CREATION AND INITIAL ASSESSMENT OF A LOW COST, EASILY MANUFACTURED, SYNTHETIC FASCIA FOR TRAINING


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Background & Aim

• Few models to train fascial closure are available.
• Current training uses cadaveric or porcine fascia based training, leading to significant inter-specimen variability, low supply, cost, and ethical concerns.

Aim: Create an inexpensive and easily manufactured synthetic fascia suitable for simulation-based fascial closure training.

Methods

Three distinct project phases: Manufacturing and Biomechanical Testing, Refinement, Qualitative Review

Manufacturing + Biomechanical Testing

• Synthetic fascia constructs were manufactured using combinations of various silicones and mesh materials.
• Constructs were evaluated via tensile suture pull-through testing.

Refinement

• Iterative testing provided direction for each fascia construct with the goal of achieving pull-through forces within 10N of the average strength of porcine fascia.

Qualitative Review

• Best construct was reviewed by 10 surgeons experienced in fascial closure.
• Respondents grasped the fascia with a Kocher clamp and toothed forceps.
• Incisions were closed with 2-0 polypropylene and 1 PDS, using both 1cm bites/1cm advancement and 5mm bites/5 mm advancement techniques.

Results

• Cost: materials for one 24x24cm sheet is $4.09; one-time cost for manufacturing frame of $50 which can be optimized to $10 with structural changes.
• Time: 16 hour curing time.

Overall, 9/10 surgeons rated the construct as an acceptable teaching tool for abdominal fascial closures.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Similar to Human Fascia</th>
<th>Stronger pull-through force/larger needle hole</th>
<th>Weaker pull-through force/smaller needle hole</th>
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<tbody>
<tr>
<td>Needle Hole Enlargement</td>
<td>9</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Suture-pull Through</td>
<td>4</td>
<td>6</td>
<td>-</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Similar to Human Fascia</th>
<th>Somewhat similar to Human Fascia</th>
<th>Not similar to Human Fascia</th>
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<tbody>
<tr>
<td>Response to cutting</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Tactile Feel</td>
<td>-</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Drag of Needle</td>
<td>3</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Grasping Behavior</td>
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Figure A shows production of a fascia construct.

Figure B represents suture pull-through testing of a sample.

Figure C shows qualitative testing of a fascia sample.

Figure D represents an inventory of materials used during the qualitative review.

Conclusion

Our construct is inexpensive, easily manufactured, mimics the biomechanical profile of porcine fascia, and performs similar to human fascia as assessed by a group of experienced surgeons. Its use in simulation-based training should be encouraged and outcomes measured.

References & Acknowledgments

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