Oblique Osteotomy for Crossover Toe Correction

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Statement of Purpose

The purpose of this study is to retrospectively evaluate the radiographic outcomes of an oblique distal lesser metatarsal osteotomy for the realignment of crossover toe.

Methodology and Hypothesis

A retrospective case series was conducted on all patients presenting with 2nd digit hammertoe deformities that were treated surgically with an oblique distal metatarsal osteotomy performed by a single surgeon between 2021 and 2023. A total of 11 patients were included. Radiographic analysis of pre-operative and post-operative imaging was done for each patient, comparing factors such as 2nd digit transverse and sagittal plane deviation as well as 2nd metatarsal protrusion distance as measured through the Hardy and Clapham method. Statistical analysis was done using a paired Student's T-test comparing pre- and post-operative data.

The proposed hypothesis is that the additional transverse plane correction offered by an oblique distal metatarsal osteotomy is effective at correcting medial or lateral deviation at the metatarsophalangeal joint in addition to sagittal plane hammertoe deformity.

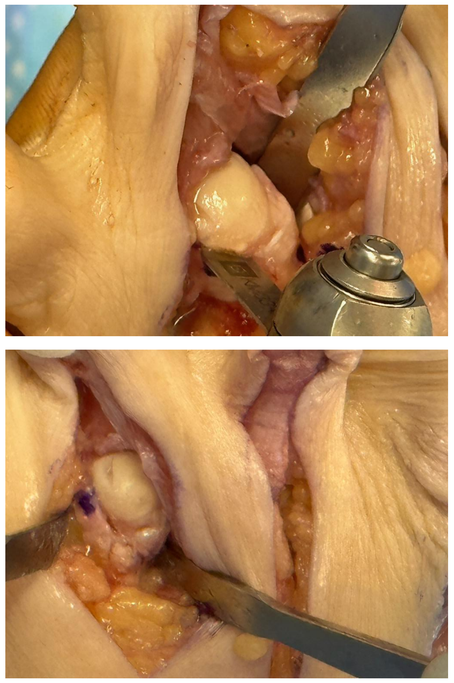

Fig 1. Example intra-operative photos from a similar case of the osteotomy cut technique. In this case, the osteotomy cut was made from distal-lateral to proximal-medial in order to rotate the digits laterally on the transverse plane. After the cut, the capital fragment is shifted proximally and medially.

Procedures

Surgical technique for the oblique osteotomy consists of placing the patient in a supine position. An incision was made over the dorsal aspect of the metatarsophalangeal joint of the affected digit. The extensor digitorum tendon was identified and retracted medially and any dorsal and lateral soft tissue attachments at the metatarsophalangeal joint were released with a #15 blade. A McGlamry elevator was then used to free up soft tissue attachments plantar to the metatarsal head. Next, a sagittal saw was used to make a cut proximal to the metatarsal head, either from distal medial to proximal lateral or distal lateral to proximal medial depending on the correction desired. The capital fragment was then translocated proximally and either medially or laterally across the osteotomy site. Two parallel K-wires were then placed across the osteotomy site for temporary fixation followed by a cannulated screw. Proper screw placement and adequate correction were verified via fluoroscopy.

Literature Review

Weil osteotomies, which are metatarsal head osteotomies involving a transverse plane cut parallel to the weightbearing surface of the foot, see widespread use in the treatment of metatarsalgia. A prospective analysis by Hofstaetter, et al in 2005 showed significant improvement in outcome measures following Weil osteotomies such as AOFAS scores as well as radiographic evaluation of MTP dislocations, degenerative changes, or non- or mal-union. However, they also reported incidences of complications such as floating or stiff toes as well as less than satisfactory range of motion.

Johansen, et al in 2018 also compared the Weil osteotomy to a minimally invasive distal metatarsal metaphyseal osteotomy that showed comparable outcomes in terms of post-operative stiffness, toe purchase, range of motion, and VAS with less operating time. Garg, et al in 2008 similarly compared the Weil osteotomy to a segmental metatarsal osteotomy, a modified version of the Weil that involves making two parallel cuts from dorsal distal to plantar proximal to allow greater shortening of the metatarsal. There was found to be significant improvement in post-operative AOFAS scores although there was a similar incidence of floating toe.

Klinge,et al in 2014 and Bevernage, et al in 2010 both described a modified translating Weil osteotomy that involved displacing the metatarsal head medially to correct medial deviation of the digit. Both papers found significant improvement in patient outcomes with relatively low incidence of complications that are commonly associated with traditional Weil osteotomies such as stiffness and floating toe. These modified translating Weil osteotomies are similar in principle to the oblique metatarsal osteotomy described in this study.

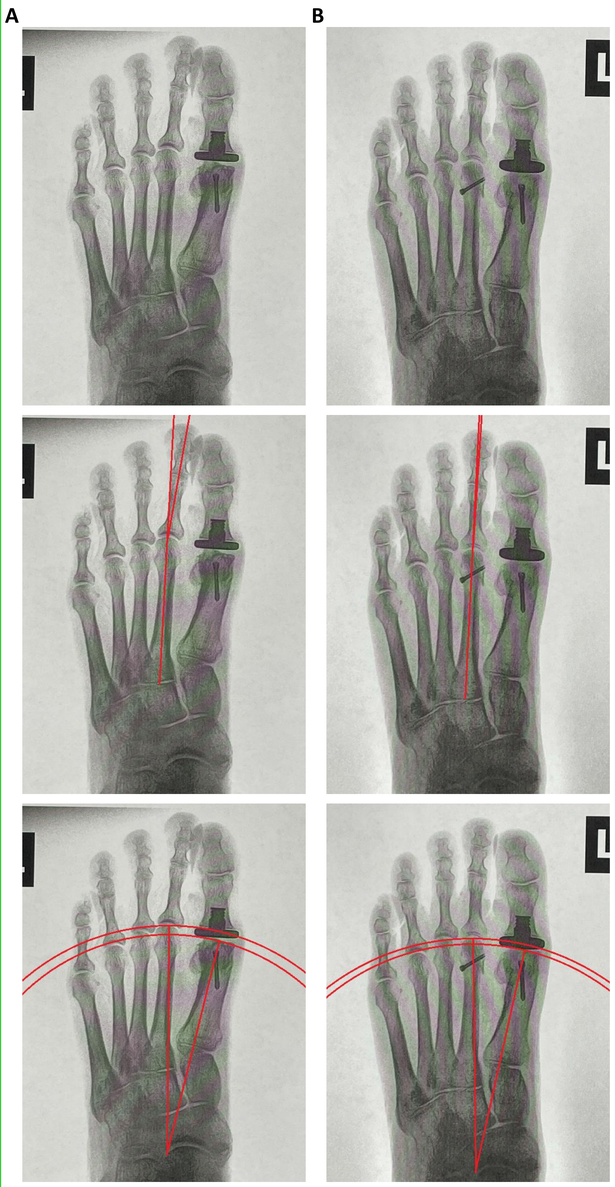

Fig 2. Example pre-operative (A) and post-operative (B) radiographs of an oblique metatarsal osteotomy on the 2nd toe. The 2nd metatarsal protrusion distance is improved from pre-op and transverse plane deviation of the 2nd digit is improved.

Results

Of the 11 patients, 2 were male and 9 were female with an average age of 59.7 years. Transverse and sagittal plane deviation were measured at an average of 14.64 and 27.10 degrees respectively pre-operative and 8.91 and 20.00 degrees post-operative. The average change in deviation was measured at -5.73 degrees for sagittal plane and -7.10 degrees for transverse plane with standard deviations of 7.13 and 11.57. P-values for both sagittal and transverse plane correction are significant at 0.012 and 0.042 respectively.

Results (cont'd)

Analysis and Discussion

Weil osteotomies have seen widespread use in correction of metatarsalgia and crossover toe. The osteotomy involves a cut along the metatarsal neck and shaft, parallel to the weightbearing surface of the foot which allows shortening of the metatarsal, which in turn relieves pressure that is causing subluxation at the metatarsophalangeal joint. We propose a modification of the Weil that involves both proximal and medial or lateral translocation of the capital fragment. This allows for greater transverse plane correction without losing sagittal plane correction, especially in the case of crossover toes.

This is achieved by altering the pull of the collateral ligamentous structures inherent to the MPJ complex. If the second toe is medially dislocated on the MPJ (a "crossover toe" deformity), then it can be theorized that the collaterals on the medial joint capsule will shorten and begin to tighten. Conversely, the opposing collaterals will lengthen, becoming loose and unstable.

By angling the osteotomy in a distal-lateral to proximal-medial orientation the capital fragment shifts medially, lengthening the medial capsular soft tissues. This also has the effect of tightening the opposing side soft tissues; in this case, the lateral side. This has the effect of pulling the second digit back into a more normal alignment upon the metatarsal head. In other words, the capital fragment is shifted in the direction the toe is deforming.

Though our current sample size is small, we have seen great results with this osteotomy, both radiographically and through patient satisfaction. In the future, we would recommend a continued evaluation of all patients undergoing this procedure, as well as correlation with patient satisfaction scores (AOFAS). Further investigation may help elucidate a particular cut angle or amount of translation for optimal outcomes.

References

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