Novel low-cost 3D printed microlaryngeal surgery trainer

University of Colorado
Anschutz Medical Campus

Ryan J. Lau, MD[1], Taylor G. Lackey, MD[1], Scott E. Mann[1], Daniel S. Fink, MD[1]

[1]Department of Otolaryngology – Head & Neck Surgery, University of Colorado, Aurora, CO

Background

- Difficulty of teaching microlaryngeal surgery: delicate nature of the procedures, narrow margin of error, difficult fine motor movements, single-operator technique
- Approx. 1/3 US ENT residencies provide microlaryngeal simulation lab, though less than 1/4 graduating ENT chief residents comfortable with microlaryngeal surgery based on recent surveys
- Many prior studies attempt to provide high fidelity simulator experience for microlaryngeal surgery – difficulty of reproducibility, cost, and accessibility
- Cost estimate
  - 3D printed trainer ≈ $20
  - Tripod ≈ $10-$15
  - Larynx (porcine) ≈ $2-15

Methods

- Participants recruited from a group of ENT residents and attending laryngologists during formal didactic session
- 3D microlaryngeal surgery trainer completed multiple iterative improvements ((Figure 1) based on expert feedback and successfully implemented during Spring 2022 pilot simulator session
- Simulator set-up (Figure 2)
- 3 procedures: injection laryngoplasty, microflap elevation, endoscopic suturing

Simulator Set-up

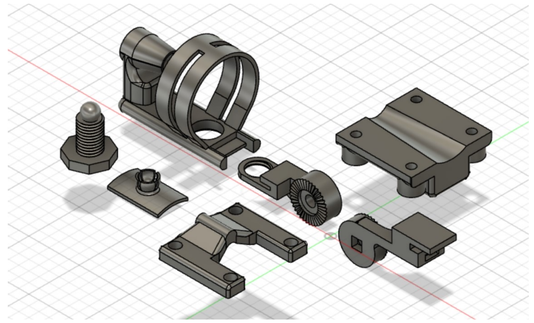

Figure 1. 3D-printed microlaryngeal surgery trainer model

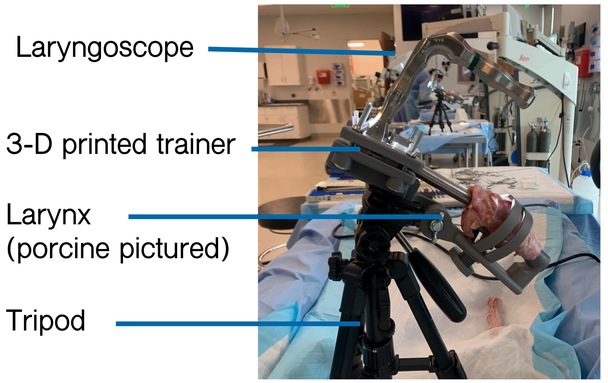

Figure 2. 3D-printed microlaryngeal surgery trainer set-up (attached to camera tripod) with mounted porcine larynx and dedo laryngoscope

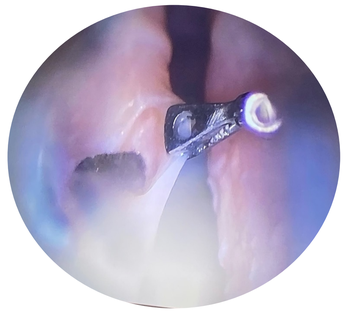

Figure 3. Representative operative view through microscope with larynx mounted on trainer (microflap elevation shown)

Figure 4. Complete simulator configuration with trainer, microscope, and mayo stand to reflect operating room ergonomics

Results

- Data collection to be completed during resident education curriculum Spring 2023 Otolaryngology Laryngology Block session

Future Directions

•Obtain validity measures:
- Face and content validity → Modified Michigan Standard Simulation Experience Scale (MiSSES)
- Construct validity → 2 experts blindly review and grade microflap procedure video recording using Construct Validity Laryngeal Simulator Questionnaire

•Distribute 3D trainer model design as open access resource

References

- Dhillon VK, Dailey SH, Akst LM. Microlaryngeal Teaching Courses: A National Survey on Prevalence, Value, and Barriers to Implementation. *Ann Otol Rhinol Laryngol*. 2020;129(2):101-109. doi:10.1177/0003489419876290
- Shah MD, Johns MM, Statham M, Klein AM. Assessment of phonomicrosurgical training in otolaryngology residencies: A resident survey. *Laryngoscope*. 2013;123(6):1474-1477. doi:10.1002/lary.23763
- Holliday MA, Bones VM, Malekzadeh S, Grant NN. Low-cost modular phonosurgery training station: Development and validation. *Laryngoscope*. 2015;125(6):1409-1413. doi:10.1002/lary.25143
- Contag SP, Klein AM, Blount AC, Johns MM. Validation of a laryngeal dissection module for phonomicrosurgical training. *Laryngoscope*. 2009;119(1):211-215. doi:10.1002/lary.20018

Disclosures

- Presented at AAO-HNS 2022 Annual Meeting Simulation Showcase, Philadelphia, PA