Plate and Screw Fixation of Isolated Syndesmotic Injuries: A Biomechanical Study

Meelan Patel, MD
Hebah El-Gendi, MS
Ashish Patel, MD
Jaime Uribe, MD
My disclosure is in the Final AOFAS Program Book. I have no potential conflicts with this presentation.
Introduction

- Injury to the ankle syndesmosis may occur in association with an ankle fracture or solely as a soft-tissue injury.
- Up to 10% of ankle sprains include syndesmotic disruption and 1% of ankle sprains require fixation of the syndesmosis.\(^1,2\)
- Several controversies exist regarding the ideal fixation strategy for isolated syndesmotic injuries.\(^3-5\)
- It remains unclear whether technical aspects of surgery as well as postoperative protocols affect the clinical outcome.
- Some surgeons prefer addition of small (2 or 3 hole) plate to standard screw fixation.
• **Objective of Study:**

To biomechanically investigate the rotational stability provided by the fibular plate-and-screws construct, as compared to the conventional screws-only fixation.
Methods

• Six paired intact cadaveric lower limbs, disarticulated at the knee, were tested

• Syndesmotic Injury: syndesmotic ligaments sectioned, interosseous membrane sectioned to 4.5cm proximal to ankle joint

• Group 1: Screws-Only Fixation: two 3.5mm tricortical stainless steel screws

• Group 2: Plate-and-Screws Fixation: two 3.5mm tricortical stainless steel screws + a two-hole one-third tubular plate
Methods cont.

• Specimens tested intact, after syndesmosis sectioning, & after fixation
  • external rotation from 0-15° at 1°/sec with constant 900N axial load
  • subsequently loaded to failure in external rotation at 1°/sec

• Torsional load & rotational angle recorded at failure

• Rotational Stiffness Calculated

• Paired Student’s t test used to analyze difference between groups
## Results

<table>
<thead>
<tr>
<th></th>
<th>Failure Torque (Nm)</th>
<th>Failure Angle (deg)</th>
<th>Average Stiffness (Nm/deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screws Only</td>
<td>18.3±6.0</td>
<td>23.5±5.9</td>
<td>.77±.11</td>
</tr>
<tr>
<td>Plate + Screws</td>
<td>24.8±6.9</td>
<td>27.9±4.4</td>
<td>.90±.27</td>
</tr>
<tr>
<td>p value</td>
<td>0.006</td>
<td>0.1</td>
<td>0.106</td>
</tr>
</tbody>
</table>

**Table 2:** Maximum Torque (Nm), Rotational Angle (deg), and Rotational Stiffness (Nm/deg) at Failure for the Screws Only vs. Plate + Screws Fixation Groups

<table>
<thead>
<tr>
<th></th>
<th>Intact (Nm/deg)</th>
<th>Cut (Nm/deg)</th>
<th>After Fixation (Nm/deg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screws Only</td>
<td>0.87±.23</td>
<td>0.47±.17</td>
<td>0.82±.38</td>
</tr>
<tr>
<td>Plate + Screws</td>
<td>0.86±.26</td>
<td>0.52±.19</td>
<td>0.76±.16</td>
</tr>
<tr>
<td>p value</td>
<td>0.97</td>
<td>0.58</td>
<td>0.73</td>
</tr>
</tbody>
</table>

**Table 3:** Average Stiffness (Nm/deg) during different stages of biomechanical testing for the Screws Only vs. Plate + Screws Fixation Groups
Results cont.
Discussion

• Load to failure of the plate-and-screws construct significantly greater than that of the screws-only fixation (24.8 ± 6.9 Nm vs. 18.3 ± 6.0 Nm)
  • Implies increased rotational stability

• Addition of fibular plate may potentially allow for earlier weight bearing & decreased need for hardware removal
  • due to the more stable fixation

• The plate-and-screws construct significantly increased rotational load to failure when compared to the conventional screws-only fixation of an isolated syndesmotic injury.
References


