Retrospective Analysis of Non-Union Rate Associated with Immediate Weight-bearing Following A Modified Lapidus Arthrodesis

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Disclosures

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  - Consultant
    - In2bones
    - Stryker
    - Integra
    - Depuy/Synthes
    - Smith & Nephew
    - KCI
    - Zimmer/Biomet

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  - No disclosures
Purpose

To evaluate the non-union rate in patients who are immediately weight-bearing in a controlled ankle motion (CAM) boot following a modified Lapidus procedure.
Methodology/Hypothesis

We propose there is NO significant difference in non-union rate between patients who immediately weight bear in a CAM and the literature reports of patients who undergo the traditional 6-8 weeks of non-weightbearing following a modified Lapidus procedure fixated with a “three screw” technique (solid cortical screws) or a single cortical screw and a medial based locking plate.
Procedures

- **Level of Evidence:** IV

- **Study Design:** Random, Retrospective Chart Review
  - 376 patients-74 meeting inclusion criteria, 4 bilateral cases

- **Procedure:**
  - Via a standard, dorsomedial approach, a modified Lapidus arthrodesis was performed with a 3 screw construct or a single cortical screw and a medial based locking plate. The only dissection was performed at the TMT-1 leaving the MTP intact.

- **Inclusion Criteria:**
  - Lapidus arthrodesis with 3 screw construct or interfrag screw and locking plate
  - Isolated Lapidus procedure with no other reported bone work (all work was performed only at the TMT-1)
  - Immediate weightbearing in CAM boot post-operatively
  - Complete chart with radiographs

- **Outcomes:**
  - Radiographic analysis for non-union between the initial post-operative visit and the final visit
Surgical techniques for correction of hallux abductovalgus (HAV) deformity are numerous. Distal, mid-shaft, proximal & Lapidus procedures are typically employed depending on the deformity. Arthrodesis of the first metatarsocuneiform joint has become a commonly performed procedure for patients with ligamentous laxity, hypermobility, severe HAV, arthritis, and recurrent HAV deformity. The procedure was first described by Albrecht et al. (1) in 1911 and later popularized by Lapidus (2) in 1934. A 6-8 week non-weightbearing period post modified lapidus arthrodesis has traditionally been universally accepted. (1,3-4). Numerous fixation options have emerged since the inception of this osteotomy originally fixated with suture including screws, plates, k-wire, external fixation and staples (5-6). Some authors have reported nonunion rates 5-33% after modified lapidus with 6-8 weeks of non-weightbearing(3,7). There are only a few reports in the literature that discuss immediate weightbearing after the modified lapidus procedure(5-6,8). In this retrospective review, we examine the nonunion rate among patients undergoing the modified Lapidus arthrodesis who received 3-screw fixation. It is our hypothesis that the two groups will have similar rates of nonunion and that the nonunion rates for both groups will be comparable to the traditional post-operative protocol nonunion rate.
Fixation Constructs
Fixation Constructs
## Results

### Table 1: Patient Demographics

<table>
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<tr>
<th>Average age</th>
<th>50.2</th>
<th>BMI &lt; 29</th>
<th>55</th>
<th>BMI &gt; 30</th>
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<td>F</td>
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<td>F</td>
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<td>Nicotine</td>
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<td>DM</td>
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<td>Autogenous graft</td>
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### Table 2: Union Analysis

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<td>49</td>
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<tr>
<td>Sex</td>
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<td>F</td>
<td>F</td>
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<tr>
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<td>&lt; 29</td>
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<tr>
<td>DM</td>
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<td>3 screw</td>
<td>Interfragment screw and plate</td>
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<tr>
<td>Autograft</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
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</tbody>
</table>

Non-union rate: 3.8%
Discussion

- Bone to Bone Contact
- Fixation
- De-rotation
  - Stress to an area is calculated by dividing force by area (\(\sigma = \frac{F}{A}\)). Having the metatarsal de-rotated provides a larger area therefore dividing the force by larger number resulting in decreased stress to the area.

Inversely, the load the construct can withstand is calculated by multiplying stress and area (\(F = \sigma A\)). The larger the area the more force the construct can withstand.

Inferior 1st Met. (lateral flare) when de-rotated provides more bone - bone contact
Discussion

In this retrospective review, we attempted to determine if our weight-bearing protocol would have a deleterious effect on union rates. As fixation constructs improve and become stronger, we feel that earlier weight bearing should be attempted. In a recent study, Blitz, DiDomenico et al reported on 80 feet in 76 patients with early weight bearing after modified Lapidus arthrodesis. All patients underwent a modified first TMT arthrodesis using variations of the crossed screw technique involved placing 2 to 3 fully threaded screws across the fusion site. Patients began protected weight bearing at a mean 14.8 days postoperative. They had a 100% union rate. Mean time to union was 44.5 days. No hardware failure occurred and no surgical revisions were performed. They concluded early weight bearing did not compromise union rate or correction(5).

Sorensen et al reported on 21 patients who underwent modified Lapidus arthrodesis with locking plate fixation. 19/21 patients had concomitant application of an interfragmentary screw. 2/21 underwent gastrocnemius recession. 2/21 had the addition of bone marrow aspirate to the fusion site. 3/21 had external bone stimulation postoperatively. 2/21 patients had allograft matrix. Patients were weight bearing at 2 weeks post-op. Average time to radiographic union was 6.95 weeks. There was a 9.52% rate of asymptomatic malunion and 0% rate of delayed union or nonunion. There were no revisions necessary(9).

Basile et al presented a study involving immediate weightbearing following modified Lapidus procedure. A total of 41 patients were included in this comparative cohort study. Patients were placed in two groups. Group one had 24 patients, who underwent modified Lapidus arthrodesis with 2 screws and an additional “neutralization” Kirschner-wire with immediate partial weight-bearing in a removable boot. Group two was the control group that had 17 patients who underwent fixation without the Kirschner-wire and was non-weight bearing for 6 weeks in a short leg cast. Basile concluded that the use of a temporary Kirschner-wire as a third point of fixation may enable immediate protected weight bearing by minimizing load placed on the crossed lag screw construct (10). The results of this study found a 3.8% nonunion rate. Based on these results we conclude that a modified Lapidus procedure using a 3 screw construct or interfrag screw and plate and allowing weightbearing only in a protective CAM boot we may permit patients to ambulate safely in the immediate post-operative period without affecting surgical outcome.
References