Anatomical Structures at Risk and Joint Preparation Effectiveness in Percutaneous First Metatarsophalangeal Fusion with the Shannon Burr: A Cadaveric Study

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INTRODUCTION: This cadaveric study aims to evaluate the anatomical structures at risk and the amount of joint preparation achieved during percutaneous first metatarsophalangeal joint (1-MTPJ) preparation with a Shannon burr using a direct medial and dorsal-lateral approach.

METHODS:

Eleven fresh-frozen cadaver foot and ankle specimens underwent 1-MTPJ preparation with a Shannon burr under fluoroscopy. Following joint preparation, dissection was carried out to locate and evaluate critical soft tissue structures in the vicinity of the 1-MTPJ, including the extensor hallucis longus (EHL) tendon, medial dorsal cutaneous nerve (MDCN), and lateral dorsal digital artery (LDA). Measurements from the surgical site to these critical structures were recorded. Image analysis using ImageJ software was conducted to measure the joint surface area prepared on both the distal metatarsal and proximal phalanx articular surfaces.

RESULTS: Contact with the LDA and EHL occurred three times each out of the 11 procedures (27%) through the dorsallateral approach without macroscopic laceration. The MDCN was contacted three times (27%) via the medial approach without macroscopic laceration and transected once (9%). The average percentage of joint preparation for the distal first metatarsal was 71.8% (+/- 24.0%), and for the proximal first phalanx was 78.2% (+/- 19.8%). There was no statistically significant difference in joint preparation percentage between both surfaces (p = 0.507). The raw joint surface area prepared on the metatarsal and phalangeal surfaces was 215.24 mm³ and 187.98 mm³, respectively. DISCUSSION AND CONCLUSION:

This study emphasizes the importance of understanding local anatomy and maintaining surgical precision during percutaneous 1-MTPJ fusion using a Shannon burr. Additionally, this technique offers comparable joint surface preparation to other minimally invasive techniques, however, inferior joint preparation compared to open techniques. Future studies with larger in vivo sample sizes are warranted to further refine the percutaneous approach and enhance patient outcomes.







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