Rhinology Online
Notes, Techniques, and Cases

RESEARCH NOTE

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Telementoring from theory to practice: experiences in developing a remote endoscopic sinus surgery training program*

Jacqueline Yao[1], Peter H. Hwang[1], Elizabeth Zambricki[1], Liang-Chun Shih[2], Jonathan B. Overdevest[3]

[1] Department of Otolaryngology-Head and Neck Surgery, Stanford University School of Medicine, Stanford, CA, USA

[2] Department of Otorhinolaryngology-Head and Neck Surgery, China Medical University Hospital, Taichung, Taiwan

[3] Department of Otolaryngology-Head and Neck Surgery, Columbia University Irving Medical Center, New York, NY, USA

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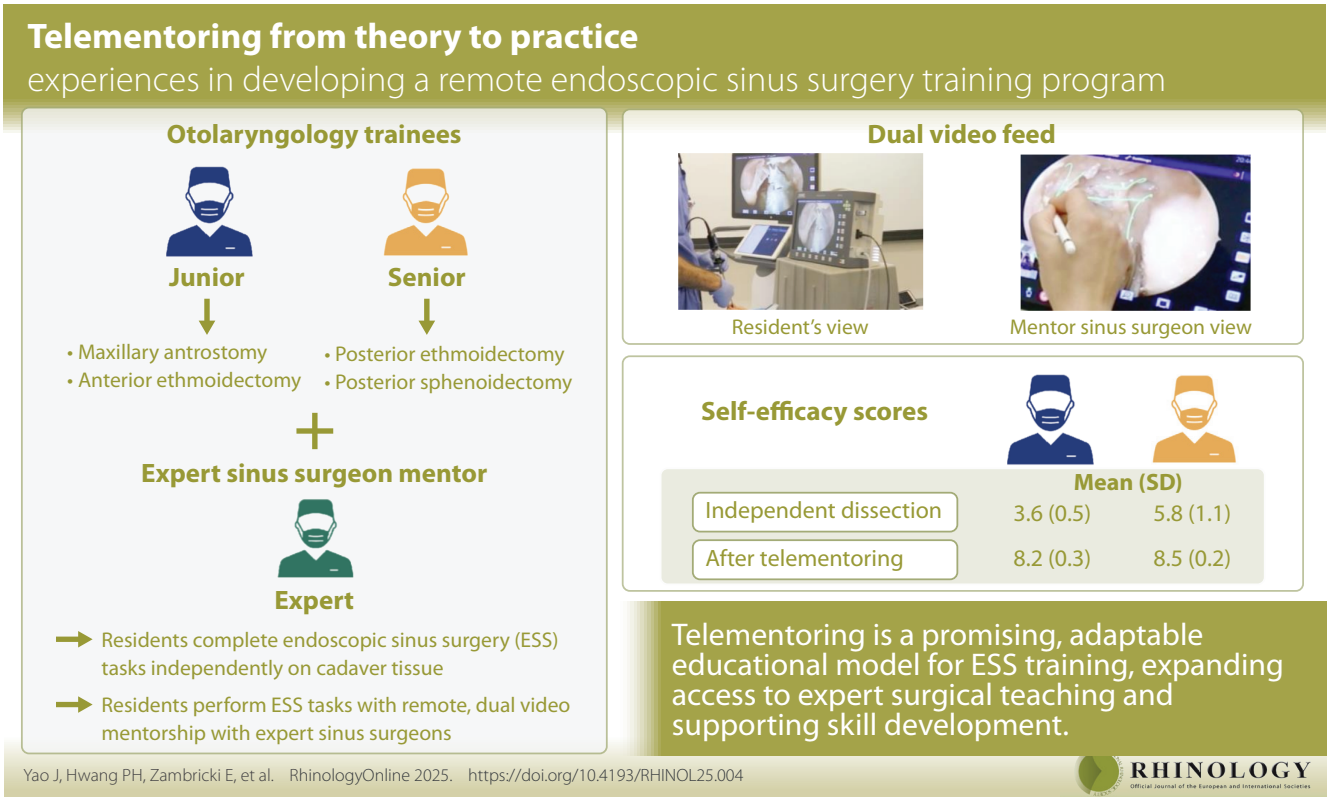

Abstract

Telementoring shows promise as a supportive tool to enhance confidence and comfort in endoscopic sinus surgery training. This study's remote guidance model demonstrates the potential of a scalable, low-barrier solution to expand access to expert mentorship in surgical education, particularly in resource-limited or geographically remote settings.

Key words: telemedicine, otolaryngology, internship and residency, endoscopic sinus surgery, self-efficacy

Introduction

Modern medical practice has increasingly integrated telehealth in clinical and educational settings [1]. Surgical telementoring enables expert surgeons to provide remote, synchronous guidance to trainees, supplementing traditional surgical education and supporting junior surgeons in underserved regions [2]. Advancements in technology have shifted surgical telementoring from passive demonstration to active, bidirectional communication [3]. Studies across multiple specialties suggest that telementoring can achieve comparable technical competency to in-person instruction [4,5]. However, its application in otolaryngology remains limited, primarily to robotic and skull base surgeries [6,7].

This study explores telementoring for training residents in endoscopic sinus surgery (ESS), a core otolaryngology competency [8]. ESS is well-suited for telementoring due to its single-surgeon, video-based nature, allowing for real-time verbal and visual guidance. We hypothesize that telementored ESS instruction enhances comfort and confidence of residents in performing surgical tasks.

Materials and methods

Resident volunteers from Stanford and UCSF were classified as "junior" or "senior" based on training level and ESS experience in the operating room (Table 1). To account for the impact of ESS experience, trainees who had completed no more than two maxillary antrostomies and anterior ethmoidectomies as primary surgeons prior to the telementoring session were grouped in the junior resident cohort. Junior residents (PGY2/3) performed maxillary antrostomy and anterior ethmoidectomy, while senior residents (PGY3/4) performed posterior ethmoidectomy and sphenoidotomy (Table 2).

Each of the 16 residents performed the assigned tasks independently and then under telementoring from a remote faculty surgeon using a two-way audio-video platform with telestration capabilities (Video 1). An impartial senior otolaryngologist observed both sessions without providing feedback (Figure 1). Residents completed a visual analogue scale (VAS)-based self-assessment before and after telementoring (Figure S1). Statistical analysis was performed using Student's t-test to compare self-efficacy and surgical competency before and after

Table 1. Participant demographics.

	Junior residents (PGY2-3)	Senior residents (PGY-3-4)	Total subjects
Number & Handedness	8	8	16
Right-handed	8	8	16
Left-handed	0	0	0
ESS experience (mean procedures performed)			
Maxillary antrostomy	3.8	11.8	7.8
Anterior ethmoidectomy	2.5	12.3	7.4
Posterior ethmoidectomy	1.1	5.9	3.5
Sphenoidotomy	1.4	4.9	3.1

Table 2. Overall trend in change in mean ASK-12 from baseline according to post-op follow-up.

Surgical procedure	Task	Resident training level
Maxillary antrostomy	i) identification of the uncinate; ii) complete removal of the uncinate; iii) identification of the natural os of the maxillary sinus; iv) enlargement of the natural os to 2cm	Junior (PGY2/3)
Anterior ethmoidectomy	i) identification of the ethmoid bulla; ii) removal of the bulla with mucosal preservation; iii) identification of the basal lamella; iv) identification of the lamina papyracea	Junior (PGY2/3)
Posterior ethmoidectomy	i) entrance into the basal lamella with preservation of the horizontal strut of the middle turbinate; ii) identification of the superior turbinate; iii) removal of posterior ethmoid cells revealing skull base; iv) superior turbinate and lamina papyracea	Senior (PGY3/4)
Sphenoidotomy	i) identification and enlargement of sphenoid ostia; ii) demonstration of the internal carotid and optic nerve location within the sphenoid sinus	Senior (PGY3/4)

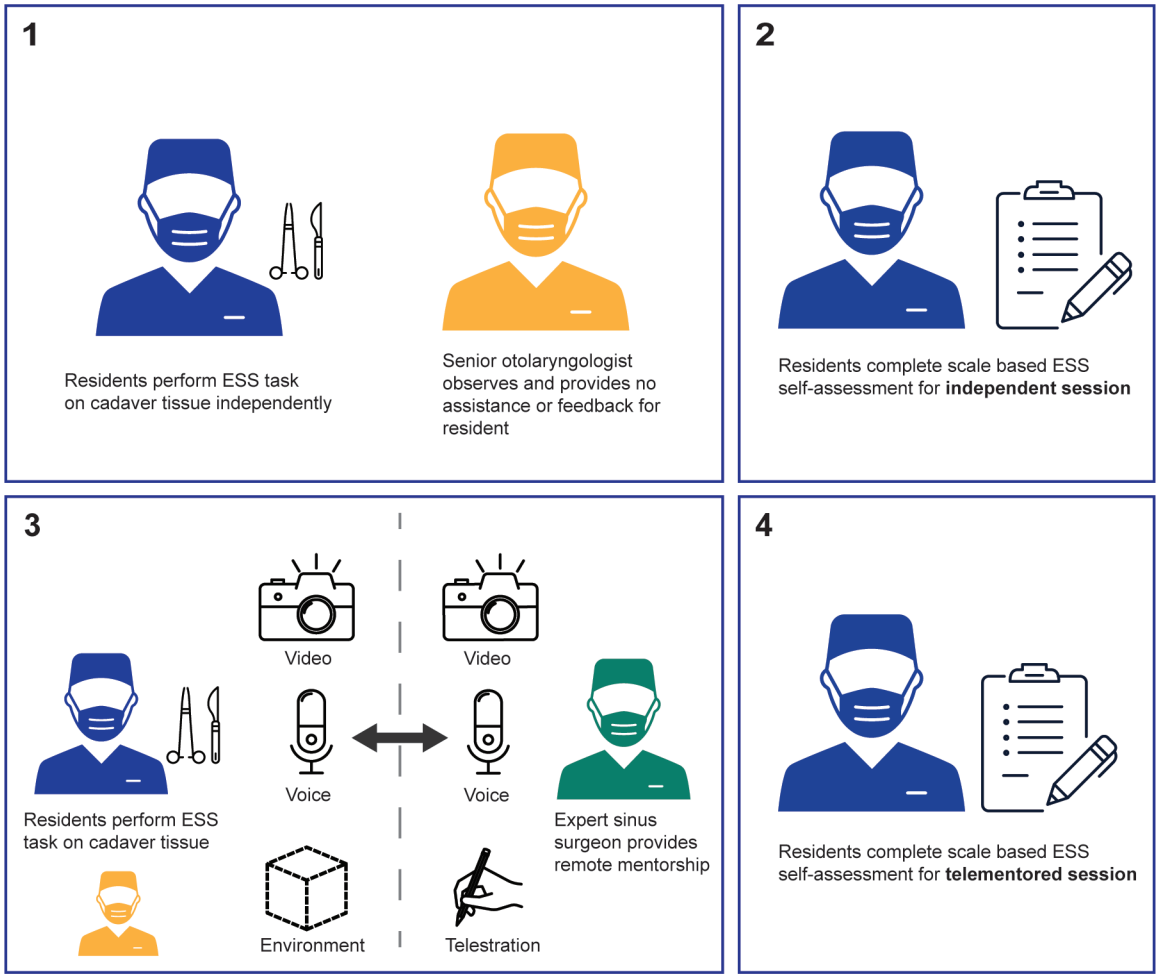

Figure 1. Schematic of independent and telementored ESS for residents in all training stages.

telementoring.

The telementoring system utilized the Nurep telepresence platform, providing dual video feeds for the mentor—one of the endoscopic procedures and one of the operating field. The telestration overlay allowed real-time visual guidance.

The study was reviewed and approved by the Stanford Institutional Board Review.

Results

Self-efficacy: junior residents

Junior residents reported self-efficacy scores reflecting their comfort with performing the procedure, averaging 3.6 after independent dissection versus 8.2 post-telementoring (P<0.01, Figure 2). The greatest improvement was in identifying the maxillary os (2.9 to 7.9, P<0.001). Other significant improvements included widening the maxillary os (4.0 to 8.1, P<0.01), resecting the ethmoid bulla (3.9 to 8.2, P<0.001), and identifying the basal lamella (3.7 to 8.5, P<0.01).

Self-efficacy: senior residents

Self-efficacy scores among senior residents increased from 5.8 (independent) to 8.5 (telementored) (P<0.01, Figure 3). Identifying the superior turbinate and posterior ethmoid cell saw the greatest improvement (4.6 to 8.3, P<0.01). Significant gains were also noted in identifying the basal lamella (6.3 to 8.6, P<0.01) and performing sphenoidotomy (6.6 to 8.6, P<0.01).

Overall impressions

All participants reported improved comfort and confidence following telementoring. Overall confidence in performing surgical tasks improved from 3.6 to 7.8 (P<0.01, Figure 4). Trainees reported that telementoring improved their ability to perform tasks (9.2; SD ±0.99), improved their confidence in their ESS training (9.1; SD ±1.13), and that telementoring would be a desirable way from to learn a surgical technique de novo (9.2; SD ±1.0). The experience gap between junior and senior residents narrowed, particularly in basal lamella identification, where post-telementoring scores were nearly equivalent. However, technological reliability was a concern (5.2; ±SD 3.6), particularly in early sessions.

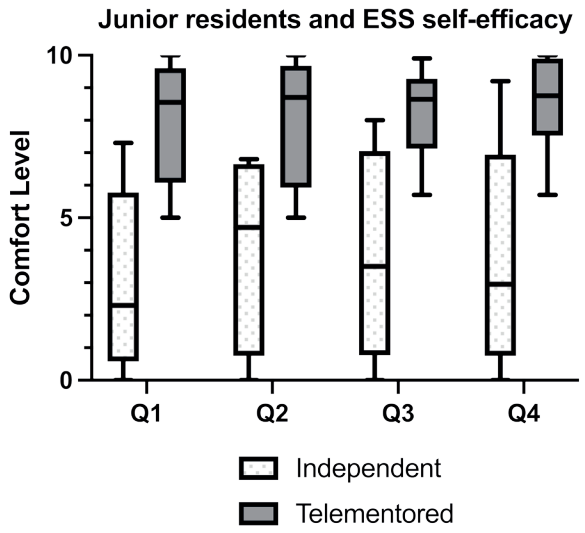

Figure 2. Self-reported comfort levels of junior residents completing maxillary antrostomies and anterior ethmoidectomies during independent and telementored ESS sessions. Comfort levels for all key surgical steps improved with telementoring in statistically significant fashion (P<0.01). Greater inter-participant comfort levels for each surgical step were noted for independent ESS compared to telementored ESS.

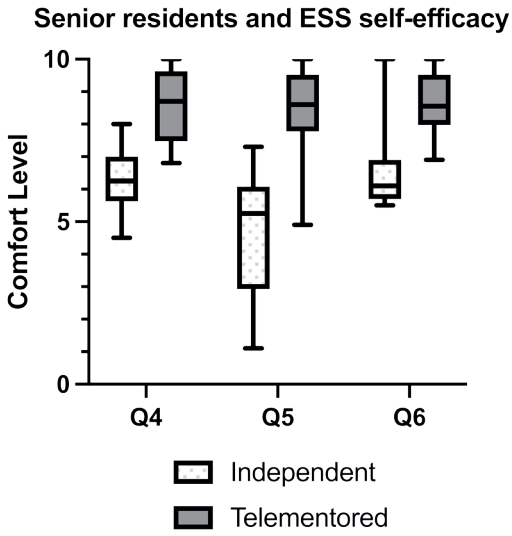

Figure 3. Self-reported comfort levels of senior residents completing posterior ethmoidectomies and sphenoidotomies during independent and telementored ESS sessions. Comfort levels for all key surgical steps improved with telementoring in statistically significant fashion (P<0.01).

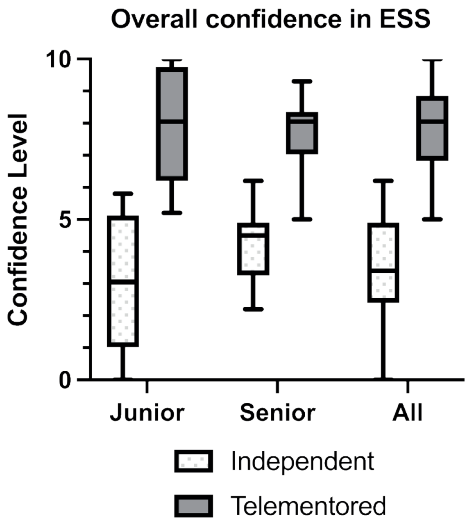

Figure 4. Overall self-assessed confidence among residents completing ESS independently and with telementoring. Telementoring intervention results in improved overall confidence in completing discrete steps within ESS among all trainees (mean independent confidence pre-intervention 3.6, post-telementoring 7.8; P<0.01).

Discussion

Telehealth has broadened access to medical education. Many telemedicine services initiated during the COVID-19 pandemic have become permanent. Our study demonstrates the feasibility of telementoring in ESS training, significantly enhancing residents' comfort and confidence. Potential applications of ESS telementoring include supplementing residency training programs, expanding surgical education in resource-limited settings, and facilitating expert consultation in complex cases. This model provides structured ESS exposure to trainees, fostering mastery through guided mentorship.

A study limitation was the non-randomized sequence of independent and telementored sessions. All participants began with independent dissection to avoid mentorship effects inflating later performance. Future randomized studies could offer more clarity on the role of sequence biases. Another limitation was the absence of a traditional control group. Though improvements in self-efficacy and confidence may reflect some task familiarity, telementoring offered real-time, structured feedback that was qualitatively distinct.

Our self-assessment instrument, though not externally validated, effectively captured learner confidence and perceived skill development. Self-efficacy is critical in surgical training, influencing skill acquisition and performance. Our findings align with previous research on the value of self-assessment in surgical education [9]. Further development of ESS telementoring would benefit from a structured curriculum, potentially following the previously established ADDIE (Analysis, Design, Development, Implementation, Evaluation) [9] and GROW models (Goals, Reality, Options, Wrap-up) [10].

Barriers to broader adoption include internet reliability, cost, and safety in live surgery. We encountered occasional connectivity and telestration disruptions, underscoring the need for robust infrastructure. A range of platforms is now available, from advanced, high-cost commercial systems developed by medical device companies to widely available, low-cost solutions like Zoom and Microsoft Teams, which offer sufficient functionality

without the need for additional equipment.

Conclusion

ESS telementoring is a promising educational tool. Our study provides proof-of-concept evidence that telementoring increases comfort, self-efficacy, and confidence in surgical execution among resident trainees, offering a scalable supplement to traditional surgical education.

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Authorship contribution

All authors read and approved the final manuscript. JY and JO created the figures and drafted the manuscript. J.O. performed the data analysis. LS, EZ, PH, and JO participated in study design and execution. PH, JO, and JY contributed to reviewing and editing of the manuscript.

Ethics approval and consent to participate

The study was reviewed and approved by the Stanford Institutional Board Review.

Consent for publication

Not applicable

Availability of data and material

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflict of interest

The authors declare that they have no competing interests.

References

1. Zundel KM. Telemedicine: history, applications, and impact on librarianship. Bull Med Libr Assoc. 1996;84(1):71-79.
2. Alkire BC, Raykar NP, Shrime MG, et al. Global access to surgical care: a modelling study. Lancet Glob Health. 2015 Jun;3(6):e316-23.
3. DeBakey ME. Telemedicine has now come of age. Telemed J 1995;1:3–4.
4. Augestad KM, Bellika JG, Budrionis A, et al. Surgical telementoring in knowledge translation--clinical outcomes and educational benefits: a comprehensive review. Surg Innov. 2013 Jun;20(3):273-81.
5. Moore RG, Adams JB, Partin AW, Docimo SG, Kavoussi LR. Telementoring of laparoscopic procedures: initial clinical experience. Surg Endosc. 1996 Feb;10(2):107-10.
6. Newman JG, Kuppersmith RB, O'Malley BW. Robotics and telesurgery in otolaryngology. Otolaryngol Clin North Am 2011;44(6):1317-1331.
7. Snyderman CH, Gardner PA, Lanisnik B, Ravnik J. Surgical telementoring: A new model for surgical training. Laryngoscope. 2016 Jun;126(6):1334-8.
8. Rosenfeld RM, Piccirillo JF, Chandrasekhar SS, et al. Clinical practice guideline (update): adult sinusitis. Otolaryngol Head Neck Surg. 2015 Apr;152(2 Suppl):S1-S39.
9. A Butt K, Augestad KM. Educational value of surgical telementoring. J Surg Oncol. 2021 Aug;124(2):231-240.
10. Singh P, Aggarwal R, Tahir M, Pucher PH, Darzi A. A randomized controlled study to evaluate the role of video-based coaching in training laparoscopic skills. Ann Surg. 2015 May;261(5):862-9.

Jonathan Overdevest, MD, PhD
Department of Otolaryngology
Head and Neck Surgery
Columbia University
Irving Medical Center
180 Fort Washington Ave
New York
NY 10032
USA

E-mail: j.overdevest@columbia.edu

Stanford Telementoring ESS Self-Assessment Instrument

Assessed after independent and telementored dissections

(Mark on the lines below your response based on a scale of 0=completely uncomfortable and 10=completely comfortable)

10

0

ESS checklist questions for Junior Residents

Q1. How comfortable were you with performing uncinectomy and identification of the natural maxillary os? (0-10)

Q2. How comfortable were you widening the maxillary os? (0-10)

Q3. How comfortable were you with identifying and removing the ethmoid bulla? (0-10)

Q4. How comfortable were you with identifying the basal lamella? (0-10)

ESS checklist questions for Senior Residents

Q4. How comfortable were you with identifying the basal lamella? (0-10)

Q5. How comfortable were you with identifying the superior turbinate, posterior-most ethmoid cell and lamina papyracea? (0-10)

Q6. How comfortable were you with identifying and widening the sphenoid os? (0-10)

Questions for All Residents

Q7. Please rate your overall confidence in performing the surgical tasks. (0-10)

Q8. Do you think that the telementored FESS improved your ability to perform the tasks? (0-10)

Q9. Do you think that the telementored FESS improved your confidence in performing the tasks? (0-10)

Q10. After comparing the independent FESS vs the telementored FESS, do you think that using a telementored session could safely and appropriately teach you a new technique? (0-10)

Q11. Did the telementoring system run smoothly with minimal hardware or software issues. (0-10)

Figure S1. Visual analogue scale (VAS)-based self-assessment before and after telementoring.