Safe Zone for the Plantar Portal: A Cadaveric Study
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Category: Arthroscopy
Keywords: safe zone, plantar nerve, plantar portal, tendoscopy

Introduction/Purpose: Open surgery of the sole of the foot requires an extensive amount of soft tissue to be dissected. In recent years, various types of endoscopic surgery for the sole of the foot have been reported, making it possible to dynamically evaluate and treat plantar lesions with a small skin incision and minimal dissection. However, there have also been reports of complications involving plantar nerve injury. A good knowledge of the plantar nerve anatomy is crucial for safe endoscopic surgery of the sole. We aimed to anatomically dissect the soles of cadaveric feet to investigate the safe zones for plantar portals.

Methods: We studied 36 feet of 24 cadavers. The soft tissue of the sole was dissected, and the relationships between the plantar nerve and flexor digitorum longus tendon, flexor hallucis longus tendon and peroneus longus tendon were studied. The plantar nerve course was digitally imaged and uploaded into Image J software to determine the nerve position. The back of the calcaneus, the medial side of the base of M (Metatarsal) 1, the medial side of the head of M1, the lateral side of the head of M5, and the proximal tip of M5 were plotted and defined as A, B, C, D, and E respectively on Image J. The nerve courses were plotted on AB, BE, and CD, and the percentage at which they were positioned on the line segment was calculated. Next, the bifurcation positions of each nerve were measured and plotted to the defined line segments.

Results: No major differences were noted in the course of the medial plantar nerve and lateral plantar nerve. The medial plantar nerve and lateral plantar nerve ran between B and E, at 32.4% ± 4% and 61.2%± 5.1% respectively from B. No plantar arteries were found to run between the medial plantar nerve and lateral plantar nerve on BE. Taking mean and standard deviation values into account, no neurovascular structure existed from 36.4% to 56.1% along a line between the medial aspect of the base of M1 to the proximal tip of M5. The flexor digitorum longus tendon and peroneus longus tendon passed through the deep layer of this region.

Conclusion: We believe this region to be a safe zone for creating plantar endoscopic portal. The plantar central portal can be created at the center of the sole. An approach from the plantar central portal to the flexor digitorum longus tendon, flexor hallucis longus tendon, and peroneus longus tendon with the plantar lateral portal, posteromedial portal, and toe portal allows for a greater range of vision and treatment options and may further advance endoscopic surgery of the sole.