Incidence of diastasis between the 1st and 2nd metatarsal following Lapidus arthrodesis with or without intermetatarsal-cuneiform fixation for treatment of Hallux Valgus

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Statement of Purpose
An incidental finding by the senior author (SB) of newly acquired 1st-2nd metatarsal diastasis after Lapidus arthrodesis was noted after final新政itive procedures. The study aimed to find the incidence of diastasis between the 1st and 2nd metatarsals after Lapidus arthrodesis with or without intermetatarsal-cuneiform fixation and whether the method of fixation implemented affected the incidence.

Literature Review
The Lapidus arthrodesis is a time tested procedure for moderate to severe hallux valgus, especially in patients with hypermobility. Many different fixation approaches have previously been described in literature, including the use of intermetatarsal fixation (1). In a cadaveric study, Rolen et al (2) found that intercuneiform fixation with the Lapidus arthrodesis had superior restriction of first ray motion. Cozzeel et al (3) noted that the use of intermetatarsal fixation decreased the chance of recurrence of hallux valgus.

Many ligaments comprise the tarsometatarsal joint, most notably the Lisfranc ligament. The Lisfranc ligament extends from the lateral surface of the medial cuneiform to the medial surface of the second metatarsal base. It primarily functions to aid in stabilization of the tarsometatarsal joint (4). The Lisfranc arthrodesis modifies the function of the first ray by fusing the articulation between the 1st metatarsal and medial cuneiform and adding stability to the medial column by reducing the 1-2 intermetatarsal angle and increasing the efficiency of the peroneus longus tendon (5). This, in turn, increases the functional lever arm of the medial cuneiform as it essentially triads in length by adding the first metatarsal.

We suspect that this would increase the biomechanical stresses placed on the Lisfranc ligament and adjacent planter and dorsal ligaments. Fleming et al (6) postulated that intercuneiform instability occurred primarily from attenuation of the intercuneiform ligaments due to longstanding adduction of the first metatarsal in hallux valgus. We suggest that the 1st-2nd intermetatarsal diastasis could potentially be attributable to disruption of an attenuated Lisfranc ligament due to the increased biomechanical stresses following the Lapidus arthrodesis.

Methodology
A retrospective analysis was performed on 101 consecutive patients receiving a Lapidus arthrodesis for correction of hallux valgus from two different surgeons (SB, JB) over a five year period who met inclusion criteria. Eighty-two patients did not have intermetatarsal-cuneiform fixation and nineteen did. Radiographs were reviewed at least ten months post-operatively. An AP foot radiograph was used to measure the distance between the lateral aspect of the medial cuneiform and the lateral aspect of the base of the 2nd metatarsal. A width of >2mm was considered to be definitive for diastasis. Pre-operative and immediate post-operative radiographs were reviewed to rule out any pre-existing or iatrogenic diastasis, respectively. Patients who had a follow-up of less than ten months, pre-existing or immediate postoperative diastasis, concomitant first ray procedures, or revisional procedures were excluded.

Results
15 patients (14.9%) had >2mm 1st-2nd intermetatarsal diastasis on plain film radiographs in the group without intermetatarsal-cuneiform fixation. One patient (0.05%) had diastasis in the group with intermetatarsal-cuneiform fixation. The overall incidence of diastasis of both groups was 15.8%. The average amount of diastasis was 2.99 ±0.8mm. Follow-up ranged from 10 months to 37 months.

Discussion
To our knowledge, there have been no previous studies analyzing the incidence of 1st-2nd intermetatarsal diastasis following a Lapidus arthrodesis. Our results showed that the overall incidence of diastasis was 15.8%, which was higher than we had anticipated. We found that there was a significantly higher incidence of diastasis in patients without intermetatarsal-cuneiform fixation. Also of note, we found that there was a significantly higher percentage of diastasis in patients fixed with a plate and screw construct versus a screw only construct.

As a retrospective study, our research was designed to strictly depict and analyze radiographic parameters. Patient subjective findings such as pain and instability were not assessed in our study necessitating further research in order to endorse one fixation method over the other; as patients with diastasis may have been asymptomatic.

We acknowledge our limitations. All AP radiographs must be taken at the correct neutral angle as to not provide a false diastasis measurement. This could be improved upon by ensuring excellent technique or with use of computed tomography (CT) for more precise measurements. Another potential variable that could have affected results was the different postoperative protocols of the two surgeons as one surgeon advocated earlier weightbearing.

In conclusion, our study found that in our population we had a diastasis incidence of 15.8% with a much lower occurrence when fixated with intermetatarsal-cuneiform fixation. We hope the results of this study can lay a foundation for future studies assessing the effect, if any, of 1st-2nd intermetatarsal diastasis when treating moderate to severe hallux valgus when utilizing the Lapidus arthrodesis.

References