



**AOPT**  **SIG**

ACADEMY OF ORTHOPAEDIC PHYSICAL THERAPY, APTA

**FOOT & ANKLE**



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## **FASIG updates**

We hope you are enjoying your summer!

The FA SIG submitted our pilot practice analysis to the American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE) for review in April 2021. This was reviewed in May, and the final steps to complete the process are now in sight. Thanks, again, to the many people who have contributed to this effort over the last 2 years. We are very excited to receive the final review and then send out the practice analysis survey for the final time at the end of 2021. Although there is just a bit more work to do, it is exciting to think about the first fellowship trained foot and ankle specialists that could be joining the community in the very near future!

The SIG is actively looking for motivated and interested people to join the leadership group. Now is the time to get involved and take the next steps for the SIG. We are looking for people to join the nominating committee, a chair for the Practice Committee, and last a NEW PRESIDENT! We have a great team now that is ready to help with the transition so contact any of us if you might be interested or to learn more. (contact information is available via our website @ <https://www.orthopt.org/content/special-interest-groups/foot-ankle>)

# Member Spotlight

Featuring John J. Fraser, PT, DPT, PhD, FACSM

**Where are you originally from?** Staten Island, NY



**What type of setting do you work in?** I have worked at Naval Health Research Center in San Diego, CA since 2017 as a Research Physical Therapist, Department Head of Warfighter Performance, and now as the Deputy Director for Operational Readiness & Health. I also serve as faculty at Naval Hospital Camp Pendleton's Primary Care Sports Medicine Fellowship. I will soon be receiving orders for a transfer and look forward to joining the faculty at the Army-Baylor DPT program in San Antonio, TX as Assistant Professor around January 2022.

**What sparked your interest in the foot and ankle?** The ankle-foot complex is able to do some amazing things. The ability to rapidly shift from a pliable and adaptable interface essential for balance and attenuating force to a rigid segment needed for efficient propulsion is remarkable. When I was in PT school, the complexity of ankle-foot anatomy and biomechanics was the most elusive of all the movement complexes in the body. I viewed this knowledge gap as a challenge and opportunity to learn more and develop a degree of mastery beyond entry-level education. I took that challenge head on by attending a series of continuing education and keeping atop of pertinent evidence. Ultimately, the study of the ankle-foot complex in individuals with lateral ankle sprains and chronic ankle instability became the focus of my PhD training and research.

**What is your current research interest?** My primary research focus revolves around ankle-foot neuromusculoskeletal function, rehabilitation, and public health of military tactical-athletes. We are currently partnered and funded to assess some innovative interventions such as a complementary foot intensive rehabilitation program and a rocky treadmill intervention for 'return to sport' in individuals with lateral ankle sprain and chronic ankle instability. We will also be validating a "tendon tapper" that may be useful in evaluation and diagnosis of achilles and other tendinopathies. In addition, we have partnered with material engineering scientists to develop innovative sensors for assessment of multisegmented ankle-foot motion/deformation while shod/clothed during community function and a next generation ankle brace, which is exciting.

**How did you become involved in research/academics?** I know it's cliché, but I became a PT to help others. As a practicing PT over the past 19 years, I have had the pleasure of assisting many individual patients in restoring function and health-related quality of life. As a clinician-scientist and educator preparing the next generation of clinicians, I have pleasure knowing that the effect is exponential. I also believe in paying things forward, since I have had the opportunity to have some amazing instructors, professors, and mentors over the years. I take satisfaction when I see clinicians I have taught over the years go on to do some amazing things. "Training your relief" is an important philosophy for the health of the profession and the organizations we serve.

**What other activities/hobbies do you enjoy outside of physical therapy?** I enjoy sailing, hunting, fishing, brewing beer, scuba diving, good food and drink, and the camaraderie and banter of friends and family.

- Lena Parker, SPT

FASIG Updates

Member Spotlight –  
John J. Fraser

Feature Article – The  
"Foot Core"

Citation Blast – Foot  
Intrinsic Exercises

## The “Foot Core”

The intrinsic muscles of the foot, also referred to as “the foot core,” have been viewed by many as a critical piece of the puzzle of overall foot and ankle function. Just as core muscles in the trunk of the body are responsible for dynamic stability, it has been theorized that the intrinsic muscles of the foot play a large role in the stability of the foot and ankle. The human body relies on the foot to absorb and dissipate forces across the foot with tasks such as walking, running, and jumping. The complex structure of the foot includes 26 bones, 20 intrinsic and 9 extrinsic muscles, 108 ligaments, and more than 30 joints that all play a role in ambulation.<sup>1</sup>

Researchers have made the comparison of the foot core to the lumbopelvic core for stability and divided components into control and capacity. The control strategy aims to restore coordination of the muscles acting on the lumbopelvic core while the capacity strategy aims to provide adequate muscle strength and endurance to prevent the spine from being mechanically unstable under varying loads.<sup>2</sup> This concept also applies to the foot core through the passive, active, and neural subsystems of the foot core. The passive subsystem consists of the bones, ligaments, and joint capsules that make up the arches of the foot. The active subsystem contains the muscles and tendons inserting and originating on the foot. The functional qualities of these structures include modulating forces, support, and synergy with the other structures. The neural subsystem is responsible for sensory and motor function contributing to balance, gait, and force modulation.

Many therapeutic and recreational strengthening exercises are focused on muscles around the ankle and higher, but fewer focus on the intrinsic muscles of the foot. The intrinsic muscles build up the arch of the foot and weak intrinsic muscles are thought to contribute to excessive subtalar joint pronation, stress fractures, and plantar fasciitis. A growing belief within the physical therapy community is that strengthening the foot core can play a large role in improving foot posture, decreasing patient’s symptoms, and improving kinematics and performance.

One of the biggest questions is whether intrinsic foot strengthening plays a role in improving activities such as running. Studies show that there is moderate evidence that strengthening improves movement performance and running propulsive forces.<sup>1,3</sup> In a study by Taddei et al.<sup>1</sup> from 2020, results showed that an 8-week intrinsic foot strengthening training program with a physical therapist improved

propulsive forces significantly during running. When it comes to exercises to strengthen the intrinsic foot muscles, they are typically focused on the motion of creating a “short foot” or creating an increased arch. Commonly prescribed exercises include: digit extension, hallucis longus/brevis extension, hallucis abduction, and towel scrunches.<sup>4</sup> These exercises are commonly prescribed within general strengthening guidelines.

Observations from many studies have shown an association between intrinsic foot muscle weakness and foot pain.<sup>5</sup> However, there is currently conflicting evidence as to whether the two have a causal relationship. Current clinical practice guidelines related to heel pain and plantar fasciitis discuss the need for further evidence for the link between decreased intrinsic muscle strength and these conditions. A recent systematic review showed that it was not possible to identify the extent to which strengthening interventions that improve intrinsic foot musculature may benefit symptomatic or at-risk populations to plantar fasciitis/heel pain.<sup>5</sup> The reason for this being a lack of external validity among studies and a lack of consistency in outcome measures used.

Use of clinical judgement is required until further evidence emerges, but foot intrinsic muscle strengthening may be a useful tool in rehab and athletic performance development.

- Cam Craver, SPT

1. Taddei UT, Matias AB, Ribeiro FIA, Bus SA, Sacco ICN. Effects of a foot strengthening program on foot muscle morphology and running mechanics: A proof-of-concept, single-blind randomized controlled trial. *Physical Therapy in Sport*. 2020;42:107-115. doi:10.1016/j.ptsp.2020.01.007
2. McKeon PO, Hertel J, Bramble D, Davis I. The foot core system: A new paradigm for understanding intrinsic foot muscle function. *British Journal of Sports Medicine*. 2014;49(5):290-290. doi:10.1136/bjsports-2013-092690
3. Hashimoto T, Sakuraba K. Strength training for the Intrinsic flexor muscles of the foot: Effects on muscle strength, the Foot Arch, and dynamic parameters before and after the training. *Journal of Physical Therapy Science*. 2014;26(3):373-376. doi:10.1589/jpts.26.373
4. Matias AB, Taddei UT, Duarte M, Sacco IC. Protocol for evaluating the effects of a therapeutic foot exercise program on injury incidence, foot functionality and biomechanics in long-distance runners: A randomized controlled trial. *BMC Musculoskeletal Disorders*. 2016;17(1). doi:10.1186/s12891-016-1016-9
5. Huffer D, Hing W, Newton R, Clair M. Strength training for plantar fasciitis and the intrinsic foot musculature: A systematic review. *Physical Therapy in Sport*. 2017;24:44-52. doi:10.1016/j.ptsp.2016.08.008

## Citation Blast – Foot Intrinsic Exercises

Foot intrinsic muscles, or the foot core, is currently a hot topic in the physical therapy and foot and ankle world. Whether or not exercising those specific muscles will greatly alter the patient outcomes in regards to recovery or prevention is the question many are trying to answer. The following articles for this quarter's newsletter concern the foot core, but the population that is being assessed varies, allowing somewhat of a well-rounded view on current foot intrinsic literature.

1. Lee, D.-R., & Choi, Y.-E. (2019). Effects of a 6-week intrinsic foot muscle exercise program on the functions of intrinsic foot muscle and dynamic balance in patients with chronic ankle instability. *Journal of Exercise Rehabilitation*, 15(5), 709–714. <https://doi.org/10.12965/jer.1938488.244>

The purpose of this article was to assess the effectiveness of a 6-week exercise program targeting the foot intrinsic muscles on its ability to improve activation of the intrinsic foot muscles and on dynamic balance in adults with chronic ankle stability. The researchers measured activation and dynamic balance of various muscles in the foot both before and after treatment (or not treatment for the control group). They found that all muscles assessed significantly improved in both categories, and concluded that intrinsic muscle strengthening can improve stability, function, and balance of the foot.

2. Taddei, U. T., Matias, A. B., Duarte, M., & Sacco, I. C. . (2020). Foot Core Training to Prevent Running-Related Injuries: A Survival Analysis of a Single-Blind, Randomized Controlled Trial. *The American Journal of Sports Medicine*, 48(14), 3610–3619. <https://doi.org/10.1177/0363546520969205>

This randomized control trial aimed to evaluate the effectiveness of a foot core strengthening program's ability to reduce the incidence of running related injuries in recreational distance runners. The authors found that those in the control group were 2.42 times more likely to experience a running related injury than the test group. Although the data was significant, the authors suggest further research be done on the mechanism and types of injuries that the participants endured.

3. Pabón-Carrasco, M., Castro-Méndez, A., Vilar-Palomo, S., Jiménez-Cebrián, A. M., García-Paya, I., & Palomo-Toucedo, I. C. (2020). Randomized Clinical Trial: The Effect of Exercise of the Intrinsic Muscle on Foot Pronation. *International Journal of Environmental Research and Public Health*, 17(13), 4882. <https://doi.org/10.3390/ijerph17134882>

Similar to the previously mentioned studies, the purpose of this article was to analyze the effects of a foot core exercise program. However, this article analyzed whether foot intrinsic training improved over pronation. The authors found no difference between the control group, who underwent "non-biomechanical exercise", and the experimental group, who participated in the exercise program consisting of "short foot exercises".

4. Okamura, K., Fukuda, K., Oki, S., Ono, T., Tanaka, S., & Kanai, S. (2020). Effects of plantar intrinsic foot muscle strengthening exercise on static and dynamic foot kinematics: A pilot randomized controlled single-blind trial in individuals with pes planus. *Gait & posture*, 75, 40–45. <https://doi.org/10.1016/j.gaitpost.2019.09.030>

Okamura et al. set out to determine if foot intrinsic strengthening improved foot alignment and kinematics during gait in people with pes planus. The participants were separated into two groups, the treatment group performed short foot exercise, while the control received no intervention. The researchers found significant improvements in the experimental group when compared to the control, concluding that short foot exercise can improve static foot alignment and temporal parameters of foot kinematics during gait for those with pes planus.

5. Hogan, K. ., Prince, J. ., & Hoch, M. . (2020). The evaluation of the foot core system in individuals with plantar heel pain. *Physical Therapy in Sport*, 42, 75–81. <https://doi.org/10.1016/j.ptsp.2019.11.011>

The aim of this cross-sectional study was to compare various aspects of the foot in those with and without plantar heel pain. The authors analyzed foot posture,

plantar sensation, plantar fascia thickness, intrinsic morphology. Significant results were found for some of the variables, however, no significant difference was found in regards to intrinsic foot muscle performance.

6. Taddei, U. T., Matias, A. B., Ribeiro, F. I. ., Bus, S. A., & Sacco, I. C. . (2020). Effects of a foot strengthening program on foot muscle morphology and running mechanics: A proof-of-concept, single-blind randomized controlled trial. *Physical Therapy in Sport*, 42, 107–115.

<https://doi.org/10.1016/j.ptsp.2020.01.007>

Taddei et al. investigated the effects of a foot training program on foot muscle morphology and running mechanics in recreational runners. The experimental group focused on strengthening the intrinsic muscles of the foot. After an eight week training program, the experimental group was found to have significantly greater volume of all the muscles that were investigated, and increased vertical propulsive impulse during running.

- Shon Kuhn, SPT

