Can Foot Exercises and Going Barefoot Improve Function, Muscle Size, Foot Pressure During Walking and Qualitative Reports of Function in People with Flat Foot?

Marcey Keefer Hutchison, DPT, Robin Dorociak, Alison Modafferi, DPT, Shanna Howland , DPT, Angela Foster, DPT, Jean Jarbath, DPT, Brenden Thompson, DPT, Tyler Whited, DPT, Jeff Houck, PhD

Category: Midfoot/Forefoot

Keywords: Flat foot, exercise, barefoot, function

Introduction/Purpose: Specific exercises to train foot muscles for barefoot running (i.e. doming seated[DS] and standing[DSt]) and post foot and ankle injury (i.e. seated plantar flexion and inversion[SPFI]) are common. Exercise programs specifically for the foot claim improvement in foot posture (foot posture index [FPI]) and foot strength. However, rigorous assessment of foot function as a result of exercise is lacking (i.e. foot posture, strength, and plantar pressure). Further, no studies specifically address patients with flat foot. The purpose of this case series study was to assess the immediate effects of an 8-week foot exercise and barefoot weight bearing program on clinical and biomechanical measures of foot function.

Methods: Thirty three participants, 23 with a severe flatfoot (SFF), measured by FPI (> 6/12, average = 9.4±1.5, age=28.9 ±11.0) and 10 age/gender matched controls (AMC) with a normal foot (FPI average=4.6±1.5, age = 29.8±7.8) participated. The SFF group completed 4 foot exercises (DS, DSt, SPFI, and toe spreading) and spent 2 hours/day barefoot weight bearing 5 days/week for 8 weeks. The SFF group was tested pre- and post exercise and the AMC group once. Testing included plantar pressure during walking (cadence 120 bpm), abductor halluces cross sectional area(CSA) using diagnostic ultrasound, paper pull test (PPT) quantified 1st metatarsophalangeal joint(MTP) flexion strength using a force plate, and heel raises (repetitions and heel height). ANOVA models and T-tests were used to assess the effects of pre- to post exercise and make comparisons between the SFF group and the AMC group. Post exercise interviews were transcribed and subjected to word count analysis.

Results: Although no calf training was included, heel rise repetition (Right: Pre=28.0 to Post 35.0, Left: Pre=30.6 Post= 38.2) and heel height (Increased Right: 1.7 cm, Left: 1.8 cm) improved (Figure 1). The PPT test indicated increased 1st MTP flexion force post exercise bilaterally (Right p=0.002, Left p=0.007). Consistent with increased force of the PPT, abductor halluces muscle CSA increased bilaterally (Right & Left = 0.3 cm2 or 12.5%). However, plantar pressures were not different post exercise (p>0.05). Post exercise the SFF group and AMC group were similar across variables(p>0.05). Compliance logs indicated 87.7% completion of prescribed exercises and 111% of time targeted barefoot weight bearing. The top 6 words mentioned in post exercise interviews were: exercise, time, stronger, standing, hard, and easy.

Conclusion: This is the first data to demonstrate that foot only exercises have a significant influence on ankle plantar flexion function (i.e. increased heel rise repetition and height) and patient qualitative assessments of their foot. The argument that this increase in ankle function derives from the training effects within the foot is supported by significantly higher 1st MTP force (increased PPT test) and increased cross sectional area of the abductor halluces muscle. Despite having significant flat foot deformity participants enhanced their foot and ankle function. This suggests that other foot problems with similar deformity may also benefit from exercise.

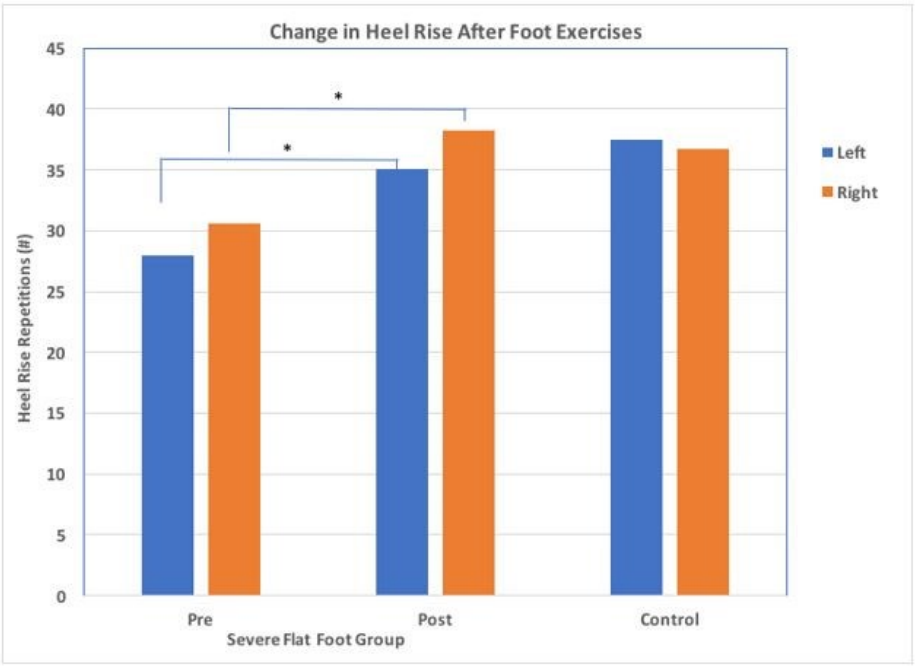

Figure 1: The average heel rise repetitions significantly increased from pre to post exercise (*= $p<0.05$) despite the fact that no calf work was included in the exercise program. Post exercise the patients with severe flat foot increased their heel rise repetitions by 7 or ~25 % of their pre exercise test. At the post test patients in the severe flat foot group were similar to age matched controls.

Foot & Ankle Orthopaedics, 3(3)
DOI: 10.1177/2473011418S00257