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Evaluating YouTube Videos for Resident Education in Free Flap Surgery

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ABSTRACT

Objective: The ease of access of online videos and the popularity of visual learning have made YouTube a popular educational resource. We analyzed the utility of YouTube videos for graduate medical education about free flap surgery using a cross-sectional study design.

Methods: Using the phrases "free flap surgery" and "free flap head and neck," YouTube videos for inclusion were identified. Videos were analyzed by free flap surgeons using Modified DISCERN, Global Quality Score (GQS), and JAMA Benchmark metrics of video quality, educational value, and transparency, respectively. Statistical analysis of video metadata and expert-determined scores was performed.

Results: In total, 44 videos with 517,227 combined views were analyzed. Most videos were intra-operative (63.6%), published by physicians (34.1%) or medical institutions (22.7%), and had health professional target audiences (95.5%). The mean Modified DISCERN score was 15.4/25, with most videos classified as "fair" (54.6%). The mean GQS was 4.17/5 and the mean JAMA Benchmark was 2.7/4. Higher Modified DISCERN scores were significantly associated with health professional target audiences ($p = 0.04$) and webinars ($p = 0.03$). Higher GQS was also significantly associated with a health professional target audience ($p < 0.01$), and higher JAMA scores with YouTube verification ($p = 0.04$).

Conclusion: Routine YouTube searches may not yield results ideal for resident education in head and neck free flap surgery. While many videos are of good educational value, lower transparency and reliability scores raise concerns of biased information. It is important to consider vetted educational or health care sources for resident surgical education.

Level of Evidence: Level IV (cross-sectional study).

1 | Introduction

YouTube is the world's second most popular search engine, boasting more than two billion users per year and a billion hours of video viewed per day [1]. Given its ubiquity, it is unsurprising that it is utilized as an educational tool by undergraduate and graduate medical learners. This is particularly pervasive in surgical education, given the visual nature of surgical anatomy and procedures. One single-center survey found that 95% of fourth-year medical students pursuing general surgery and general surgery residents and 83% of attending surgeons used video content to prepare for surgical procedures [2]. Residents are also significantly more likely to utilize video-based education than attending surgeons, significantly more likely to use YouTube videos over Academy or Society-validated videos, and more likely to value videos that include intra-operative procedural narration [2, 3].

Creating, posting, and accessing online videos through platforms such as YouTube have very almost no barrier to entry, benefitting educators and trainees globally. However, without any regulation of the accuracy or quality of available content, there could be variability in the validity of the information being accessed by surgical learners [4].

YouTube as an educational tool for patients has been a popular research topic in the past five to ten years, with more than 202 research articles published assessing the utility of YouTube for patient education by 2020. Fewer articles address the topic of YouTube videos for graduate medical education. A 2021 systematic review of 31 studies of YouTube video quality for graduate medical training found that while there are many easily accessible videos intended for professional medical education on YouTube, they were not of high educational value and were highly variable in quality according to validated scoring systems [5]. However, few of the included studies were in the domain of head and neck surgery and fewer still addressed complex microsurgical procedures such as free flaps.

This study specifically evaluates the role of available YouTube videos for resident education in free flap harvest and reconstruction surgery given the highly technical nature of these procedures. As such, we sought complete a qualitative analysis of the utility of YouTube videos as a means of graduate and professional medical education using both video metrics and expert scoring. These metrics were used to further compare routine search-generated video results to videos from YouTube-verified health care channels and videos that are expert-validated and to those specifically marketed toward graduate medical learners in head and neck surgery, as there are currently no studies that have comprehensively investigated this relationship.

2 | Methods

2.1 | Video Selection

The terms "Free flap head and neck" and "Free flap surgery" were searched on December 15, 2022, in an incognito window of Google Chrome web browser with all cookies and cache data cleared to minimize tailored video search results. The search was also completed using a VPN internet connection to a New York server. Broad search terms were chosen over terms more specific to types of flaps to capture a larger breadth of videos viewed by a larger audience. Search results were sorted with the default setting of "relevance" and other default search settings. Following the methodology of similar studies that analyzed YouTube videos, the first 50 results from each search were selected for screening to be included in the study, for a total of 100 screened videos. Videos were then added to a private playlist for review. Inclusion criteria were English language videos. Exclusion criteria were videos not in English, videos without voice narration, video duplicates (within or between searches), and videos not specific to free flap procedures in the domain of head and neck surgery. Videos from the expert-verified Toronto Video Atlas of Surgery (TVASurg) series on flap harvests for head and neck surgery were analyzed separately and were compared to routine video search results on YouTube. All videos from the American Academy of Otolaryngology—Head and Neck Surgery's *Oto Logic* educational platform course on Free Flaps for Head and Neck Reconstruction were also analyzed separately and compared to routine search result videos from YouTube. This study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines for cross-sectional studies.

2.2 | Video Metrics and Categorization

Our primary outcome was the description of videos in terms of subjective characteristics of educational adequacy. Secondary objectives included objective video descriptions and statistical associations among video characteristics.

Videos were accessed via YouTube and all data were collected from what was publicly available. Video data collected included video title, publisher, date published, views, likes, dislikes, number of comments, and duration. View ratio (VR = views/day since upload), like ratio (LR = (likes $\times$100)/(likes + dislikes)), and video power index (VPI = (VR $\times$ LR)/100), which have been validated and used by previous studies [6], were calculated using gathered video metadata. The video power index quantifies the relative popularity of YouTube videos. Additionally, YouTube search data between January 1, 2008, and December 15, 2022, were also accessed via Google Trends to assess overall trends in searches.

Videos were categorized into six types: advertisement, webinars/informational videos, intra-operative videos, patient perspectives, and animations. Publishers were categorized into eight types: medical institutions/universities/hospitals, medical societies, medical journals, independent physicians, medical device/pharmaceutical companies, independent educational enterprises/users, and other. Intended audiences were categorized into health care professionals, patients, and other. Videos were further categorized into eleven flap categories: radial forearm flap, fibula flap, rectus abdominus flap, latissimus dorsi flap, pectoralis major flap, anterolateral thigh flap, scapula tip, lateral arm flap, ulnar flap, multiple, and other. Videos were categorized further into YouTube-verified health care providers, educators, or medical journals, or non-accredited videos. Expert-verified videos from *TVASurg* and *OTO Logic* were also designated.

To limit bias, video quality was subjectively and independently assessed by two head and neck oncology fellowship-trained surgeons who perform microvascular reconstruction (CB, NG) using the Modified DISCERN, Global Quality Scores, and JAMA Benchmark. Modified DISCERN (mDISCERN) is a 25-point score that rates five criteria: achievement video aims, reliability of information sources, bias of presented information, availability of additional information sources for viewer reference, and mention of areas of uncertainty (Table S1) [7]. Global Quality Score (GQS) is a subjective four-point score that assesses the quality, flow, relevancy, and utility of information in videos (Table S2) [8]. GQS was determined for learner-specific audiences. Journal of the American Medical Society (JAMA) Benchmark is a four-point score that evaluates authorship, attribution, disclosure, and currency of selected videos (Table S3) [9].

Expert reviewers did not have access to video characteristics nor to each other's ratings until after their reviews were complete to avoid potential bias.

2.3 | Statistical Analysis

Categorical data were reported as rates and proportions, while continuous data were reported as means and standard errors. Agreement of rater scores was determined using Kendall's W and reported as Kendall's coefficient of concordance and degree of agreement. Normality of numerical data distribution was determined to be non-normal with the Shapiro–Wilk test for normality and non-parametric tests were used in later analyses to assess associations of video characteristics to average expert mDISCERN, GQS, and JAMA Benchmark scores. Continuous-continuous variable comparisons were completed using Spearman's rank correlation and reported using rho and *p-value*. Continuous-categorical comparisons were completed using the Kruskal-Wallis rank sum test and reported using the H statistic and *p-value* and post hoc tests Dunn's tests were reported using *p values*. Categorical-categorical comparisons were completed using Fisher's Exact Test and reported as a *p value*. Global quality score and JAMA benchmarks were considered as categorical variables. Missing objective data (e.g., if comments were disabled on a video) was excluded from statistical analyses. Significance was defined as $p < 0.05$ for all statistical tests. All statistical analyses were done using R Statistical Software v4.2.2 [10].

This study was deemed to be not human research and therefore exempt from review and approval by the Pennsylvania State University Institutional Review Board (STUDY00021777).

3 | Results

3.1 | Video Characteristics

Forty-four videos with 517,227 combined views met our inclusion criteria and were included in our analysis. Sixty-six videos were either duplicates or lacked relevance and were excluded.

Most included videos were intra-operative ($n = 28$, 63.6%), followed by webinars for health professionals ($n = 9$, 20.5%). Videos were primarily produced by physicians ($n = 15$, 34.1%), health care institutions ($n = 10$, 22.7%), and independent educators ($n = 8$, 18.2%). Among included videos, ten (22.7%) were produced by health care organizations or institutions verified by YouTube and identified as such on the video webpage. Additionally, seven videos (15.9%) were validated by educational experts in otolaryngology. Fibula flaps ($n = 9$, 20.5%), radial forearm flaps ($n = 7$, 15.9%), and anterolateral thigh flaps ($n = 6$, 13.6%) represented the greatest proportions of included videos. Included videos had an average of 3.85 years online ± 131.8 days, 100.5 likes (± 20.9), and 11,755 views (± 2426), contributing to an average video power index (VPI) of 7.1 ± 1.3 (Table 1). Google Trends data showed that relative search interest on YouTube was highest for our search terms from 2008 to 2010 and again from 2012 to 2016, with a consistent decline in relative search interest overall (Figure 1).

TABLE 1 | Summary of video characteristics and expert scoring.

Views	11,755 ± 2426
Days online	1406 ± 131.8
Likes (m.d.[a] = 5)	100.5 ± 20.9
Dislikes (m.d. = 5)	4.9 ± 1.3
Comments (m.d. = 5)	5 ± 1.0
Duration (seconds)	1143 ± 193
Video power index (m.d. = 5)	7.1 ± 1.3
Publisher type, *n* (%)	
Physician	15 (34.1)
Institute	10 (22.7)
Independent educator	8 (18.2)
Society	5 (11.4)
Journal	5 (11.4)
Other	1 (2.3)
Video type, *n* (%)	
Operative video	28 (63.6)
Webinar	11 (25.0)
Animation	5 (11.4)
Target audience, *n* (%)	
Health professionals	42 (95.5)
Patients	2 (4.5)
Flap type, *n* (%)	
Fibula flap	9 (20.5)
Radial forearm flap	7 (15.9)
Anterolateral thigh flap	6 (13.6)
Latissimus dorsi flap	2 (4.5)
Lateral arm flap	2 (4.5)
Scapula tip flap	2 (4.5)
Ulnar flap	1 (2.3)
Multiple flaps	11 (25.0)
Other flaps	4 (9.1)
YouTube verification	10 (22.7)
Expert verification (*TVASurg, OTO Logic*), *n* (%)	7 (15.9)

[a]m.d. = missing data.

3.2 | Expert Scoring

Expert scoring agreement measured by Kendall's W found that substantial agreement for all metrics ($W = 0.63$, 0.75, 0.64 for mDISCERN, GQS, JAMA Benchmark, respectively). The mean mDISCERN score for included videos was 15.4/25 (± 0.33), with most videos classified as "fair" (54.6%) (Table 2, Figure 2). The mean GQS was 4.17/5 (± 0.14), with most videos

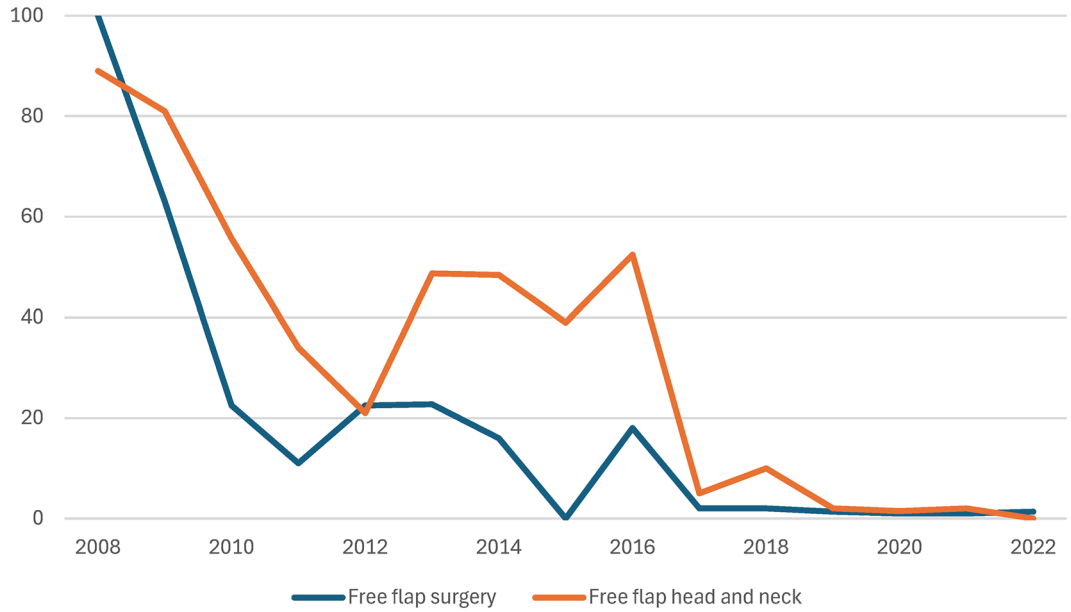

FIGURE 1 | Relative search frequency of search terms.

TABLE 2 | Summary of video expert scoring.

Scoring	Rater agreement (Kendall's W)	Mean score
Modified DISCERN Criteria	0.63; substantial agreement	15.41 ± 0.33
Global Quality Score	0.75; substantial agreement	4.17 ± 0.14
JAMA Benchmark	0.64; substantial agreement	2.71 ± 0.20

classified as "excellent" for resident education ($n = 31$, 70.5%) (Table 2, Figure 3). Mean JAMA Benchmark score was 2.7/4 (± 0.20) (Table 2).

3.3 | Statistical Relationships

Statistical analysis showed that operative videos had statistically better popularity based on the Video Power Index ($p < 0.01$) while other video characteristics like publisher type, target audience, flap type, YouTube validation, or outside validation had no significant relationship to a video's relative popularity. Higher mDISCERN scores were significantly associated with independent educators ($p = 0.01$), webinars ($p < 01$), and health professional target audiences ($p = 0.04$). Higher GQS was significantly associated with a health professional target audience ($p < 0.01$) and webinars ($p < 0.01$). Higher JAMA scores were also associated with independent educators as well as journal publishers, while lower scores were associated with physicians and independent uploaders ($p < 0.01$ for all). YouTube-verified sources were associated with higher GQS and JAMA Benchmark scores, but not higher mDISCERN scores ($p = 0.03$, $p = 0.04$, $p = 0.06$, respectively), while expert-verified or produced videos were significantly higher mDISCERN and JAMA Benchmark, but not higher GQS scores ($p < 0.01$, $p < 0.01$, $p = 0.59$, respectively) (Table 3).

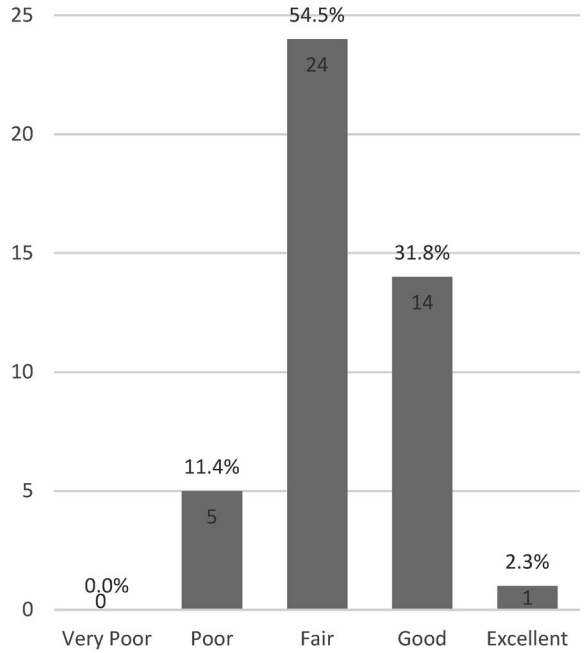

FIGURE 2 | Modified DISCERN quality scores.

4 | Discussion

Video-based education has become a mainstay for medical learners. Our study finds that routine YouTube searches for resident education in head and neck free flap surgery yield inconsistent results. For graduate medical learners, our searches provided near-instant access to popular YouTube videos on more than 10 free flap types in head and neck surgery, most of which were produced for health professional use. Additionally, many of these videos were evaluated to be of excellent educational quality for residents according to GQS scores. However, mDISCERN scores of factual completeness indicated that a minority of videos fell into good or excellent categories. However, higher mDISCERN scores of factual completeness were most

strongly associated with health profession webinar videos and health profession target audiences.

JAMA transparency scores of included videos were low (2.7/4) for reliable resident education. Further, while videos validated by YouTube and external institutional educators had higher JAMA transparency scores, this did not translate to associations with higher mDISCERN nor GQS scores—in fact, higher mDISCERN scores were significantly associated with videos *not* validated by YouTube. This could mean that more thoroughly cited videos leading to verification may not correlate with factual accuracy. This idea is further supported by findings that VPI did not correlate with higher measures of quality, accuracy, or transparency. Thus, a strategy of choosing videos with a high number of views, likes, or comments is also not a reliable method of accessing high-quality surgical education material on YouTube.

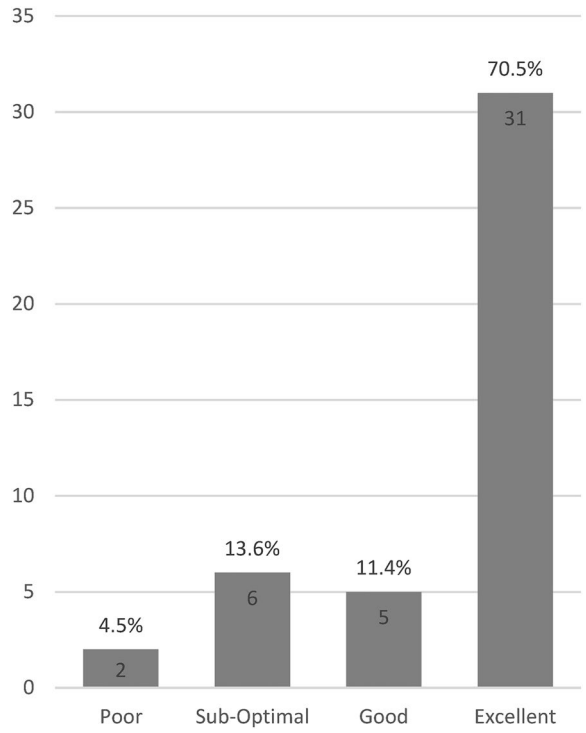

FIGURE 3 | Global Quality Scores for resident education.

A 2017 study of 13 resident physicians who curated videos meant to supplement graduate medical education in otology showed that residents not only found the videos useful, but found that the ease of the video format made learning more efficacious [11]. Further, a 2022 survey-based study demonstrated that among 91 resident learners, traditional educational resources like textbooks were judged to be less useful when compared to internet or video resources, with video resources being ranked the most valuable to learning [12]. A 2021 systemic review of 31 studies of YouTube video quality for graduate medical training found that few videos posted on YouTube presumably for education purposes achieved high scores with quality rating tools [5]. Further, recent studies of operative-based videos, which made up the majority of videos included in the present study, found that they were rarely comprehensive enough to provide sufficient stand-alone education [4, 13]. These educational shortcomings in instructional videos for complex surgical techniques can have disastrous consequences for patients. Recent controversy and outcry resulted from a 2022 surgeon survey and subsequent 2023 New York Times investigation finding that 23% of surgeons performing component separation for robotic hernia repair were self-training (post-residency) using YouTube and Facebook videos, many of which were found to demonstrate inappropriate and incorrect techniques that led to numerous reports of patient harm [14, 15].

Our study supports these findings with variable scores reflecting factual accuracy and transparency (mDISCERN, JAMA Benchmark), despite a high proportion of videos scoring highly in quality of information presentation for resident education (GQS). Further, aside from consistent findings that webinars, which tend to be longer and more lecture-based in nature, were significantly associated with higher factual accuracy and video quality scores, few characteristics of included videos related directly to scoring outcomes of included videos. This further complicates the task of the user to select a high-quality surgical education video using a YouTube search. We suggest, as have other authors [16], that YouTube should improve its ranking and

TABLE 3 | Statistical comparisons of video characteristics and average expert scores. Continuous-continuous variable comparisons were completed using Spearman's rank correlation and reported using rho and *p-value*. Continuous-categorical comparisons were completed using the Kruskal-Wallis rank sum test and reported using the H statistic and *p-value*. Categorical-categorical comparisons were completed using Fisher's Exact Test and reported as a *p-value*. Global quality score and JAMA benchmarks were considered as categorical variables.

	Modified DISCERN		Global quality score		JAMA benchmark	
	Statistic	***p***	**Statistic**	***p***	**Statistic**	***p***
Video power index	−0.09	0.60	11.65	0.11	2.26	0.52
Publisher type	15.65	0.02		0.10		<0.001
Target audience	4.40	0.04		0.004		0.71
Video type	17.03	<0.001		0.002		0.08
Flap type	5.65	0.69		0.65		0.68
YouTube verification	0.06	0.80		0.03		0.04
Expert verification	6.84	0.009		0.59		0.004

recommendation algorithm to promote higher-quality content, perhaps even stratifying by health professional versus patient audiences.

Within otolaryngology, there is a continued need for more robust, validated, and readily available learning resources. Currently, there exist several validated educational platforms like *COCLIA*, *OTOSource*, *OTO Logic, AcademyU*, and *FLEX*, though many require a paid subscription and may be more arduous to access compared to the relative ease and free nature of accessing YouTube. Other authors have compared paid video resources to those found on YouTube, finding that educational quality was more closely based on individual video content rather than whether or not they were behind a paywall [17]. Other resources like the Iowa Head and Neck Protocols and Headmirror.com produce free video content on a voluntary basis, but there could be more effort to incentivize academic institutions, physicians, and societies to produce, peer review, and publish professional medical education videos. Our study also demonstrates the availability of high-quality, free videos, but the issues of distribution, access, transparency, and validation remain. One promising new resident resource is the Otolaryngology Core Curriculum produced by the American Academy of Otolaryngology-Head and Neck Surgery [18]. This module-based curriculum has the potential to be widely used by residents, though issue of accessibility remains due to its subscription-based model and the ability to easily to search a library of surgical videos will need to be developed. It is important for trusted professional societies and academic institutions to also produce high-quality free content on platforms like YouTube, which is already attracting and influencing learners. Concurrently, standardization of validated review tools for educational material such as those used in this study should also be widely implemented and used to assess videos included in this and other resources. On the individual residency program level, learners should be provided with and directed to resources validated by the program or an outside institution as comprehensive and in-line with residency training goals. Learners should be cautioned against using YouTube as a learning tool and should be encouraged to discuss learned material with their faculty surgeon prior to and during surgical procedures. Faculty could also use the metrics included in this study to evaluate the educational adequacy of video materials they provide.

The current study is the first to examine the quality of videos in head and neck free flap surgery for graduate medical education using metrics comparable to previous studies examining the educational quality of YouTube videos. We were able to base our study on the previously published protocols of past authors in this topic space and use externally validated, standardized video quality review tools, which strengthened the validity of our results [5]. Notably, this differs from previous works looking at head and neck free flap surgical videos for surgical education [17], a difference that allows for greater comparability and relevance of our findings. However, it is also important to note that while these video metrics are global, unbiased, and validated in nature, they are not well adapted to assessing for accuracy or adequacy of specific facts for the subject matter and their application is at least partially up to the interpretation of the user. We also employed a large sample of videos and the input of surgeons performing free flap surgeries into our study. However, our study also had several limitations. First, our search terms were chosen to yield desired results of videos of free flaps in head and neck surgery. Given this, we recognize that residents may have used different or less specific search terms to research free flap procedures for head and neck cancer surgery. Further, involving residents and patients in the video review process would have augmented the value of our results for the education of these respective groups. Future works involving both residents and educational faculty could even compare resident and faculty perceptions of the same online educational material to evaluate differences in learner vs. educator goals in addition to analyzing the videos themselves.

5 | Conclusions

Routine YouTube searches may not yield results ideal for resident in head and neck free flap surgery. While many videos are of good educational value for residents, lower transparency and reliability scores raise concerns of biased information. It is important to consider and produce vetted educational or health care sources for resident education in head and neck free flap surgery procedures.

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Disclosure

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Ethics Statement

Exempt by Pennsylvania State University Institutional Review Board—STUDY00021777.

Conflicts of Interest

The authors declare no conflicts of interest.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.