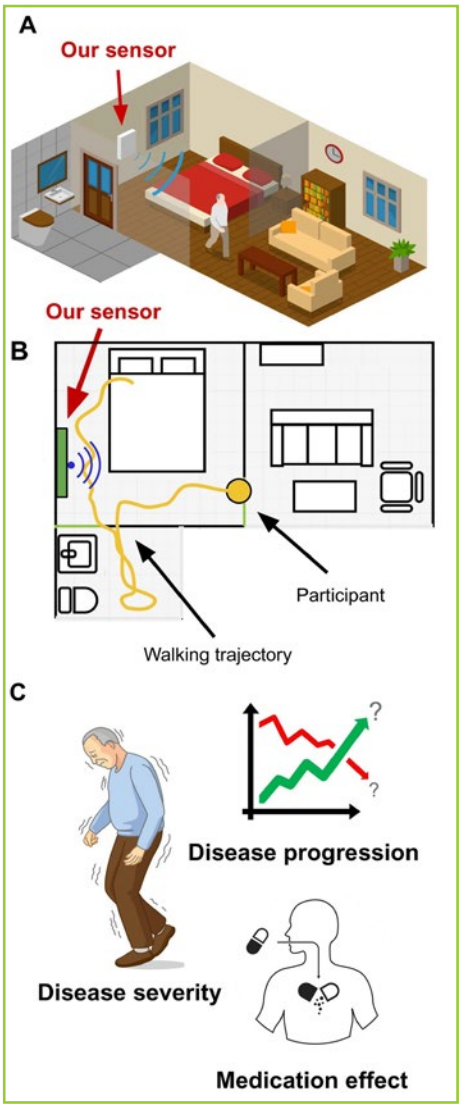
Prosthetic manufacturer and patient care provider Ottobock, Duderstadt, Germany, has recently agreed to acquire Pace Rehabilitation, one of the United Kingdom's (UK's) independent providers of prosthetic and rehabilitation services for people who have sustained a serious limb injury. Established nearly 20 years ago, Pace Rehabilitation has 3 clinics, located in Cheshire and Buckinghamshire, England, and Glasgow, Scotland. Financial details of the acquisition were not provided.

ANKLE STABILIZER

The SKY Stabilizer™ provides featherlight and streamlined support to athletes with healthy ankles and who want to keep them that way. The device is engineered to aid in promoting a more stable positioning range, thereby reducing potential for serious injury that could lead to chronic ankle instability. The SKY Stabilizer was born from the company's focus upon the biomechanics and causal factors of inversion sprains among athletes focused upon jumping vertically, such as basketball and volleyball players. Research revealed an unrecognized opportunity to enhance ankle protection by lessening the tendency for these athletes to let their feet drop while airborne. This in turn helps keep the ankle in a more stable landing posture and less susceptible to dangerous hyper-ranging scenarios when they land awkwardly, such as on another player's foot.

Mueller Sports Medicine
800/356-9522
www.muellersportsmed.com.

IN-HOME TRACKING DEVICE TRACKS DISEASE PROGRESSION IN PARKINSON'S PATIENTS



(A) The sensor passively and continuously collects signals reflected from nearby people. (B) The signals are analyzed to extract participants' movement trajectories and gait speeds. (C) The data is used to evaluate disease severity, disease progression, and patients' response to medications.

Researchers from the Massachusetts Institute of Technology (MIT) and elsewhere demonstrated an in-home device that can monitor a patient's movement and gait speed, which can be used to evaluate Parkinson's severity, the

progression of the disease, and the patient's response to medication. The device, which is about the size of a Wi-Fi router, gathers data passively using radio signals that reflect off the patient's body as they move around their home. The patient does not need to wear a gadget or change their behavior. Because the device operates in the background and runs all day, every day, it can collect a massive amount of data.

The researchers used these devices to conduct 2 studies that involved a total of 50 participants; 1 study lasted 2 months and the other was conducted over the course of 2 years. They showed that by using machine-learning algorithms to analyze the data they gathered—more than 200,000 gait speed measurements—a clinician could track Parkinson's progression more effectively than they would with periodic, in-clinic evaluations.

"By being able to have a device in the home that can monitor a patient and tell the doctor remotely about the progression of the disease, and the patient's medication response so they can attend to the patient even if the patient can't come to the clinic—now they have real, reliable information…," said researcher Dina Katabi, PhD, the Thuan and Nicole Pham Professor in the Department of Electrical Engineering and Computer Science, and a principle investigator in the Computer Science and Artificial Intelligence Laboratory and MIT Jameel Clinic.

NOTRE DAME TEAM DEVELOPING POWERED PROSTHESIS TO AID NATURAL MOVEMENT

A team from the University of Notre Dame's Robotics, Optimization and Assistive Mobility (ROAM) lab has tested 3 different control mechanisms designed to advance the human-machine interface of a powered prosthetic ankle. While current lower limb prostheses can be given a motor assist, the team is advancing the human-machine interface so that users can control the ankle movement, giving them a crucial "sense of volition" while improving comfort and safety. The study subject, Laura Light, has worn a transtibial prosthesis since she was 18 months old.

The first control mechanism—volitional—is based on myoelectric sensors that allowed Light to control the rollover movement of the ankle. The second—autonomous—automatically boosts ankle roll based on pre-programmed angles in the way that some already available motorized prostheses work. The third, the team's latest experiment, combines the advantages of the first 2. The electrode sensors read electrical twitch signals from Light's muscle contractions in different spots on her residual calf, allowing her to fully control, for the first time, the forward roll of a motorized ankle device—and to ultimately stand on her toes.

Light walked on the treadmill for 2

Light helps test out and give feedback on the powered prosthesis. Photograph courtesy of Notre Dame.

minutes with each system, while her gait was videotaped to evaluate how natural it appeared, and data was gathered on how well the myoelectric sensors picked up and responded to her muscle signals. She practiced rolling the foot forward and back, standing on tiptoes, and sitting with it flat on the floor.

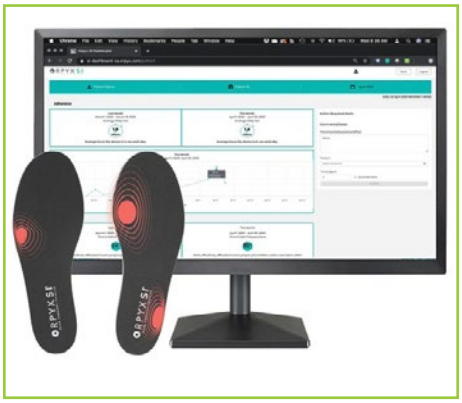
"This has gone better than we imagined," said ROAM's director, Patrick Wensing, PhD. "There are lots of myoelectric solutions out there for prosthetic hands. But there are less for legs because you have to avoid falls to ensure safety."

SOCKS TO TREAT PERIPHERAL NEUROPATHY PAIN, IMPROVE BALANCE

Balance Sock hugs specific nerves in the feet to improve proprioception and reduce, or even eliminate, neuropathic pain, with its proprietary design that increases stability, boosts performance, and soothes pain. The socks also provide strategic Achilles cushioning, activating the body's natural feedback/balance system. Early clinical trials indicate that Balance Sock can help people achieve up to 24% better balance and significantly reduce pain in over 90% of patients. The socks are breathable, moisture-wicking, and come in 3 types: Neuropathy Series hugs the nerve on either side of the ankle, easing foot pain at its source while helping to improve balance and circulation. Master Series adds Achilles tendon cushioning to help the body balance itself, adding confidence with more support and stability. Sports Series adds cushioning sections around the Achilles tendon, delivering feedback to the brain that enables real-time movement and balance correction.

Balance Doctor
844/722-5262
balancesockstore.com

SENSORY INSOLES WITH REMOTE PATIENT MONITORING



Orpyx® Medical Technologies has launched the Orpyx SI® Flex Sensory Insole system and Orpyx Remote Patient Monitoring (RPM) services. This remote monitoring program drives engagement and extends mobility for people living with diabetes by transforming patient care through real-world patient data, analytics, and coaching. The wearable technology is designed to help prevent plantar foot complications for at-risk patients with peripheral neuropathy by monitoring plantar pressure, capturing wear time to determine how compliant the patient is to their provider's treatment plan, counting steps to help dose activity levels, and monitoring temperature, the last line of defense to indicate when inflammation is present and tissue damage is occurring. The ultra-thin, prefabricated sensory insoles fit in most every-day footwear, making them practical and comfortable for a broad range of patients.

Orpyx
855/996-7799
orpyx.com

SMART TEXTILES SENSE HOW USERS ARE MOVING

Using a novel fabrication process, researchers from the Massachusetts Institute of Technology (MIT) have produced smart textiles that snugly conform to the body so they can sense the wearer's posture and recognize its wearer's activities, like walking, running, and jumping. By incorporating a special type of plastic yarn and using heat to slightly melt it—a process called thermoforming—the researchers were able to greatly improve the precision of pressure sensors woven into multilayered knit textiles, which they call 3DKnITS. They used this process to create a "smart" shoe and mat, and then built a hardware and software system to measure and interpret data from the pressure sensors in real time. Once the model was trained, it could classify the user's activity on the smart mat (walking, running, doing push-ups, etc.) with 99.6% accuracy and could recognize 7 yoga poses with 98.7% accuracy.

Their fabrication process, which takes advantage of digital knitting technology, enables rapid prototyping and can be easily scaled up for large-scale manufacturing, said Irmandy Wicaksono, a PhD student and research assistant in the MIT Media Lab. The technique could have many applications, especially in healthcare and rehabilitation. For example, it could be used to produce smart shoes that track the gait of someone who is learning to walk again after an injury, or socks that monitor pressure on a diabetic patient's foot to prevent the formation of ulcers.

The high accuracy of 3DKnITS could make them useful for applications such as gathering biomechanical and form-fitting data, which are useful not only for athletes and dancers, but also for prosthetic designers and shoemakers.

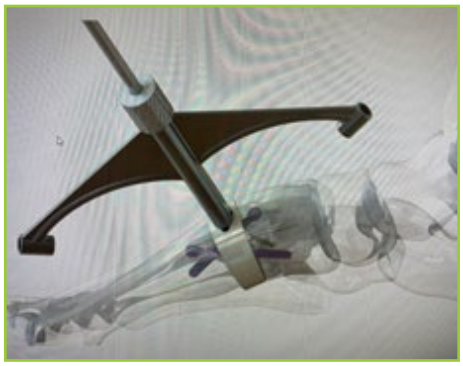
REVITALIGN'S NEWLY DESIGNED FOOTWEAR

Waco Shoe Company brand Revitalign® is relaunching 3 products, the Kholo™, Siesta™ and Yumi™, that integrate new improvements in sole design to increase performance and comfort. In the updated design, PWR-BRIDGE® technology properly supports, cradles, and stabilizes both the heel and midfoot to assist in aligning the foot. Within the outsoles, flex grooves allow the shoe to bend more easily with the foot's natural movement, providing more flexibility and ease in each step. The Yumi features a slide-in style with thong straps and toe posts. The Kholo offers slide-in style with hook-and-loop closure upper. The Siesta has a slide-in style with textured canvas upper and fray detailing. All 3 styles are available in women's sizes, and the Yumi and Siesta are available in men's sizes. Each product includes the new sole design along with deep heel cupping, orthotic arch support, and cushioned forefoot.

Waco Shoe Company
844/827-0439
wacoshoecompany.com

LAPIDUS FUSION WEDGE

The Trigon Lapidus Wedge is a PEEK-OPTIMA® HA Enhanced implant indicated for a first metatarsal-cuneiform lengthening arthrodesis, and is the first implant to specifically reference lengthening in its US Food and Drug Administration indication. It is offered in 3 footprint sizes with various length-restoring



thicknesses, as well as variations in sagittal and transverse angle correction. Additionally, the system provides a jig that allows for frontal plane rotation, resulting in triplanar correction with the ability to restore or maintain length of the first metatarsal. The PEEK-OPTIMA HA Enhanced polymer from Invibio Biomaterial Solutions promotes multi-directional bone healing and allows for improved fixation. With a 25mm diameter, the subtalar wedge offers correction heights ranging from 6mm to 16mm in parallel and angled options.

Nvision Biomedical Technologies
210/545-3713
nvisionbiomed.com

RELAUNCH OF RECOFIT COMPRESSION BRAND

Movement Interactive, a developer of impact-detection technology, has acquired RecoFit™ compression gear brand and is relaunching the products. RecoFit products include compression tights, calf compression sleeves, shin-splint therapy compression sleeves, full-leg compression sleeves, and arm coolers. Used by amateur and professional athletes, compression gear is designed to reduce fatigue and enhance performance. RecoFit, founded in 2008, was invented to help prevent shin splints and address other sports-related issues by delivering oxygen to muscles faster, reducing damaging muscle vibration, and delaying fatigue. The brand's GreatFiT (Gradient Recovery Exercise & Activity Technology) high-quality carbon-based fabric and left- and right-specific design mean superior compression performance for any activity that is tackled.

RecoFit
888/585-9311
recofit.me

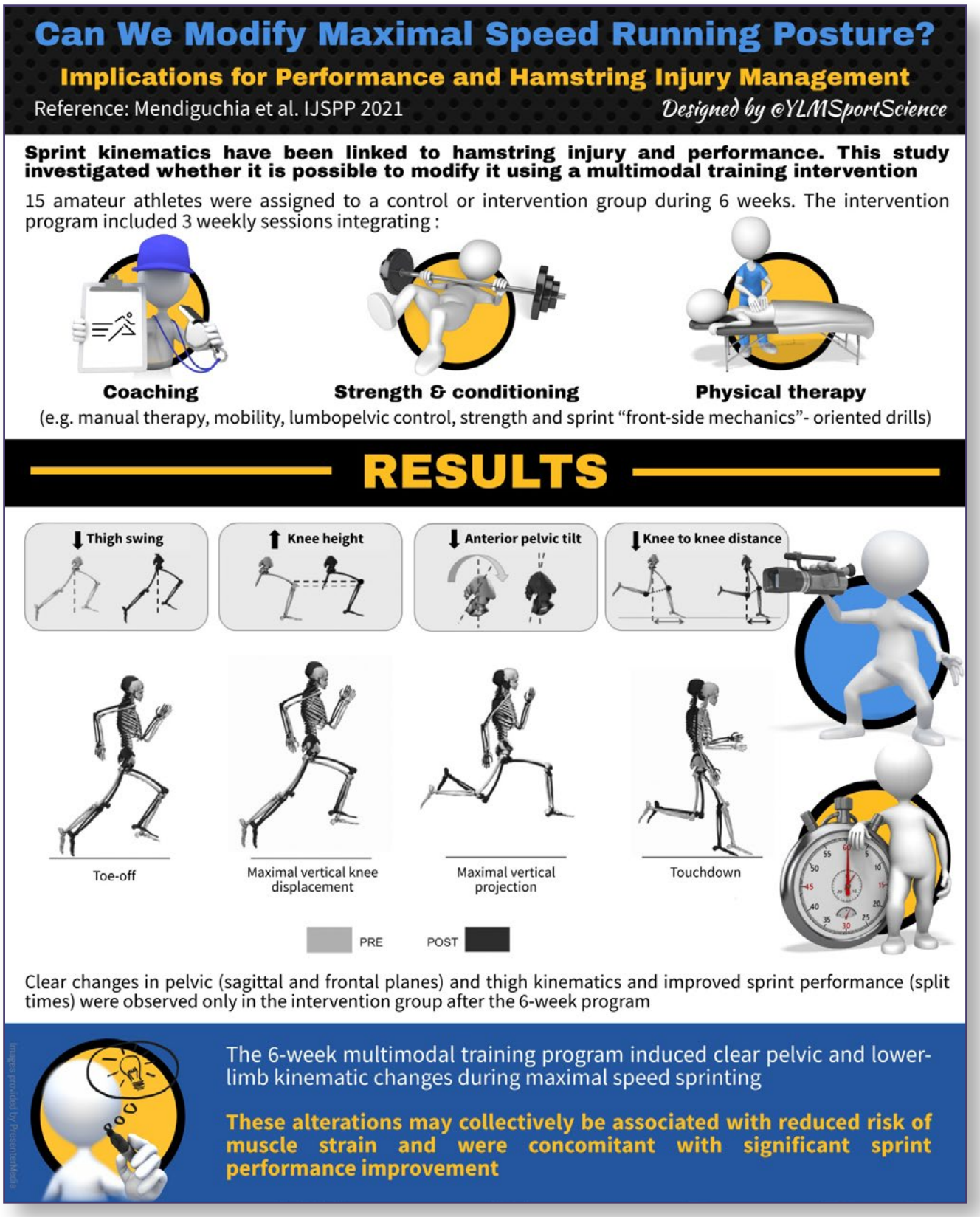
SELF-INSTALLATION RUNNING BLADE KIT

Levitate has removed the barriers that stand between amputees and an active life with a self-installation kit and a blade. Made from a composite material, the blade is lightweight, flexible, durable, compact, and affordable. With this hands-on approach, users can order the running blades themselves and have them shipped to their home. The user simply needs to pick the right size, enter their weight, order the blade, receive, unbox, and assemble. Each kit comes with all the tools needed to assemble, align, and attach the blade, including components for height adjustability (from 0–14cm) and male and female adapters to fit every socket. The geometric structure is optimized for maximum power return and long-term comfort, allowing the user to stay active for longer. Levitate currently has 3 sizes of blades available: 19cm, 25cm, and 35cm. Wholesale options are available for prosthetists and amputee healthcare providers.

Levitate
letslevitate.com

DO YOU HAVE A NEW PRODUCT OR NEWS?

We want to hear about your new product, news, or innovation! We want to hear from you! Please send information to Laura@LERmagazine.com



Source: Mendiguchia J, Castano-Zambudio A, Jiménez-Reyes P et al. Can we modify maximal speed running posture? Implications for performance and hamstring injury management. Int J Sport Phys Perform. 2021;17(3):374-383.

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