The Effect Of Peroneus Brevis Tendon Anatomy On Stability Of Fractures At The Fifth Metatarsal Base

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Objectives: Fractures of the fifth metatarsal base are not uncommon. Both fracture management and outcomes can differ greatly depending on fracture location. The purpose of the present study is to evaluate the influence of the peroneus brevis (PB) tendon on proximal fifth metatarsal fracture stability. We hypothesize that proximal fifth metatarsal fractures distal to the PB tendon footprint are inherently less stable than more proximal fractures.

Methods: We utilized 5 matched pairs of fresh-frozen cadaveric specimens. We carefully exposed the 5th metatarsal and PB tendon. We measured the length of the PB insertion at the base of the fifth metatarsal with calipers. The PB and Achilles tendons were then whip-stitched proximally to facilitate loading. A custom leg holder was fabricated to allow loading and fluoroscopic evaluation. Two conditions were utilized for biomechanical testing; (1) a simulated fracture distal to the PB insertion (Jones equivalent) and (2) a simulated fracture within the footprint of the PB insertion (avulsion equivalent). All fractures were carefully created with a narrow osteotome. Following fracture creation, the plantar flexed foot was statically loaded through the Achilles and PB tendons. Oblique images with and without loading and digital measurements were performed to evaluate for fracture separation. We utilized a paired student T test and intraclass correlation coefficient (ICC) for all statistical analysis.

Results: The average length of the PB footprint was 15.2 mm. Compared to fractures within the PB footprint, fractures distal to the PB tendon insertion demonstrated greater fracture widening following loading of the PB tendon. Fractures within the PB footprint widened 0.4 mm on loading (Figure 1A to 1B) compared to 1.1 mm of widening in the fractures distal to the PB insertion (Figure 1C to 1D). This difference was significant (p = 0.02). Intraobserver reliability for all radiographic measurements showed substantial agreement.

Conclusion: Avulsion fractures at the base of the fifth metatarsal have much better healing potential than the so-called Jones fracture. Poor vascularity has been cited as a cause for poor healing potential following Jones fractures. The principal findings of this study demonstrate that proximal fifth metatarsal fractures distal to the PB insertion are significantly more unstable than more proximal fractures. In our study, the PB exerts a deforming force on the proximal fragment of fractures distal to the PB footprint. This deforming force was less pronounced in fractures within the PB footprint. Our findings help support the notion that a mechanical component may contribute to the poor healing potential of Jones fractures secondary to deformation exerted by the PB tendon. This would help explain why screw fixation is often recommended to address Jones fractures. Further research is needed to evaluate the biomechanics of these fractures.