

## Multicenter Early Radiographic Outcomes of Triplanar Modified Lapidus Arthrodesis with Immediate Weight-Bearing

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**Introduction/Purpose:** Hallux valgus is a complex positional deformity of the first ray. Traditional correction methods for hallux valgus prioritize correction in the transverse plane based on anteroposterior (AP) radiographs. However, only addressing the transverse plane component of hallux valgus is a potential factor resulting in poor outcomes and high long-term recurrence rates ranging from 8%-78%. Recent evidence suggests that hallux valgus is a multi-planar deformity with significant contributions from the sagittal and frontal planes. The triplanar tarsometatarsal arthrodesis (modified Lapidus, Figure 1) uses a multi-planar approach to evaluate and correct the deformity associated with hallux valgus in all three anatomical planes. The purpose of this study is to investigate early radiographic outcomes and complications of triplanar tarsometatarsal (TMT) arthrodesis with immediate weight-bearing.

**Methods:** After receiving IRB approval, radiographs and charts were retrospectively reviewed for 101 patients (age  $41.9 \pm 17.9$  years) undergoing triplanar tarsometatarsal arthrodesis (modified Lapidus) for hallux valgus deformity correction at four institutions between June 2016 and June 2017. Patients were allowed immediate weight-bearing as tolerated after the procedure. Radiographic imaging at 4 months and 12 months was reviewed and compared to pre-operative imaging. Radiographic measures included hallux valgus angle (HVA), intermetatarsal angle (IMA), tibial sesamoid position (TSP), metatarsus adductus angle, evidence of metatarsal pronation, and radiographic first TMT union. Demographics included age, gender, body mass index, medical comorbidities, and smoking status. Time (days) to weight-bearing, wearing athletic shoes, and return to full activity were also noted. Any complications were recorded. For statistical analysis, t-tests were performed for continuous variables and chi-square tests were performed for categorical variables using JMP 11.0.0 (SAS Institute Inc., Cary, NC).

**Results:** Radiographic results demonstrated significant improvements in IMA, HVA, and TSP at final follow-up. IMA was  $5.9 \pm 3.2$  degrees at final follow-up compared to  $15.0 \pm 3.1$  degrees pre-operatively ( $p < 0.001$ ). At final follow-up, HVA was  $8.3 \pm 5.5$  degrees compared to  $23.7 \pm 10.1$  degrees pre-operatively ( $p < 0.001$ ). TSP was also significantly improved at final follow-up ( $2.0 \pm 0.9$ ) compared to pre-operatively ( $5.1 \pm 1.2$ ;  $p < 0.001$ ). Lateral round sign was present in 5 patients (4.9%) at final follow-up compared to 88 patients (87.1%) prior to corrective surgery. Four patients (4.0%) demonstrated evidence of radiographic non-union at final follow-up. Regarding complications, there were four cases (3.9%) of hardware removal for either soft-tissue irritation or hardware failure.

**Conclusion:** In this study, early radiographic outcomes of triplanar tarsometatarsal arthrodesis (modified Lapidus) with immediate weight-bearing were promising with low complication rates. These results demonstrate that this procedure is able to reliably achieve anatomic correction in all three planes for hallux valgus deformity. The triplanar tarsometatarsal arthrodesis technique also demonstrated high union rates and low recurrence rates at final follow-up. Longer follow-up is necessary to determine the long-term survivorship, outcomes, and complications of this new technique to correct hallux valgus deformity.



**Figure 1.** Post-operative radiographs demonstrating the triplanar first tarsometatarsal (TMT) corrective arthrodesis technique with biplanar mini-plate construct at 90° angles to each other.