High Union and Low Removal Rates with Plate Fixation of Metatarsal Fractures

David Beck, MD
Tony Bryant, MD
David Pedowitz MD
Steven Raikin MD
Disclosures
Introduction

• Metatarsal (MT) fractures are common foot injuries and account for almost half of all foot fractures

• Often treated nonoperatively

• Unstable MT fractures are best treated surgically to avoid significant post-traumatic foot pain and/or disability
  • Commonly, surgical treatment is done with Kirchner wire fixation
• Internal fixation with plate and screw may provide a more stable construct for these fractures

• Despite the high incidence of 1st through 4th MT shaft and neck fractures, few studies have evaluated their treatment and outcomes

• PURPOSE: First study to report the healing rates, fracture angulation and need for hardware removal of operatively treated 1-4 MT shaft and neck fractures with plate fixation.
Methods

• IRB approved

• Review of all surgically treated 1-4 Metatarsal fractures at our institution between October 1, 2006 – December 31, 2014

• Excluded: TMT joint fractures, isolated 5th metatarsal fractures, fractures treated at outside facilities, skeletally immature patients and fractures initially treated non operatively

• Surgery completed by one of four fellowship trained Foot and Ankle Surgeons at our institution
Methods

• Reviewed AP/lateral radiographs of patients with minimum of one year follow up
  • Recorded evidence of union
  • Measured angulation and degree of malunion

• Recorded time to full weight bearing, fracture location, plate size, and number of screws on either side of fractures

• Surveyed patients for current bothersome symptoms, plate removal, or desire for plate removal

• Statistical analysis: Multiple linear regression analysis was used to make calculations of statistical significance. A p-value <0.05 was considered statically significant.
Results

• 45/75 patients who underwent plate fixation of metatarsal fractures were included

• All fractures went on to union and full weight bearing

• The average time to union and time to full weight bearing was 10.9 ± 2 weeks and 7.5 ± 1.6 weeks respectively

• There was no significant difference on time weight bearing and union rate with regards to plate size, and screws across the fracture

• The average coronal and sagittal plane angulation was 3.9 degrees and 2.2 degrees respectively
Results

• AP Radiograph demonstrates coronal plane displacement measured by taking the divergence of the distal and proximal shafts.

• No demographic variable showed statistical significance with regards to sagittal and coronal plane angulation.

• Fractures located in the neck were found to have higher coronal plane angulation malunion compared to fractures in the shaft (P=0.019).

• No variable was found to be related to final sagittal plane angulation.
Patient Outcomes

• Twenty-eight of 45 patients responded to our telephone interview with an average follow-up of 4.4 years with a minimum of 1.1 years

• 8 patients said the plate bothered them
  • 7 male, 1 female

• No plates had been removed

• 26/27 patients did not want the plate removed
<table>
<thead>
<tr>
<th>Metatarsal Fractured</th>
<th>Number</th>
<th>Coronal displacement Degrees (Range)</th>
<th>Sagittal plane displacement Degrees (Range)</th>
<th>Neck</th>
<th>Shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>8</td>
<td>1.6 (0-7.1)</td>
<td>1.8 (0-6)</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2nd</td>
<td>23</td>
<td>1.6 (0-12.7)</td>
<td>2.2 (0-5.8)</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>3rd</td>
<td>24</td>
<td>4.75 (0-17.1)</td>
<td>2.3 (0-6)</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>4th</td>
<td>20</td>
<td>2.5 (0-14.2)</td>
<td>2.5 (0-9.8)</td>
<td>7</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fracture location</th>
<th>Number</th>
<th>Coronal Malunion (Range)</th>
<th>Sagittal Malunion (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>16</td>
<td>6.5 (0-17.1)</td>
<td>2.2 (0.1-9.8)</td>
</tr>
<tr>
<td>Shaft</td>
<td>59</td>
<td>3.1 (0.4-14.0)</td>
<td>2 (0-8.2)</td>
</tr>
</tbody>
</table>

[p=0.002]
Conclusion

- High rates of union with plate fixation
  - All healed by 16 weeks

- Low rates of malunion with plate fixation of metatarsal fractures
  - No variables correlated to presence of malunion

- ~30% of patients stated they were bothered by their plates, but none had their plates removed and only one desired to have surgery for plate removal

- Further research will need to directly compare plate fixation to K wire fixation of metatarsal fractures
THANK YOU.