Unique Microvascular Anastomoses Task Trainer for Neurosurgical Resident Learning

Callum Dewar\textsuperscript{1}, Jake Stewart\textsuperscript{1}, Carter Bell, Jonathan Garst\textsuperscript{1,2}, Julian J Lin\textsuperscript{2,3}

\textsuperscript{1}COLLEGE OF MEDICINE, UNIVERSITY OF ILLINOIS COLLEGE OF MEDICINE AT PEORIA, PEORIA, ILLINOIS
\textsuperscript{2}OSF SAINT FRANCIS DEPARTMENT OF NEUROSURGERY, PEORIA, ILLINOIS
\textsuperscript{3}ILLINOIS NEUROLOGICAL INSTITUTE, PEORIA, ILLINOIS
Disclosures

We have no disclosures
Introduction

The STA-MCA bypass is a technically challenging procedure that many resident neurosurgeons fail to garner experience with during training. Our 3D-printed microvascular task trainer is designed to create a user-friendly, portable, multi-vessel compatible suturing training protocol for neurosurgical residents.

Goals are:

1) determine the capacity of the device to discriminate skill level of residents

2) use objective measures to analyze improvements in performance across trials to provide evidence for task trainer efficacy.
The small vessel task trainer is designed to create a user-friendly, cost-effective, portable, multi-vessel compatible suturing training protocol for the University of Illinois College of Medicine, Peoria neurosurgical residents.

- Incorporates vessels from 1-3 mm
- Flow rate adjustable from 5 ml/min to 500 ml/min
- Portability allows for easy transport between OR suites
Methods

UIC Peoria neurosurgical residents performed repeated video monitored microvascular end-to-end anastomosis under Zeiss microscope using unique task trainer and 2 mm synthetic vessels.

Per trial: subjects instructed to place six 10-0 simple interrupted sutures as fast and accurately as possible

N = 7 total residents

Residents divided into groups (PGY 1-2 vs 3-4 vs 5-6)
Primary Endpoints

- Time to Completion
- Modified Northwestern Objective Microanastomosis Assessment Tool (NOMAT)
  - Scored on 1-10 Likert scale

- Use of Microscope
- Handling of surgical instruments
- Vessel handling and respect for tissue
- Needle handling and care
- Needle bite uniformity
- Spacing of the sutures
- Knot tying
- Needle efficiency
- Knot tying efficiency
- Off pump evaluation of complete anastomoses
Results

Time Improvement

Mean time improvement
933.4 secs
Final times faster than baseline (P=0.047)

Spearman correlation coefficients between time improvement and number of trials was -0.93, p value=0.0026.
Results

NOMAT Improvement

Final modified NOMAT scores were higher than baseline scores (P=0.035). Mean improvement of 19.7 pts.

Positive spearman correlation coefficients (0.27, p-value 0.554) exist between NOMAT improvement and number of trials.
Discussion

- A negative correlation exists between time and number of practice trials. Not surprisingly, the more practice the residents obtained, the larger improvement in final time and NOMAT scores.

- Junior residents show trends towards greater NOMAT and time improvement scores compared to seniors.
Summary Points/Conclusions

- Unique task trainer based simulation in learning microanastomosis suturing is feasible and can be incorporated into residents' curriculum.
- Video analysis of training sessions documents performance, progression, and improvement.
- Allows for early use/experience with the Zeiss microscope and handling of micro vessels with suturing early in residency.