Arthroscopic Evaluation of Syndesmotic Instability in a Cadaveric Model

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Our disclosures are in the Final AOFAS Mobile App. There is a potential conflict with this presentation: This cadaveric study was funded by DJO Global.
Evaluation of Instability

• Clinical tests DO NOT identify partial disruption efficiently
• Beumer, FAI. 2003.
  – External rotation stress most sensitive clinical test to identify syndesmotic disruption
  – However, no clinical tests produce >2mm of diastasis
Radiographic Instability

- Ebraheim et al. FAI. 1997.
  - Radiographic & CT evaluation of syndesmotic diastasis in 12 cadavers
- Radiographs and Diastasis
  - 0% sensitive at 2mm
  - 50% sensitive at 3mm
  - 100% sensitive at 4mm
- CT (axial cut 1 cm proximal to plafond) and Diastasis
  - 100% sensitive at 2mm
    - Ebraheim, FAI, 1997
- Concluded that partial syndesmotic diastasis is not appreciated with routine radiographs
Syndesmotic Instability

- Ankle arthroscopy
  - 100% sensitive without stress
    - Takao et al
      - JARS, 2001
      - JBJS(br), 2003
    - Surgeon comfort and ability dependent

- Recent studies have demonstrated multiplanar instability via arthroscopy; however, to our knowledge, no studies have focused on the amount of force it takes to produce instability with an intact or partially disrupted syndesmosis
Methods & Materials

- 7 cadaveric below knee specimens, mounted in a traction tower, non-invasive ankle distractor
- Standard anteromedial and anterolateral ankle portals

<table>
<thead>
<tr>
<th>Group</th>
<th>Gradual Ligamentous Disruption</th>
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<tbody>
<tr>
<td>Group 1</td>
<td>Superficial dissection; no ligamentous disruption</td>
</tr>
<tr>
<td>Group 2</td>
<td>Disruption of Anterior Inferior Tibiofibular Ligament + Interosseous Ligament</td>
</tr>
<tr>
<td>Group 3</td>
<td>Group 2 + Talofibular Ligament + Calcaneofibular Ligament</td>
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<tr>
<td>Group 4</td>
<td>Group 3 + Posterior Inferior Tibiofibular Ligament + Transverse Ligament</td>
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</tbody>
</table>
Methods & Materials

- Digital scale was used to measure the force applied in pounds
- Scale was attached to each fixation point individually (distal fibula & 5th metatarsal)
  - An external rotation force was applied through the pin in the 5th metatarsal
- Force was gradually increased to a predetermined maximum or until the diastasis was greater than 6 mm
- Calibrated probe used to measure the diastasis with each successive effort

- *2 of the specimens used to determine baseline diastasis without ligamentous disruption (Group 1)
Results

<table>
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<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
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<tbody>
<tr>
<td>(No ligamentous disruption)</td>
<td>(Disruption of AITFL &amp; IO ligaments)</td>
<td>(Group 2 + disruption of Talofibular &amp; Calcaneofibular ligaments)</td>
<td>(Group 3 + disruption of PITFL &amp; Transverse ligaments)</td>
</tr>
</tbody>
</table>

- 1 specimen demonstrated 1 mm of diastasis in the ant/post sagittal planes with max of 30 lbs of force
- No diastasis in 2nd specimen at max 30 lbs
- Control group

- < 2 mm diastasis in coronal & anterior/posterior sagittal planes
- Transverse/external rotation plane demonstrated most diastasis
- > 3 mm of diastasis in ext rotation when 10 or more lbs applied

- Anterior sagittal plane had least amount of diastasis; < 2 mm of diastasis with max 30 lbs applied
- Greater displacement with lesser force (6 lbs)
- Multiplanar instability visible in every specimen with as little as 2 lbs of force

- No measurements were obtained in this group because of the gross instability with complete disruption of the syndesmotic ligament complex
Discussion

• As anticipated, an intact syndesmosis provided multi-planar stability

• In Group 2, our partial syndesmotic disruption model (AITFL & IO ligaments), diastasis was appreciated arthroscopically, particularly in the transverse/external rotation plane
  – Clinically significant displacement of 2 mm was appreciated with as little as 6 lbs of force
  – Amount of force necessary to elicit appreciable displacement varied from specimen to specimen

• Every specimen in Group 3 demonstrated multi-planar instability with as little as 2 lbs of force
Discussion

  – 53 Weber B or C ankle fractures without frank syndesmosis diastasis
  – Intraop stress radiographs/ankle arthroscopy
  – 16 cases (30.2%) with positive intraop stress radiographs
  – 35 cases (66%) with positive arthroscopic findings of syndesmotic instability
  – When the 16 (+stress radiographs) were viewed arthroscopically:
    • Only 2/16 had pure coronal plane instability
    • 10/16 had associated sagittal plane instability
    • 4/16 had instability in all 3 planes
• How does this relate to our study?
  – Illustrates that over half of the syndesmotic injuries were missed when only referencing intraop stress radiographs which indicates the usefulness of ankle arthroscopy to aid in the diagnosis of subtle syndesmotic injury
  – As evident in our study, Lui et. al demonstrated multiplanar instability as well
  – They did not mention the amount of force that it took to produce syndesmotic instability
Conclusion

• Determining clinically relevant syndesmotic instability represents a challenging and difficult problem for the surgeon

• Our study demonstrates that a small amount of force can produce subtle instability with just partial disruption of the syndesmosis which may not be evident with plain radiographs

• Secondly, syndesmotic instability can occur in multiple planes when viewed arthroscopically which can help determine the extent of the injury

• Finally, the use of arthroscopy in evaluating the syndesmosis not only determines the instability, but may help in anatomic reduction during surgery
References