Comparison of Bicortical vs. Uncortical Medial Malleolus fixation

Ryan Lerch, DPM Jeffrey Manway, DPM1 Gele Moloney, MD1
Department of Orthopedic Surgery, UMPC

Statement of Purpose
We sought to compare bicortical fully threaded 3.5mm screw fixation to unicortical partially threaded 4.0mm fixation in medial malleolar fractures. Our aims were to compare post operative complications such as screw failure/loosening, nonunion, delayed union, painful hardware, time to union, and time to full weightbearing. Demographic data and comorbidities were recorded and analyzed to see if certain populations would perform better with bicortical fixation.

Methodology
The two primary surgeons listed on this study work at level 1 trauma centers in Pittsburgh, PA. 292 patients were retrospectively reviewed and 126 were included following inclusion and exclusion criteria. Inclusion criteria was 18 years and older treated with open reduction and internal fixation of medial malleoli from 2012-2020 with unicortical or bicortical screw fixation. Exclusions included: open fractures and charcot neuroarthropathy. We recorded post operative complications, demographic data and comorbidities. Statistics were calculated using chi-square for binary variable, two sample t-test for continuous variables that were symmetric, and Wilcoxon rank-sum test for continuous variables with a skewed distribution.

Hypothesis
We hypothesize patients treated with bicortical screw fixation will present with significantly less postoperative complications while achieving similar time to union and time to full weight bearing compared to those treated with unicortical fixation.

Literature Review
Ankle fractures continue to increase in incidence and severity among an older more challenging geriatric population. The medial malleolus is commonly fixated with two 4.0mm partially threaded cancellous screws (1). When medial malleolar fractures fail it has been shown to be due to pullout strength (1.2). Increasing pullout strength includes decreasing screw pitch, increasing major diameter and length of screw (1.3). Thompson et al in 1997 found that increased length of threaded screws and noncannulated screws correlated with increased pullout force (2). Pollard et al found the pullout strength to be significantly higher in the bicortical fully threaded screws (116.2N vs. 327.6N) (4).

Our data included 87 females and 39 males with an average combined age of 66 ±18.0. There was 48 in the bicortical group and 78 in the unicortical group. Total complications for bicortical screw fixation was 3 patients (6%) and unicortical was 6 (8%), which was not significant. No significant difference was noted for gender, age, neuropathy, obesity, PVD/PAD, CAD, or MI. There was a significantly higher number of diabetics treated with unicortical fixation. No significant difference was noted for weeks to ambulation or time to union with bicortical being 8.4 ±3.2 and 7.7 weeks and unicortical being 8.9 ±3.5 and 8.1 weeks, respectively.

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Hypothesis

<table>
<thead>
<tr>
<th>All (n=126)</th>
<th>Bicortical (n=48)</th>
<th>Uncortical (n=78)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complications</td>
<td>9 (7%)</td>
<td>3 (6%)</td>
<td>0 (8%)</td>
</tr>
<tr>
<td>Weeks till ambulation</td>
<td>8.7±3.4</td>
<td>8.4±3.2</td>
<td>8.9±3.5</td>
</tr>
<tr>
<td>Time till Union</td>
<td>8.0 (3.0)</td>
<td>7.7 (3.7)</td>
<td>8.1 (2.4)</td>
</tr>
<tr>
<td>Follow-up (Months)</td>
<td>4.0 (4.3)</td>
<td>5.0 (4.9)</td>
<td>4.0 (3.3)</td>
</tr>
</tbody>
</table>

Results

References
3. DeCoster T, Haedens DE, Dreyer GI, Ferrer JE, Jones WO. Optimizing full-contact bicortical fixation for the treatment of malleolar fractures. Foot Ankle Int. 2012; 33:1284-1291

Analysis and Discussion
Our results show medial malleolar fixation has overall low complication rates of 7% total combined which is comparable to current literature. We demonstrate no significant difference in complications, weeks to ambulation or time to union between bicortical and unicortical fixation. Complications include 2 delayed wound healing in unicortical, 1 nonunion in bicortical, 4 delayed unions in unicortical and 1 bicortical and 1 malunion in bicortical groups. Overall bicortical and unicortical fixation shows similar results with overall low complication rates. We believe this is the largest study comparing bicortical and unicortical fixation for the medial malleolus.

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