Early Weight bearing Following Arthrodesis of the First Metatarsal-Medial Cuneiform Joint: A Systematic Review

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Statement of Purpose and Literature Review

Arthrodesis of the first metatarsal-medial cuneiform articulation (i.e. the Lisfranc joint) is a reliable and powerful surgery for correction of the hallux abductovarus deformity [1]. However, one potential relative contraindication to the procedure is the extended period of non-weight bearing immobilization typically associated with the post-operative course. As consolidation of the arthrodesis site is required for successful outcome, a 6-8 week period of non-weight bearing cast immobilization is often prescribed [2-4]. Not all patients are able to tolerate this recommendation, in addition to the known potential complications associated with prolonged immobilization (muscular atrophy, thrombotic event, etc.) [5,6].

Secondary to these considerations, several authors have recently proposed early or immediate weight bearing with the procedure. However, these have typically consisted of Level 4 retrospective case series’ with varying fixation constructs and numbers of participants. The objective of this investigation was to perform a systematic review of the incidence of non-union following early weight bearing in patients undergoing arthrodesis of the first metatarsal-medial cuneiform articulation for the correction of the hallux abductovarus deformity.

Methods

We performed a systematic review of medical literature including Pubmed and Ovid through Medline®, Embase, and the Cochrane Database of Systematic Reviews. Additionally, we performed a manual search of the references of any article we identified as meeting our inclusion criteria. The search was performed 07-2016 with no restriction on publication date with the word query: (“arthrodesis” OR “fusion”) AND (“first metatarsal-medial cuneiform” OR “Lisfranc” OR “tarsal-metatarsal” OR “hallux ray” OR “hallux abductovarus” OR “HAV”). The abstracts returned from these searches were initially individually reviewed by a single author (AJM) for potential relevance. Each potentially relevant report was then reviewed by two authors (AC and JCV) for our specific inclusion/exclusion criteria. Complete agreement between reviewers was necessary for final inclusion, with the corresponding author (AJM) consulted for final advice.

Inclusion criteria consisted of retrospective case series’, retrospective clinical cohort analyses, and prospective clinical trials with n ≥ 15 participants, a follow-up period of 2 years or greater, a defined post-operative early weight bearing protocol (defined as ≤ 2 weeks), a clear description of the fixation construct, and a reported incidence rate of non-union. Only full text reports were considered, and studies not published in the English language were excluded.

Table 1: Overview of Included studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year of Publication</th>
<th>Fixation Construct</th>
<th>Post-operative Weightbearing Protocol</th>
<th>Rate of Non-Union</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sangermano et al. 1996</td>
<td>N=80 arthrodeses</td>
<td>Screw fixation</td>
<td>No weight bearing for 6 weeks</td>
<td>N=2 (2.5%)</td>
</tr>
<tr>
<td>Fisher et al. 2001</td>
<td>N=70 arthrodeses</td>
<td>Screw fixation</td>
<td>Immediate weight bearing in a short walking boot</td>
<td>N=2 (2.9%)</td>
</tr>
<tr>
<td>Klos et al. 2002</td>
<td>N=88 arthrodeses</td>
<td>Screw fixation</td>
<td>No weight bearing for 6 weeks</td>
<td>N=1 (1.1%)</td>
</tr>
<tr>
<td>Cotlar et al. 2003</td>
<td>N=88 arthrodeses</td>
<td>Screw fixation</td>
<td>Immediate weight bearing in a CAM walker</td>
<td>N=1 (1.1%)</td>
</tr>
<tr>
<td>Kazi et al. 2004</td>
<td>N=114 arthrodeses</td>
<td>Screw fixation</td>
<td>No weight bearing for 6 weeks</td>
<td>N=1 (0.9%)</td>
</tr>
<tr>
<td>King et al. 2008</td>
<td>N=98 arthrodeses</td>
<td>Screw fixation</td>
<td>No weight bearing for 6 weeks</td>
<td>N=1 (1.0%)</td>
</tr>
<tr>
<td>Gutteck et al. 2016</td>
<td>N=55 arthrodeses</td>
<td>Ankle plate</td>
<td>No weight bearing for 4 weeks</td>
<td>N=1 (1.9%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>N=254 arthrodeses</td>
<td>Screw fixation</td>
<td>No weight bearing for 6 weeks</td>
<td>N=8 (3.1%)</td>
</tr>
</tbody>
</table>

Discussion

The objective of this systematic review was to evaluate the incidence of non-union in patients undergoing arthrodesis of the first metatarsal-medial cuneiform articulation with implementation of an early weight bearing protocol. We observed an incidence rate of non-union of 3.61% (16/443), and would conclude that this is an acceptable rate when considering this procedure. This indicates that arthrodesis of the first metatarsal-medial cuneiform articulation likely does not always require an extended period of post-operative non-weight bearing immobilization. It is our hope that this investigation has added to the body of knowledge with respect to arthrodesis of the first metatarsal-cuneiform articulation, leads to further investigations on the topic, provides foot and ankle surgeons with an objective measure of the perioperative risk associated with the procedure, and allows foot and ankle surgeons to more effectively communicate these risks to their patients during the education process.

Results

The searches for potentially relevant articles yielded 47 unique studies. We then obtained and reviewed each of these for our specific inclusion/exclusion criteria, and this resulted in the final inclusion of 8 published reports [7-14]. Six of the included studies were retrospective cohort analyses [7, 9-12, 14], one was a prospective comparative cohort analysis [13], and one was a prospective and randomized clinical trial [8]. In total these 8 studies included analysis of 443 arthrodeses, and of these, 16 (3.61%: 16/443) were described as being a non-union.

Four of these studies (n=254 arthrodeses) involved fixation with at least two compression screws [7-9, 12, 13]. Of these studies, 16 non-unions were identified, and of these, 15 were described as requiring removal of the internal fixation device with or without an external compression screw [7, 12]. The fourth study (n=143 arthrodeses) allowed immediate weight bearing in a surgical shoe, short cast boot or cast [7, 9, 11, 13], while the remaining (n=300 arthrodeses) allowed for weight bearing within two weeks [7, 9, 10, 12, 14].

References


We conclude that, after careful analysis of the available literature, early weight bearing following arthrodesis of the first metatarsal-medial cuneiform joint articulation is safe and effective, with a non-union rate of 3.61% when compared to other published reports.