Angiology of the Plantar Plate: A Novel Technique for Imaging of the Plantar Plate Microvasculature
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Introduction/Purpose: Hammertoes, crossover toes, and claw toes are common deformities and can be a major source of pain and dysfunction. These deformities result from instability of the metatarsophalangeal (MTP) joint due to incompetence of the plantar plate and/or collateral ligaments. Non-operative management is the first line of treatment. When non-operative treatment is unsuccessful, surgical interventions have been described. Newer surgical techniques focus on performing anatomic repairs of plantar plates. The vasculature of the foot has been well studied, but the vascular supply of the plantar plate has not been described. This study presents a new technique for imaging the microvasculature of the lesser toe plantar plates through micro-computed tomography (micro-CT) in order to better understand tear pathology and the capacity of healing with plantar plate repairs.

Methods: The posterior tibial and dorsalis pedis arteries of a fresh frozen human cadaver foot were dissected and cannulated at the ankle for perfusion distally. After administration of an anticoagulant, each artery was perfused with Microfil® Silicone Rubber, a contrast agent. The compound was then allowed to cure, and the foot was fixed in formalin. The foot was sectioned through the metatarsal shafts for imaging, and imaging of the lesser toe MTP joints was performed using a Bruker Skyscan 1176 micro-CT scanner at 18 micron slices. Computerized reconstruction of the images was performed for three dimensional visualization of the vasculature.

Results: Post-perfusion imaging of the lesser toe MTP joints using micro-CT allows for visualization of the plantar plate microvasculature. Preliminary imaging suggests that micro-CT is a useful modality for analysis of the blood supply of the plantar plate.

Conclusion: Anatomic repair of the plantar plate has become a viable treatment option for MTP joint instability. One important question that remains to be answered is whether plantar plate tears have the capacity to heal. We present a novel technique for imaging of lesser toe plantar plate microvascularity using micro-CT. Preliminary results of post-perfusion imaging of the plantar plate are promising for developing a better understanding of its blood supply. Further definition of the plantar plate vascular supply will help clinicians understand the capacity for healing after repairs and may provide some insight to the biological causes plantar plate tears.

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Figure 1: Post-perfusion microCT of lesser toe MTP joint

Dorsal

Metatarsal

Proximal Phalanx

Plantar