The Effects of Short-Foot Exercises on Postural Control: A Critically Appraised Topic

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Clinical Scenario

Athletic trainers evaluate and treat a variety of chronic lower extremity injuries. These chronic injuries may be insidious in nature, caused by secondary injury, repetitive trauma, and/or muscle imbalances in the lower kinetic chain.1 The clinician’s evaluation of the foot is critical in understanding underlying causes of injury and the best course of treatment. The anatomy of the human foot is complex, with an abundance of intricate ligaments, muscles, and bony structures which can be further divided into two main subsystems. The passive subsystem consists of the plantar calcaneonavicular ligament, bony arch, and the plantar fascia.4 The active subsystem includes the global foot extrinsic muscle tendons and the intrinsic foot muscles (IFM) (e.g., abductor hallucis longus, abductor hallucis brevis, and flexor digitorum brevis).4 Together they serve as the base of support for the lower kinetic chain and play a crucial role in stabilizing the lower extremity during dynamic activity.2,4 Several structures from the passive and active subsystems contribute to the medial longitudinal arch (MLA), which is responsible for providing stability and transferring forces throughout the foot and up the kinetic chain.2–4 Weak or inactive IFM may contribute to overpronation during static and dynamic movements, which can contribute to a host of lower extremity injuries.2,5,6 Therefore, strengthening the IFM through short-foot exercises (SFE) has been proposed as a strategy to reduce overpronation and subsequent injury.2 SFE are described as a midfoot contraction, where the metatarsal heads are moved posteriorly toward the calcaneus without flexing the toes.5 These exercises target activation of the IFM and increase MLA height;5,6 however, minimal research has examined their effect on postural control. Examining the effects of SFE on the body’s ability to maintain or achieve standing balance, often referred to as postural control, may provide deeper insights into the clinical utility of these exercises.

Focused Clinical Question

Is there evidence to suggest SFE improve postural control?

Search Strategy

We performed a computerized search in February 2016 (Figure 1). We used the following search terms in combination:

- Patient/Client group: adult
- Intervention: short foot OR foot positioning
- Comparison: None
- Outcome: balance OR postural control

Sources of Evidence Searched

- Academic Search Complete
- CINAHL
- Medline
Additional resources were obtained via review of references lists and hand searches.

The criteria for study selection were as follows:

**Inclusion Criteria.**
- Prospective studies (Level 3 or higher) that examined the effects of rehabilitation program that included SFE
- Assessed static or dynamic postural control as an outcome measure
- Studies published in English
- Studies performed on human subjects
- Studies published between 2004 and April 2016

**Exclusion Criteria.**
- Studies that did not use SFE or examined the effects of a single treatment
- Studies that focused on outcome measures other than postural control (e.g., EMG activation).

**Evidence Quality Assessment**

Validity of the selected studies was appraised using the PEDro scale for randomized controlled trials (RCTs). The PEDro was selected because of designs of the included studies, which were either RCT or pretest-posttest designs. Two authors (CM and LW) independently reviewed each study and a consensus was reached for each item to create an overall article score (Table 1).

**Results of Search**

**Summary of Search, Best Evidence Appraised, and Key Findings**
- All authors searched the literature for studies of Level 3 evidence or higher (based on the Levels of Evidence, Centre for Evidence-Based Medicine, 2009) that examined the effects of SFE on postural control in adults. All authors met to determine study eligibility and inclusion.

**Table 1 Characteristics of Included Studies**

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<td>Study Title</td>
<td>Effect of Active Foot Positioning on the Outcome of a Balance Training Program</td>
<td>Differences in Static and Dynamic Balance Task Performance after 4 Weeks of IFM Training: The SFE v. Towel-Curl Exercise</td>
<td>Effect of Plantar Intrinsic Muscle Training on Medial Longitudinal Arch Morphology and Dynamic Function</td>
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<td>Study Participants</td>
<td>45 healthy college students (18 female and 27 male, age 20.9 ± 2.4 years, height 172.9 ± 9.6 cm, mass 73.3 ± 13.9 kg)</td>
<td>30 healthy participants (15 male and 15 female, age 23.0 ± 1.6 years, height 1.72 ± 0.66 m, mass 68.2 ± 9.8 kg)</td>
<td>21 healthy subjects (3 men and 18 women, age 26.1 ± 3.7 years, height 168.4 ± 7.11 cm, weight 69.3 ± 13.55 kg)</td>
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<td>Inclusion/Exclusion Criteria</td>
<td>Subjects were excluded if they reported a traumatic injury to the lower extremity within the past 6 months; had a history of surgery to the lower extremities; had previously participated in balance training; or had any disorders involving the vestibular system, visual system, central or peripheral nervous systems.</td>
<td>Subjects were excluded if they reported a history of lower extremity or low back injury in the last 6 months or if they had been diagnosed with a neurological condition that would hinder ability to balance.</td>
<td>Exclusion criteria included any sign of foot pain, history of patellofemoral pain syndrome, plantar fasciitis, anterior or posterior tibialis dysfunction, or systematic or neurological disease within the past 6 months that could affect motor function.</td>
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