Assessing Efficiency in Microsurgery Using Motion Tracking Technology

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American Council of Academic Plastic Surgeons
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Challenges in Microsurgical Education

Skill Acquisition

- Resident work hour restrictions
- Reduced operative opportunity
- *In vitro* model limitations

Skill Assessment

- Halstedian tradition
- ACGME case logs
- Competency based training programs
Project Aim

To analyze microsurgical skill and efficiency at various levels of training using motion pattern analysis
Methods

“Blue-Blood” Chicken Thigh Microsurgical Anastomosis Model

3D Motion Tracking Technology
## Results: Study Participants

<table>
<thead>
<tr>
<th>Study Subject</th>
<th>Anastomoses Performed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fellowship trained microsurgeon (expert)</td>
<td>4</td>
</tr>
<tr>
<td>Fellowship trained microsurgeon (expert)</td>
<td>4</td>
</tr>
<tr>
<td>PGY4 (intermediate)</td>
<td>4</td>
</tr>
<tr>
<td>PGY1 (novice)</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>
Results: Microsurgical Motion Maps

NOVICE
Results: Microsurgical Motion Maps

NOVICE

EXPERT
Results: Path Length

**Needle Pass**

**Knot Tying**

Path Length (m)

Expertise

- **Novice**
- **Intermediate**
- **Expert 1**
- **Expert 2**

Path Length (m)

Expertise

- **Novice**
- **Intermediate**
- **Expert 1**
- **Expert 2**

P-values:

- **Needle Pass:**
  - Novice vs. Intermediate: P = 0.049
  - Novice vs. Expert 1: P = 0.047

- **Knot Tying:**
  - Novice vs. Intermediate: P = 0.007
  - Novice vs. Expert 1: P = 0.009
  - Novice vs. Expert 2: P = 0.015
Results: Jerkiness

**Needle Pass**

- Expertise 1: $P = 0.003$
- Expertise 2: $P = 0.024$
- Novice: $P = 0.021$

**Knot Tying**

- Expertise 1: $P = 0.003$
- Expertise 2: $P = 0.024$
- Novice: $P = 0.029$
Phase II Data Collection

Anastomoses Performed

Level of Training

Student  PGY1  PGY2  PGY3  PGY4  PGY5  PGY6  Attending

n = 32
Study Conclusions

- Motion tracking technology facilitates objective assessment of microsurgical skill

- Future work:
  - End-to-side anastomoses, venous couplers
  - Use motion pattern signatures to create a quantitative representation of the microsurgical learning curve
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