Distal Chevron Osteotomy Increases Anatomic Intermetatarsal Angle in Hallux Valgus

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Introduction/Purpose: Loss of correction in hallux valgus (HV) deformity following distal chevron metatarsal osteotomy (DCO) has been demonstrated in short-term follow-up with HV recurrence rates of up to 75% reported in the long-term. The purpose of this study was to evaluate the radiographic effect of the DCO on the anatomic and mechanical axes of the first metatarsal. Our hypothesis was that patients undergoing DCO would have improvement in the mechanical metatarsal axis but worsening of the anatomic axis.

Methods: This was a retrospective single surgeon case series of all patients who underwent DCO for HV between 2017 and 2019. Patients were included if they had both preoperative and postoperative weightbearing foot radiographs. The primary outcomes were the change in anatomic first-second intermetatarsal angle (a1-2IMA, defined by the metatarsal diaphyseal axis) and the change in mechanical first-second intermetatarsal angle (m1-2IMA, defined by the axis from the center of the metatarsal head to the metatarsal base). Secondary outcomes included the change in hallux valgus angle (HVA) and medial sesamoid position (medial sesamoid in relation to the mechanical axis of the metatarsal). Change in second-third intermetatarsal angle (2-3IMA, defined by the metatarsal diaphyseal axis) was measured to control for any inconsistencies in radiographic technique. Given the relatively small patient cohort, the non-parametric Wilcoxon signed rank test and Mann Whitney U test were used for statistical analysis.

Results: 41 feet were included for analysis with a mean follow-up of 20.4 weeks. The a1-2IMA increased significantly (mean, 4.0 degrees, p<0.001) while the m1-2IMA decreased significantly (mean, 4.6 degrees, p<0.001) following DCO. There was a significant improvement in HVA (mean, 13.2 degrees, p<0.001). No changes were noted in 2-3IMA (mean, 0.0 degrees, p=0.834). (Table 1) Medial sesamoid position was improved in 22 feet (53.7%). Patients with improved sesamoid position were noted to have a significantly larger decrease in m1-2IMA (mean, 5.3 versus 3.8 degrees, p=0.01) and a smaller increase in a1-2IMA (mean, 3.4 versus 4.7 degrees, p=0.02) compared to patients with no improvement in sesamoid position.

Conclusion: Distal chevron osteotomy for HV is associated with an increase in the anatomic intermetatarsal angle despite improvements in the m1-2IMA, HVA and medial sesamoid position. Patients with improved sesamoid position were associated with greater correction of the mechanical first metatarsal axis. Our findings may suggest the presence of intermetatarsal instability, which could limit the power of DCO in HV correction for more severe deformities and provide a mechanism for HV recurrence.

Table 1. Radiographic Changes Following Distal Chevron Osteotomy

|                      | Preop (Mean ± SD) | Postop (Mean ± SD) | Change | p-value |
|----------------------|-------------------|--------------------|--------|---------|
| Anatomic 1-2 IMA (deg) | 11.1 ± 2.1        | 15.1 ± 2.6        | 4.0    | <0.001  |
| Mechanical 1-2 IMA (deg) | 11.1 ± 2.1      | 6.5 ± 2.0         | -4.6   | <0.001  |
| 2-3 IMA (deg) | 1.6 ± 1.4         | 1.6 ± 1.5         | 0.0    | 0.834   |
| Hallux Valgus Angle (deg) | 21.6 ± 7.0     | 8.4 ± 3.8         | -13.2  | <0.001  |
| Medial Sesamoid Position* |                   |                    |        |         |
| Grade 1 | 6                  | 26                 |        |         |
| Grade 2 | 33                 | 15                 |        |         |
| Grade 3 | 2                  | 0                  |        |         |

*Based on grade scale in Kusano et al. (Foot Ankle Int 2002)

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