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# Comparison of the clinical heel rise test in subjects with Stage II PTTD and healthy controls

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## Introduction

The heel rise test is commonly used as a strength test for the triceps surea muscle group but has also become widely used as a functional task to aid in the diagnosis of Posterior Tibial Tendon Dysfunction (PTTD) [1,2]. Although failure to invert the hindfoot during the heel rise test is reported to be a sign of failure in the posterior tibial muscle, posterior tibialis function may also contribute to forefoot plantar flexion, assisting with raising the heel off the floor. Midfoot collapse associated with weakness of the posterior tibialis muscle may limit a PTTD subjects' ability to plantar flex the forefoot during the heel rise test. The purpose of this study was to compare sagittal plane ankle and midfoot kinematics as well as HF frontal plane kinematics in subjects with stage II PTTD and healthy controls during a bilateral heel rise test.

## Methods

30 stage II PTTD subjects (age; 59.2 (11.3) years, BMI; 29.8 (4.8)) and 15 healthy controls (58.6 (7.7) years, BMI; 30.5 (3.6)) were included in this study. While subjects performed a bilateral heel rise task, kinematic data was collected (sampled at 60 Hz, filtered at 6 Hz) from the shank, calcaneus (HF), and first metatarsal (FF) using an Optotrak Motion Analysis System (Northern Digital Inc, CAN) and Motion Monitor Software (Innsport Training Inc, USA). Kinematic data were used to calculate Cardan angles (Z-X-Y sequence) including ankle plantar flexion/dorsiflexion (HF relative to the shank), ankle inversion/eversion (HF relative to the shank) and midfoot plantar flexion/dorsiflexion (FF relative to the HF). Statistical Analysis: To compare groups a mixed design ANOVA model with a repeated factor of phase (three levels: start position, peak heel rise position, and ending position) and a fixed factor of group (two levels: PTTD and healthy controls) was utilized.

## Results

There was no significant difference ($p = 0.11$) in sagittal plane ankle motion between subjects with PTTD and healthy controls across all phases of the heel rise test. Interestingly, although subject with PTTD began the heel rise test with greater eversion compared to controls (5 degrees difference $p < 0.001$) they achieved a position of inversion equal to controls at peak heel rise (1.7 degrees difference $p = 0.15$). A significant difference between groups in sagittal plane midfoot motion was found to be dependent on phase of the heel rise task (interaction $p = 0.05$). Pairwise comparisons between groups at each phase revealed a significant ($p = 0.03$) decrease in midfoot plantar flexion in subjects with PTTD (6.5 degrees) compared to healthy controls (12.1 degrees) at the peak heel rise position.

## Conclusion

Raising the heel off the floor during the heel rise test is accomplished with both ankle plantar flexion and midfoot plantar flexion. Significantly reduced midfoot plantar flexion (midfoot collapse) was observed in PTTD subjects compared to healthy controls despite normal HF inver-

sion. Hindfoot inversion may provide some stability to the midtarsal joint limiting midfoot collapse but this relationship is only partially able to protect secondary ligaments. Summary: In this first investigation of the heel rise test failure to plantar flex the midfoot while completing the heel rise test was more common in subjects with stage II PTTD than failure to invert the hindfoot. The ability to stabilize the midfoot with muscle control or joint stability is compromised in subjects with stage II PTTD placing increased demand on support ligaments.

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## References

1. Alverez RG, *et al.*: *Foot and Ankle International* 2006, **27(1):**2-8.
2. Flanagan SP, *et al.*: *Journal Aging and Physical Activity* 2005, **13:**160-171.