Shortening of first metatarsalia after ReveL procedure depends on the osteotomy angle

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Category: Midfoot/Forefoot

Keywords: Hallux valgus, ReveL, Metatarsalgia

Introduction/Purpose: Recent studies have shown that Hallux valgus deformity can lead to transfermetatarsalgia due to an impairment and relative shortening of the first ray. During ReveL osteotomy the relative shortening of the MT I is not addressed. Furthermore, a posterior deviation of the osteotomy angle results in additional iatrogenic shortening of the MT I and might favor postoperative transfermetatarsalgia.

Methods: A 3-dimensional model of a foot was obtained from CT scans of a cadaveric foot. The MT I of the 3-dimensional model was then pivoted medially to simulate a severe hallux valgus deformity of an intermetatarsal angle (IMA) of 18° and an intermediate hallux valgus deformity of an IMA of 13°.

A ReveL operation was simulated to correct the IMA to 8° for the severe and the intermediate Hallux valgus. Therefore the osteotomy angle in the coronal plane (f=0) was chosen perpendicular to the axis of the second metatarsalia. Afterwards the length of MT I was measured. This procedure was repeated for an posterior altered osteotomy angle (f = 5°, 10°, 15° and 20°).

Results: The change in MT I length resulting from an osteotomy perpendicular to the axis of MT II was 0.6 mm for a severe hallux valgus (IMA correction from 18° to IMA 8°) and 0.3 mm for a moderate hallux valgus (IMA 13° to IMA 8°). A posterior deviation of the osteotomy angle led to additional shortening (max. 2.9 mm) with a total shortening of up to 3.5 mm (Figure 3). To avoid any shortening of MT I an osteotomy slightly pointing anterior (negative f) of 3.5° (IMA change of 10°) and 3° (IMA change of 5°) was found.

Conclusion: ReveL procedure led only to a maximum shortening of 3.5 mm for a posterior deviation of 20°. Considering recently described MT I length cut off values of 2-3 mm for avoiding transfermetatarsalgia the osteotomy should be performed within an anterior directed cut angle of 4° and a posterior directed cut angle of 10° for the correction of a severe hallux valgus. However, further studies are needed to investigate the clinical impact of our findings.

Foot & Ankle Orthopaedics, 2(3)
DOI: 10.1177/2473011417S000397
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