

## CLINICAL MEASUREMENTS PREDICTING VERTICAL ORIENTATION OF THE AXIS OF ROTATION OF THE 1-METATARSAL ABOUT THE NAVICULAR

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Supported by the Arthritis Foundation North Central Chapter.

In accordance with Univ of MN IRB (#0709M16823)

Abstract (Limited to 300 Words)

**PURPOSE:** This study investigated the ability of clinical measures to predict the vertical component of the 1-metatarsal's axis of rotation.

**SUBJECTS:** Data were collected from twenty adult female subjects (ages 22-73 years) with and without bunion.

**METHODS AND MATERIALS:** Magnetic resonance images were taken using a FONAR upright 0.6 Tesla magnet with the subject placed in positions imitating the midstance, heel off, and terminal stance phases of gait. The calcaneus, 1-metatarsal, 2-metatarsal, navicular, and distal fibula were reconstructed using MIMICS and a principal coordinate system was embedded for the 1-metatarsal with respect to the navicular with z lateral (dorsi/plantar flexion), y up (ab/adduction), and x forward (inversion/eversion). Four foot mobility measures (navicular drop, change in dorsum height over truncated foot length, change in rearfoot valgus, and hallux dorsiflexion) were taken on the foot. Three planar bone angle measures (hallux valgus, intermetatarsal, and calcaneal-1-metatarsal angles) were taken on the MIMICS reconstructions.

**ANALYSES:** A multiple regression analysis was performed to determine which foot measures could best predict the vertical component of the 1-metatarsal's axis of rotation.

**RESULTS:** The three measures that contributed most to predicting the vertical orientation of the axis of rotation from midstance to heel off were hallux dorsiflexion, hallux dorsiflexion squared, and hallux valgus angle ( $R^2=0.490$ ,  $p=0.01$ ). The variables that contributed most for heel off to terminal stance were hallux dorsiflexion, hallux valgus angle, calcaneal-1-metatarsal angle, and their squared counterparts ( $R=0.33$ ,  $p=0.44$ ).

**CONCLUSION:** Clinical measures can be used to describe 49 percent of the variation in vertical orientation of the axis of rotation of the 1-metatarsal about the navicular from midstance to heel off, but the prediction model for heel off to terminal stance is not significant.

**IMPLICATIONS:** Clinical measures can be used to predict an axis tipped towards horizontal for early intervention of foot pathology.