

A Midshaft Osteoplasty Corrects Hallux Valgus Oblique Plane Deformity with Rotation

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Introduction

- Frontal plane rotation of the first metatarsal (first metatarsal dorsiflexion, adduction, eversion-inversion) has been recognized as a contributing factor in hallux abducto-valgus (HAV) deformities for decades^{1, 2}.
- Nonetheless, the majority of surgical procedures primarily aim to correct only the transverse and sagittal plane deformities³.
- In the recent literature of Dayton, the importance of frontal plane rotation has been reestablished as a primary contributor of this deformity^{4, 5}. Current literature addresses rotational deformities with the Lapidus procedure, basal crescentic osteotomy, and single “through and through” inclination osteotomy.
- Of the single inclination osteotomy techniques described in the literature, the majority are performed in the proximal portion of the metatarsal⁶. The authors present a commonly performed midshaft osteoplasty (Ludloff/ Mau) that can be modified to provide the surgeon with a precise osteotomy angle required to correct the oblique plane deformity and rotation.

Technique

- Four sawbone models were used for this analysis. Hallux valgus deformities were created in each model with a transverse plane deformity (M1-M2 angle) of 16-24 degrees and a frontal plane deformity (rotation) of 8-17 degrees. Two sawbones were fixated in a metatarsus varus deformity and the other two in a metatarsus valgus deformity. Shown below is an example of one sawbone.
- Deformity parameters (angulation and rotation) were inserted into the Multiplier App and rotational orientation and vertical inclination of the osteotomy angles were calculated (Fig.2)
- Midshaft osteoplasties were performed by starting the saw blade perpendicular to the sawbone, then angulating the blade to the rotational orientation angle obtained from the Multiplier App calculation (Fig. 3). The blade was then oriented to the angle vertical inclination of the osteotomy (Fig. 4- Fig. 5. Osteotomies were fixated with Kirschner wires. Post-fixation photos were taken and deformity assessment and measurements were performed Fig. 6.
- All sawbone models were noted to have complete reduction of transverse plane deformity (M1-M2 angle) and frontal plane deformity (rotation), regardless of the initial internal/external rotation of the metatarsal. The mean M1-M2 angle was noted to be 11 degrees and the mean rotation was 3 degrees.

Figure 1:

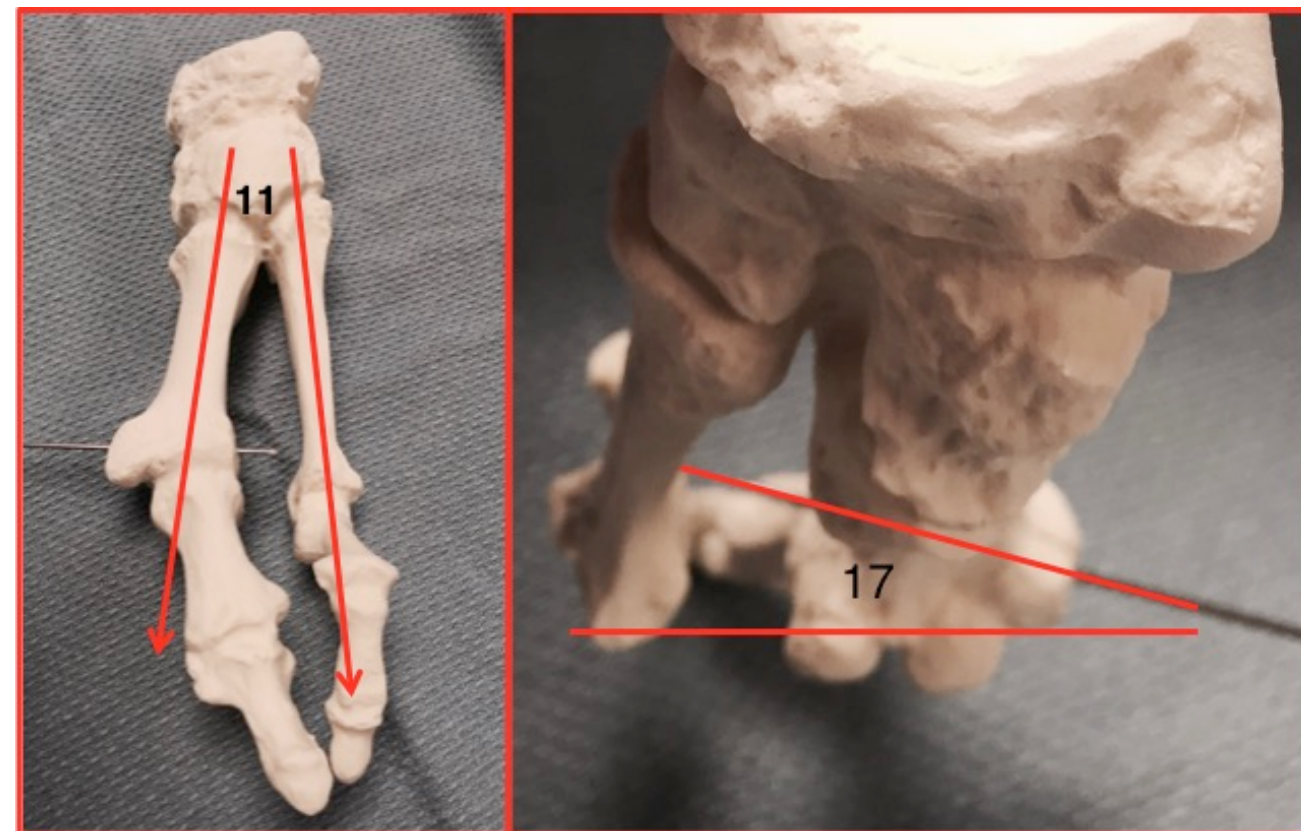


Figure 2:

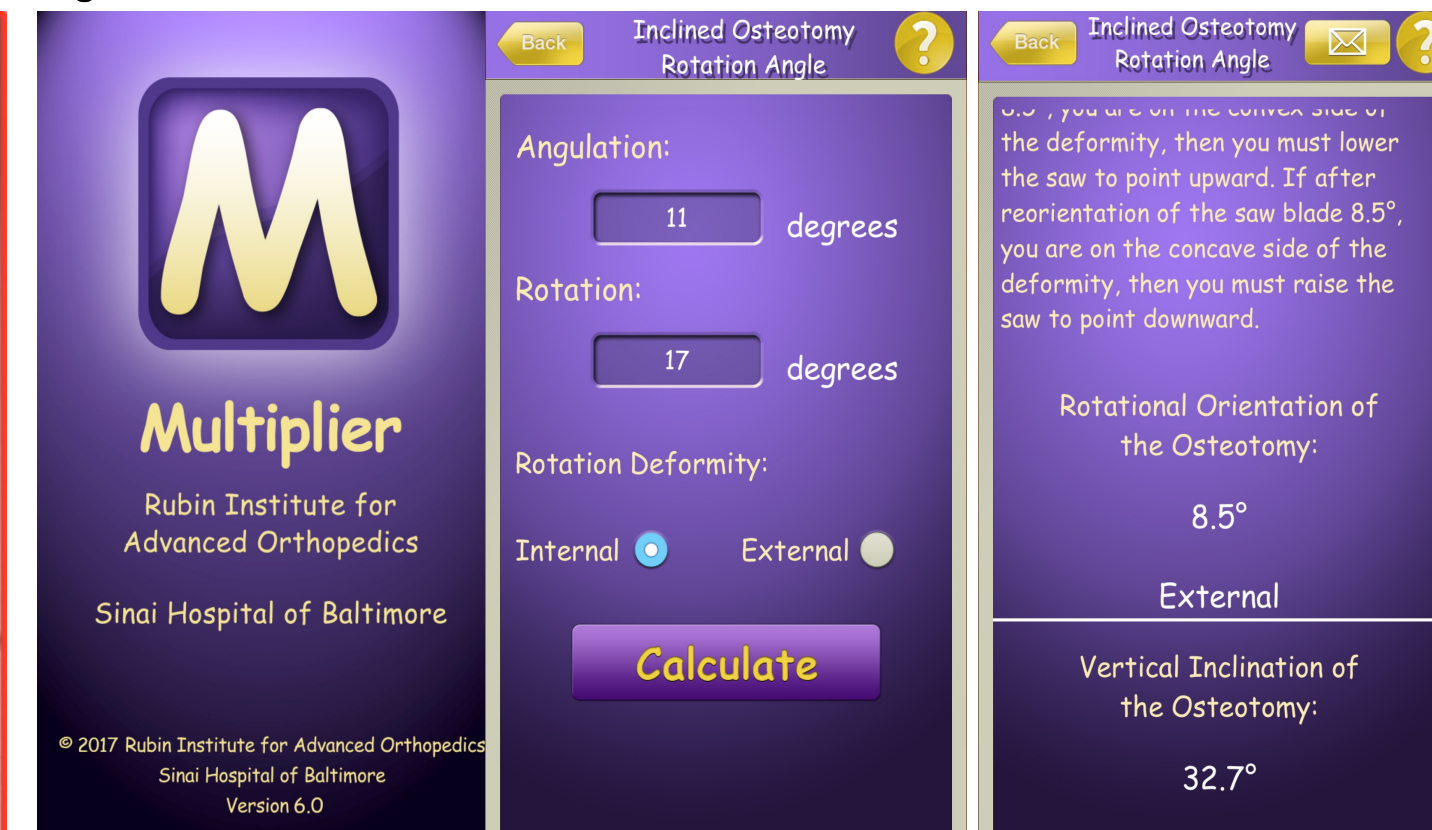


Figure 3:

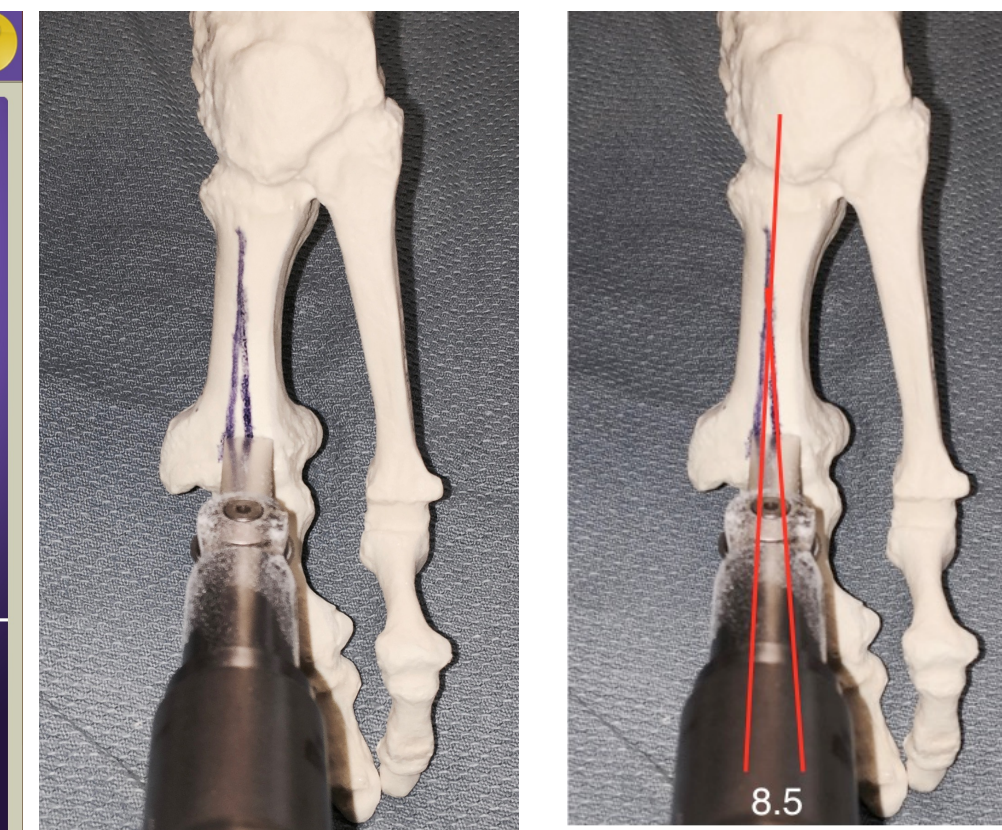


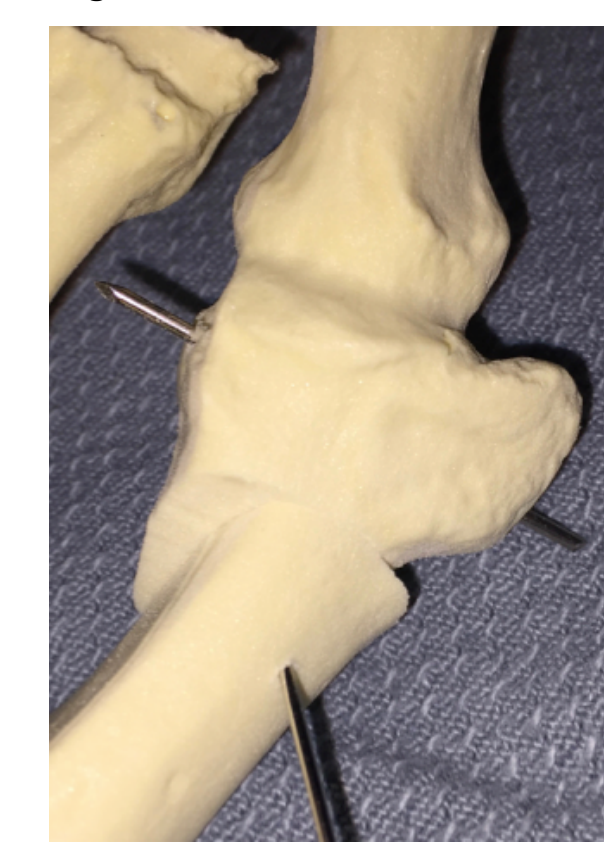
Figure 4:



Figure 5:



Figure 6:



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Discussion

- A single cut inclined osteotomy has been described and utilized in deformity correction of the tibia for decades⁷. The literature is limited in the foot and ankle, specifically the first metatarsal.
- Wagner et al⁶ described a proximal rotational metatarsal osteotomy (PROMO) procedure through the use of the Multiplier app in order to obtain specific angles. This procedure was performed in the proximal one third of the metatarsal bone
- We believe that in addition to the commonly performed Lapidus procedure, a through and through metatarsal osteotomy maintains the principle and importance of realigning the first MTPJ.
- Dayton⁵ and Didomenico⁸ both describe that the malalignment of the first metatarsal in the frontal plane is a key component of HAV deformity and must be addressed during correction to provide anatomic alignment of the first MTPJ.
- Rush⁹ also found that the windlass mechanism is most efficient when the first metatarsal, sesamoid apparatus, and hallux are properly aligned. By using trigonometry, or the Multiplier App, one can obtain specific angles in order to correct the triplanar hallux abductovalgus deformity without sacrificing the first metatarso-cuneiform joint.
- Although we have not yet performed this in patients, we believe that this surgical approach provides the surgeon with guidelines for choosing the angle at which the osteotomy is performed to meet the deformity correction.