Evaluation of Footprint Contact Pressure and Area in Rotator Cuff Repair using Conventional Suture-bridge, Knotless Suture-bridge, Dozen Knotless Suture-bridge Technique: Cadaveric Study

Sittan Aimprasittichai¹, Bancha Chernchujit²

¹ Department of Orthopedics, Chulabhorn Hospital, Thailand
² Department of Orthopedics, Faculty of Medicine, Thammasat University, Thailand
Authors have no financial conflicts to disclose
Postoperative re-tear is one of the common complications after arthroscopic rotator cuff repair.

- Conventional (medial knot-tying) suture-bridge technique
  - 59% : Type II retear (ruptured tendons medial to a healed footprint)

- Possibly come from the over-tensioning and strangulation at the medial row of the repaired tendon
  - Interruption of blood supply

Objective of the Study

• To evaluate the average pressure and the area of the repaired supraspinatus tendon in the 3 different techniques.

• To compare the pressure distribution between the medial and the lateral footprint.

Dozen knotless suture-bridge technique
8 strand-Knotless suture-bridge technique
Conventional knot-tying suture-bridge technique
Materials & Methods

- **21 Fresh-frozen cadaveric shoulder** in Thammasat Surgical Skills Training Center was randomized into 3 groups
- The shoulders were resected the portion of the supraspinatus tendon to simulate the rotator cuff tear

**Inclusion criteria**
- Cadaveric shoulder
- Intact rotator cuff

**Exclusion criteria**
- Previous fracture
- Osteoarthritis
- Pre-existing rotator cuff tear
- Previous shoulder surgery

- Dozen knotless suture-bridge technique
- 8-Strand Knotless suture-bridge technique
- Conventional knot-tying suture-bridge technique
Pressure-Sensitive Film

Fuji Prescale Film (Fuji Photo Film Co Ltd, Tokyo, Japan)

- The pressure or pressurized area increased, the stronger color or greater area was fixed to the film
- Size of film for analysis: 20 x 15 mm
- Extreme Low Pressure level
  - Range: 0.05-0.25 MPa
  - Used in the previous study
- Analysis by the digital scanner and Fujifilm pressure-distribution mapping system to calculate the pressure and the area

“Dozen” Knotless Suture-bridge Technique

- Apply 2 triple-loaded anchors
- Total 12 limbs of suture
- 2 suture limbs of each anchor were passed through the tendon
- No medial knot tying
- Carefully place the pressure sensitive film at the tendon-footprint interface before the lateral row insertion
8-Strand Knotless Suture-bridge Technique

- Apply 2 double-loaded anchors
- Total 8 limbs of suture
- No medial knot tying

Conventional Suture-bridge Technique

- Apply 2 double-loaded anchors
- Total 8 limbs of suture
- Tie the knot at the medial row before the lateral row insertion
Results: Average Pressure (MPa)

- No significant difference the average pressure on the entire footprint (p-value = 0.179)
**Results: Pressure Distribution Pattern**

<table>
<thead>
<tr>
<th>Technique</th>
<th>Medial (%)</th>
<th>Lateral (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dozen Knotless Suture-bridge Technique</td>
<td>43.9</td>
<td>56.1</td>
</tr>
<tr>
<td>Knotless Suture-bridge Technique</td>
<td>48.1</td>
<td>51.9</td>
</tr>
<tr>
<td>Conventional Knot-tying Suture-bridge Technique</td>
<td>51.5</td>
<td>48.5</td>
</tr>
</tbody>
</table>

Contact pressure on the medial footprint

- **Dozen knotless suture-bridge technique** was **significant lower** than the **conventional knot-tying technique** (43.9 ± 4.19 vs 51.5 ± 5.97) (P < 0.05)
- No significant difference between Dozen knotless technique and 8-strand knotless technique (p-value = 0.128)
Results: % Contact Area

- **Dozen knotless suture-bridge technique** was **significant superior** than the Conventional knot-tying technique in the footprint coverage and the 8-strand knotless suture-bridge technique (76.5±9.19 vs 65.1±9.23 vs 67.6±3.4% ) (P < 0.05)
Rhee et al.

- Compared the clinical and radiologic outcomes between a conventional medial knot-tying group and a medial knotless group
- Result: Medial knotless TOE group showed a significantly lower re-tear rate

“Dozen” knotless suture-bridge technique

- Less pressure on the medial footprint
  - Decrease strangulation of the microcirculation of the rotator cuff
- Comparable average pressure to the conventional medial knot-tying technique
- Significant superior footprint contact coverage
Conclusion

We recommend to use the “Dozen” knotless suture-bridge technique

- Effective to decrease the type II re-tear
  - Less pressure at the medial row
- Provide an optimal environment for tendon healing
  - Strong repair construct
  - Large footprint coverage
- Convenient technique
  - Safe time
  - No knot-tying problem ex. knot tangle

Reference: