Plantar Forces in FHL vs FDL Transfer in Adult Acquired Flatfoot Deformity

Foot & Ankle Category: Basic Science / Biologics

Author(s):
E. Meade Spratley, MS
John M. Arnold, MD
John R. Owen, MS, PE
Christopher D. Glezos, BS
Jennifer S. Wayne, PhD.
Robert S. Adelaar, MD

Introduction
Flexor hallucis longus (FHL) and flexor digitorum longus (FDL) tendon transfers are frequently used to augment deficient posterior tibial tendon (PTT) function in stage II adult acquired flatfoot deformity (AAFD). [1] FHL transfer has been preferred given that its physiologic cross-sectional area is twice that of the FDL, though biomechanical data demonstrating improved surgical outcome remains inconclusive. [1–3] Loss of toe flexion force with tendon transfer has also been noted, though the clinical significance of this is unclear. [4,5] The decision to tenodese the stump of the transferred tendon to restore this force remains controversial particularly because of the increased risk to neurovascular structures in the medial arch. [6] The aim of this study was to quantify changes in plantar force in the great and lesser toes following tendon transfer with and without tenodesis in order to assess the ability of tenodesis to restore lost plantar force.

Methods
Using a previously developed loading frame, 10 matched pairs of cadaveric lower extremities were loaded under a static 100lb axial force through the tibia. [7] Soft-tissue activation was approximated through a 100lb Achilles force, as well as 10lb and 6lb loads to the FHL and FDL, respectively. [8] Specimens were first tested intact, then with one of the two tendon transfers, and finally with both transfer and tenodesis. For each state, plantar force in 5 forefoot regions was assessed as described previously. [7] These regions were the great toe (R1), the lesser toes (R2), the distal 1st metatarsal (R3), the distal 2nd metatarsal (R4), and distal metatarsals 3-5 (R5).

Results
There was a decrease in flexion force from intact for the great toe (R1) (p<0.01) and lesser toes (R2) (p<0.001) for FHL and FDL transfers, respectively (Figure). Tenodesis demonstrated an ability to restore flexion force in the great (p<0.05) and lesser (p<0.01) toes over transfer alone for FHL and FDL, respectively. Great toe flexion force following FHL transfer with tenodesis was not significantly less than intact (p>0.7). Additionally, FHL transfer resulted in an increase in forefoot loading (R3-R5) over intact (p<0.05). This increase was disproportionately distributed to the medial forefoot with increases of 22.4%, 18.4%, and 8.6% for R3-R5, respectively.
Conclusion