

## A Comparison of First Ray Length and Dorsiflexion after Arthrodesis, Osteotomy and Suture Button Procedures for Hallux Valgus Deformity

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**Introduction/Purpose:** Shortening and dorsiflexion of the first metatarsal are a known side effect of metatarsal osteotomies for hallux valgus (HV) deformity with the potential to cause transfer metatarsalgia. We compared the effect of the first tarsometatarsal joint arthrodesis (Lapidus), proximal lateral closing wedge osteotomy (PLCWO), and intermetatarsal suture button fixation procedures on the length and dorsiflexion of the first ray.

**Methods:** We retrospectively evaluated 123 feet in 115 patients. The average age was 54. There were 106 females. Eighty-four feet had a Lapidus procedure, 14 had a PLCWO, and 24 had intermetatarsal suture button fixation. Digital radiographic measurements were made for pre- and postoperative hallux valgus angle (HVA) and intermetatarsal angle (IMA), absolute and relative shortening of the first ray, and dorsiflexion.

**Results:** Preoperative HVA and IMA did not differ between treatment groups ( $p > 0.05$  for each). Similar corrections of HVA (30.1 to 12.3 degrees) and IMA (14.7 to 7.0 degrees) were achieved in all three groups ( $p > 0.05$ ). There were significant differences in absolute first-cuneiform-metatarsal length (FCML) between Lapidus (-1.5mm), PLCWO (-2.5mm), and intermetatarsal suture button fixation (+1.1mm) ( $p < 0.05$ ). There were also significant differences in relative 1st metatarsal shortening between Lapidus (0.32mm relative lengthening), PLCWO (1.05mm relative shortening), and intermetatarsal suture button fixation (1.24mm lengthening) ( $p < 0.05$ ). Average dorsiflexion differed between the Lapidus (1.95 degrees) and PLCWO groups (0.49 degrees) ( $p < 0.05$ ).

**Conclusion:** The use of the intermetatarsal suture button fixation relatively lengthens the first ray, whereas the Lapidus and PLCWO shorten it. Dorsiflexion may be higher with Lapidus and osteotomy procedures. These findings may be helpful to explain postoperative symptoms of metatarsalgia and for the surgeon's selection of the appropriate surgical technique for preoperative planning.

**Table 1.** Changes in parameters between pre-operative and post-operative radiographs with different interventions.

Parameter	Lapidus	PCO	Suture Button Fixation
Change in intermetatarsal angle (degrees)	+8.5	+5.7	+6.3
Change in hallux valgus (degrees)	+19.0	+16.1	+14.8
Change in absolute FMCL (mm)	-1.5*†	-2.5*	+1.097*†
Change in relative first metatarsal length (mm)	+0.32*†	-1.05*†	+1.24*†

FMCL = First-metatarsal-cuneiform length. PCO = Proximal closing wedge osteotomy

\* Statistically significant difference between groups with ANOVA.

† Statistically significant difference between group on Tukey post-hoc testing.