Collagen Ribbon Augmentation of Achilles Tendon Tears: A Biomechanical Evaluation

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Disclosure

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A Biomechanical Evaluation

Christopher F. Hyer, DPM, MS

Our disclosures are in the
Final AOFAS Program Book.

I have a potential conflict with this presentation due to:
Consultant relationship, WMT

This study was funded by Wright Medical Technology
The Achilles Challenge

• High load tendon
• Crucial for normal ambulation
• Midsubstance acute and chronic pathologies
• Limited local healing responses
Primary vs. Augmented Repair?

• Early ROM and therapy
  – Benefit maintain strength
  – Faster return to function

• Can primary repair alone take early ROM?

• Would augmentation with collagen ribbon improve strength?
Methods

- 10 matched pairs BK cadaver specimens
  - Intact Achilles/Gastrosoleal complex
  - Male 25-55 years
  - Anchored proximal and distally
- Primary defect created @ site of primary rupture
Methods: Primary vs. Augment

Each pair:

- **Primary repair**
  - 4-strand Krackow
  - #2 Ethibond EXCEL®

- **Collagen ribbon Augment**
  - Primary Krackow repair plus
  - Collagen ribbon (TRELLIS™, Wright Medical Technology)
    - Box weave pattern
    - Sutured to itself, #2 Ethibond EXCEL®
Cyclic Loading & To Failure

- Repaired constructs
- Intact insertion to calcaneus mounted to test frame
- Gastroc aponeurosis attached to mesh strap
- Cyclic loading
  - 20 cycles, 2-30 N
Methods

• Any gap at primary repair site measured after cyclic loading

• Load to failure
  – Load @6mm/sec until fail

• Evaluations
  – Peak load to fail
  – Gap values
Results

**Peak Load (N)**

<table>
<thead>
<tr>
<th>DONOR #</th>
<th>Collagen ribbon Augment</th>
<th>Primary Repair only (Control)</th>
<th>INCREASE (Augment ÷ Primary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>428</td>
<td>303.4</td>
<td>87.6</td>
<td>3.5</td>
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<tr>
<td>452</td>
<td>401.3</td>
<td>120.8</td>
<td>3.3</td>
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<tr>
<td>472</td>
<td>422.0</td>
<td>116.6</td>
<td>3.6</td>
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<tr>
<td>486</td>
<td>412.7</td>
<td>109.6</td>
<td>3.8</td>
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<tr>
<td>521</td>
<td>279.0</td>
<td>87.1</td>
<td>3.2</td>
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<td>565</td>
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<tr>
<td>655</td>
<td>450.2</td>
<td>84.8</td>
<td>5.3</td>
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<tr>
<td>667</td>
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<tr>
<td>730</td>
<td>373.8</td>
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<tr>
<td>mean</td>
<td>392.4</td>
<td>98.0</td>
<td>4.1</td>
</tr>
<tr>
<td>SD</td>
<td>74.9</td>
<td>17.6</td>
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<tr>
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<tr>
<td>max</td>
<td>533.1</td>
<td>121.6</td>
<td>5.6</td>
</tr>
</tbody>
</table>
Summary

- Mean peak load was significantly different ($p<0.001$) between groups
  - Collagen ribbon Augment: $392.4 \pm 74.9$ N
  - Primary repair only (Control): $98.0 \pm 17.6$ N
- Mean increase of peak load (ie, Augmented ÷ Primary repair only) was $4.1X \pm 0.9X$ (range 3.2X-5.6X)
- Suture failed before collagen ribbon in all collagen ribbon (TRELLIS™) Augmented specimens