AOPT SIG

ACADEMY OF ORTHOPAEDIC PHYSICAL THERAPY, APTA

FOOT & ANKLE

FASIG

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Foot & Ankle SIG News & Updates

- Check out our FA SIG Infographics and podcasts! New podcast is posted and there are two new infographics forthcoming. https://www.orthopt.org/content/special-interest-groups/foot-ankle

- The Technical Report and Description of Fellowship Practice for the PT foot and ankle specialist has been submitted to ABPTRFE! Stay tuned for an update.

- Are you social media savvy? Want to help spread the foot and ankle PT educational content and news? FASIG is opening up a new **Social Media Chair** position! Please let us know if you're interested!

The **FASIG Student Team is looking for students to join our team**! If interested, please contact Hayley Smitheman at hpowell@udel.edu

Please check out the July 2023 Orthopaedic Physical Therapy Practice Article by Stacey Meardon discussing Physical Therapy considerations for management of BSIs:

Meardon S. Physical Therapy Considerations for the Managements of Bone Stress Injuries. Orthop Pract. 2023;35(3):56-58.

Member Spotlight

Featuring Dr. Stacey A. Meardon, PT, PhD

Associate Professor at East Carolina University

Where are you originally from?

Janesville, Iowa

What type of setting do you work in?

University physical therapy program and research lab

What sparked your interest in foot and ankle?

I have always been captivated by human movement – how our bodies coordinate multiple joints for safe, effective, and smooth action. Growing up on a farm with a mechanic as a father, I learned that if parts don't work or don't work well together, the whole system breaks down. Observing human movement, particularly lower extremity joint coordination during activities associated with healthy lifestyle (walking, running, jumping), I noticed "break downs" when the foot hit the ground. This sparked my passion for the foot and ankle. Early in my journey, I was also fortunate to be inspired and mentored by exceptional foot and ankle PTs, namely Dave Sinacore and Michael Mueller.

What is your current research interest?

My current (and persistent) interest lies in uncovering the mechanisms of bone and joint injuries, seeking targets for intervention that empower people to lead active lives. My research has focused on the biomechanics and motor control related lower extremity injury in active populations, with a special interest in bone and joint health. Recently, I have begun translating my work to clinical populations, including those recovering from BSI, fracture, surgery, and ankle instability. The opportunity to work in this domain excites me, and my goal is to contribute to the identification and implementation of effective interventions for recovery of function.

How did you become involved in research/academics?

My passion for understanding human movement continued to grow during my clinical practice, fostering a deep commitment to advancing my knowledge in musculoskeletal injury mechanisms. Sharing this knowledge to empower patients, students, and other healthcare providers brought me immense satisfaction. To further challenge myself, I took advantage of opportunities to participate in sports medicine symposiums, deliver guest lectures, contribute to program development, and engage in inter-professional collaborations. Through involvement with the Iowa Physical Therapy Association, I discovered the varied trajectories that the physical therapy profession offers. So, after seven years of clinical practice when I found myself looking for the next step, academia seemed like a natural fit. Conversations with my professors at Washington University of St. Louis guided me on this path. I visited Bryan Heidersheit's lab during his time at Des Moines University, and he suggested I meet with Tim Derrick, a biomechanics expert at Iowa State University, known for his interest in quantifying and studying musculoskeletal loads during exercise. Tim's mentorship was invaluable, providing me with a quantifiable perspective on musculoskeletal injury from the lens of biomechanics and motor control.

Starting my PhD program eight years after completing my master's degree was not without its doubts, especially being newly married with a newborn. Nevertheless, I remained committed, and I am grateful that it did. Tim's guidance and mentorship helped solidify my understanding of musculoskeletal injury, and now, as a teacher and researcher, I have the privilege of working in the very field where my passion for physical therapy began.

What other activities/hobbies do you enjoy outside of physical therapy?

While I tend to be highly committed to my work, I find balance in spending quality time with my husband, three kids, and two labs. Hiking, kayaking, and enjoying the great outdoors are some of my favorite activities. I also relish quiet moments with a good book and movie nights.

- Tyler Arl, SPT, Rosalind Franklin University

Foot and Ankle – Bone Stress Injuries

Bone stress injuries (BSIs) are common overuse injuries that occur due to an accumulation of microdamage. Rather than being caused by an acute injury, stress injuries develop over time from repetitive loading. They usually occur in the lower leg or foot due to the weight bearing nature of these bones. With continued stress, without adequate recovery, microdamage can lead to macrodamage and a complete fracture.[1]

The prevalence of BSIs of the foot and ankle is 1% in athletic populations but make up almost half of total BSIs in athletes.[2] BSIs occur in 15% of runners and more so in women than men. 40.3% of BSIs occur in the lower leg[3], with a majority arising at the tibia and metatarsals but can also occur at the navicular, calcaneus, fibula, sesamoids, and other tarsal bones. Additionally, 5-10% of new military recruits suffer BSIs in the initial months of training.[6] Although the overall incidence is low in the general population, stress injuries are common in individuals with higher impact and repetitive loads or in individuals who have a sudden increase in activity.

Risk factors for BSIs can fall into two categories: 1) the load applied to the bone and 2) the bone's ability to resist the load. Factors in the first category include activities that require large ground reaction forces on the lower extremities (e.g. running, basketball, gymnastics, military duty), frequency of training, training surface, shoes, and the strength and endurance of local musculature. Second category factors include genetics, sex, nutrition, medications, previous physical activity levels, conditions such as osteoporosis, and certain biomechanical factors.[4,5]

Management of BSIs is generally guided by the injury location and are generally classified as low-risk or high-risk. Low-risk BSIs occur in locations with good vascular supply and are more often due to compressive forces rather than tensile forces. Common sites of low-risk BSIs include the 2nd and 3rd metatarsal shaft, posteromedial tibia, and fibula. Most low-risk stress injuries recover in about 6 weeks. Stress injuries that have a low chance of healing or high chance of non-union are considered high-risk. Common sites of high-risk BSIs include the base of the 5th metatarsal, navicular, talus, and anterior tibia.[1,4,6]

In my own experience after being misdiagnosed as a midfoot sprain, I remember when my doctor showed me the x-ray of my 5th metatarsal stress fracture and it looked like such a small and simple indent on the bone. Little did I know that it could cause so much damage as I went on to fracture the bone twice and require surgery. Awareness of the signs and symptoms of stress injuries are important to reduce risk of injury progress and avoid delayed treatment. Clinical diagnosis often includes a combination of patient history, physical examination, as well as imaging for confirmation and management guidance. Localized bony tenderness aggravated by loading are key signs of BSIs.

The role of physical therapy in the prevention and management of stress injuries is critical. Physical Therapist management should include pain education, activity modification, and progressive loading activities that include short-bout, moderate-high intensity, and multi-directional movements.[1] While optimal loading has yet to be established, it is important to balance periods of rest and reduced loads with mechanical loading to promote bony healing and prevent disuse related bone loss.[1] Rehabilitation may also include strengthening lower leg and intrinsic foot musculature, and address gait mechanics, malalignment, and movement patterns.[6]

-Andrea Rose, SPT, University of Delaware

References

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Citation Blast – Bone Stress Injuries

Hoenig T, Tenforde AS, Strahl A, Rolvien T, Hollander K. Does magnetic resonance imaging grading correlate with return to sports after bone stress injuries? A systematic review and meta-analysis. The American Journal of Sports Medicine. 2021;50(3):834-844. doi:10.1177/0363546521993807

The purpose of this systematic review was to determine if MRI grading offers prognostic value in the prediction of time and rate of return to sport (RTS) following non-surgical treatment of bone stress injuries (BSI). Authors found that 13 of 16 studies supported MRI-based grading as a prognostic factor in time to RTS. The mean time for RTS with a grade 1 (least severe) BSI was 42 days, while a grade 4 (most severe) was 99 days. Additionally, high grade trabecular injuries took longer for RTS than high grade cortical injuries (47.6 vs 24.8 days). >90% of athletes returning to their sport, regardless of injury grade. The findings suggest that bone stress injuries of different grades and different locations should not be considered identical. Overall, it is important that the clinician considers the severity and location of the BSI when planning treatment.

Milner CE, Foch E, Gonzales JM, Petersen D. Biomechanics associated with tibial stress fracture in runners: A systematic review and meta-analysis. Journal of Sport and Health Science. 2023;12(3):333-342. doi:10.1016/j.jshs.2022.12.002

This systematic review assessed 14 publications to examine biomechanics in runners with and without tibial stress fractures. 25 kinematic/kinetic variables were reported, and significant differences were found for peak eversion angle, peak hip adduction angle, early stance sagittal plane knee joint stiffness, and tibial rotation during barefoot running. 38 ground reaction force variables had no statistically significant differences that were consistent between articles. A meta-analysis was completed for peak vertical impact force, peak vertical active force, and peak braking force, however, these results also found insignificant differences between those with tibial stress fractures and those without. Due to many variables only being reported in single studies and small samples sizes, the analyses were likely underpowered to demonstrate differences in the biomechanics of runners with tibial stress fractures. Therefore, as clinicians it is important to look at the runner as a whole, taking into account their biomechanics as well as other risk factors (e.g. sex, age, training intensity) to prevent and treat tibial stress injuries.

Greeves JP, Beck B, Nindl BC, O'Leary TJ. Current risks factors and emerging biomarkers for bone stress injuries in military personnel. Journal of Science and Medicine in Sport. 2023;26. doi:10.1016/j.jsams.2023.04.006

This article focuses on the risk factors and potential use of biomarkers to predict bone stress injuries (BSI) in military personnel. BSI prevalence in the military is as high as 20%, occurring most often in the metatarsals and tibia. As with most populations, women are three times more likely than men to have a BSI. In addition to sex, an increase in the type and intensity of mechanical loading that occurs in recruit training is a risk factor, and it should be noted that BSI's peak in the first 4-7 weeks of training. Age, medications (e.g. corticosteroids), muscle fatigue, and sleep/stress management are also risk factors for BSI's. Overall, per the authors, "the highest quality observation data consistently identifies female sex, older age, and lower physical fitness as the primary risk factors for BSIs." Additional discussion on biomarkers and their correlation to BSIs is less concrete and further research is likely needed. Correlations with low energy availability, hypoestrogenia in women, and emerging biomarkers such as exerkines have been posited and warrant further investigation. Further studies are required to quantify specific values within the military population and determine their reliability in predicting risk for bone stress injuries.

Bickle C, Deighan M, Theis N. The effect of pointe shoe deterioration on foot and ankle kinematics and kinetics in professional ballet dancers. Hum Mov Sci. 2018;60:72-77. doi:10.1016/j.humov.2018.05.011

This article discusses the impact that "worn" pointe shoes, used by professional ballet dancers, has on ground reaction forces as well as foot and ankle kinematics. The study looked at 15 female professional dancers completing trials of bourrées (dancer rises onto pointe, with one leg placed in front of the other, the knees extended, and ankles in full plantar flexion) while moving over force plates. Video analysis software was used to calculate foot and ankle kinematics. Results showed no difference in ground reaction force but did show significantly greater midfoot flexion and ankle plantarflexion angles in the worn shoes compared to new shoes. This was attributed to the difference in structural integrity between the types of shoes, which can be further correlated to potential increases in common dance injuries. Therefore, if dancers continue to dance in deteriorating shoes their risk for stress fractures, ligament sprains, and Lisfranc injuries will increase.

- Jessica Glauber, SPT, East Carolina University