Original Article

Evaluation of YouTube videos as a patient education source for novel surgical techniques in thyroid surgery

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Background: Patients and physicians are increasingly utilizing online video sharing sites such as YouTube for obtaining and disseminating health-related information in multimedia format; however, due to its free, open-access platform, YouTube videos fall short in providing validated, up-to-date medical information, and may even convey unintended messages to patients who are seeking additional information on surgeries. We evaluated the relevance, reliability, and quality of YouTube videos on novel surgical techniques in thyroid surgery.

Methods: The top 50 indexed YouTube videos for the queries, "robotic thyroid surgery" and "transoral thyroid surgery", were assessed by two independent reviewers for video quality and reliability for patient understanding. Videos were scored using Global Quality Score (GQS), a scale for video quality, and DISCERN Scoring, a questionnaire for reliability and quality measures of information presented.

Results: The mean ± standard deviation (SD) duration of the videos (n=50) was 8.1±3.7 minutes. Total views were 261,440 and the mean ± SD time since upload was 3.6±2.6 years. The median and interquartile range of video power index (VPI) was 1.9 (0.5–3.7), GQS was 3.0 (2.0–4.0), and DISCERN score was 2.8 (2.3–3.2). Most videos were uploaded by physicians (75.8%) and the highest number of videos (63.6%) uploaded were from the United States (US). Videos with higher quality and reliability scores were uploaded by academic professionals, and included videos of physicians who described procedural information, perioperative instructions, and possible postoperative complications ($P<0.05$). Adequate medical information on the procedure and discussion of complications in YouTube videos were independent predictors of advanced educational quality and reliability.

Conclusions: Clinical information on new surgical techniques such as transoral and robotic thyroid surgeries in YouTube videos scored low on quality and reliability as a source of patient education. Physicians should provide supplemental educational material online and offline to aid patient understanding of novel procedures.

Keywords: YouTube; Global Quality Score (GQS); DISCERN; transoral thyroid surgery; robotic thyroid surgery

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Introduction

YouTube has become the largest open-access, video-sharing platform available, gaining over 1.9 billion active monthly users worldwide since its inception in 2005 (1). The interface allows virtually unlimited, free video content for users to view, post comments on, and to indicate likes and dislikes. Little censorship exists from the parent company, and ability to view certain content is only restricted by age verification, regional setting, and parental guidance presets. Medical and health-related content is readily found on YouTube. However, due to a lack of peer review or a verification process for medical information, YouTube videos are at risk of delivering outdated or inaccurate information regarding certain diseases and surgical procedures. Despite its global audience and popular usage, YouTube videos may not contain adequate physician or patient education materials for new surgical techniques (2,3).

A conventional cervical thyroidectomy is performed for indications of thyroid cancer and several benign thyroid diseases, including multinodular goiter, Graves' disease, and Hashimoto's thyroiditis. The thyroidectomy commences with the surgeon first making a low-neck incision. But minimally invasive surgical techniques to avoid a visible neck incision have been evolving, with patients and surgeons having a growing interest in these procedures (4). Robotic thyroid surgery has been done using several different approaches: transaxillary, transoral, bilateral/unilateral axillo-breast, and retroauricular. Transoral robotic thyroid surgery (TORT or TORS) is one of the latest techniques for removing the thyroid and parathyroid glands with robot-assistance. The transoral endoscopic thyroid and parathyroid vestibular approach (TOETVA or TOEPVA) surgery uses a similar incision location to TORT; however, it uses laparoscopic instruments for organ removal. Compared to TOETVA, TORT provides the advantage of a three-dimensional, magnified view; use of articulating instruments; and the ability to control an additional port by the surgeon.

The latest procedural techniques such as the ones described above may be attractive to patients who wish to avoid having a visible scar in the neck after thyroid surgery. Some of the most readily accessible and free sources of medical information for patients to explore are available through the internet. However, insufficient and less comprehensive internet-based information on novel techniques, such as TORT and TOETVA surgeries, may dissuade patients from undergoing the procedure or set misguided expectations for the procedure.

We evaluated the popularity, quality, and reliability of robotic and endoscopic transoral thyroid surgery videos on YouTube using the video power index (VPI), Global Quality Scoring (GQS), and the DISCERN Instrument scoring system. We assessed video content for the presence of procedure-specific information such as risks, benefits, operative details, and peri-operative instructions.

Methods

On March 26, 2019, search results from two keyword phrases, "robotic thyroid surgery" and "transoral thyroid surgery", were compiled using a hypertext preprocessor (PHP) code with a YouTube application program interface (API) developer key. After running the code in Visual Studio Code software with a retrieved YouTube data API developer key, an output of a user interface consisting of modes of selections for input, sorting, and a number of results were produced. Once the inputs were submitted to the user interface window generated by the code, a list of results was generated by the API calling into the YouTube search engine (*Figure 1*). The queries included the top 50 video results sorted by relevance. The videos mostly consisted of robotic and endoscopic transoral thyroid surgery, robotic transaxillary thyroid surgery, and two videos on robotic retroauricular thyroid surgery. No video using bilateral axillo-breast approach for thyroid surgery was assessed. Cookies were deleted prior to the search queries. The source, duration, days since upload, view count, number of comments, and like and dislike counts were tabulated. If comments were blocked, no value was recorded.

The videos were broadly categorized by upload sources such as medical professional, academic institution, commercial, and patient testimonials. Two independent medical professionals, a post-graduate medical student and a graduate researcher, scored each video using the GQS and DISCERN scoring system criteria. Additional parameters determined by the reviewers were viewer intent of the video, putative target audience, demonstration of surgical technique, and involvement of an actual patient. Viewer intent of the video was appraised by the reviewers into categories such as choice of surgical approach, preoperative preparation, postoperative, or educational material for health-care professionals. Choice of surgical approach was marked when the video contained a discussion of different surgical options. Preoperative preparation was defined as the video addressing what to expect before the scheduled surgery. Postoperative was selected when the video discussed

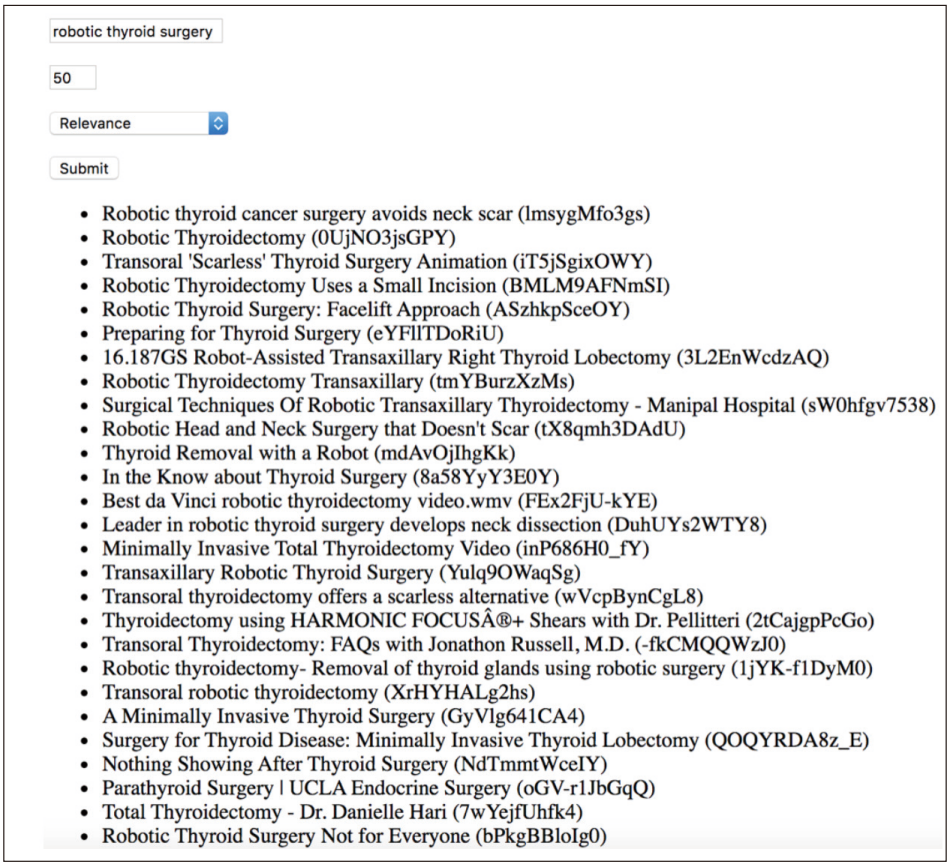

Figure 1 PHP code output. PHP, hypertext preprocessor (HTML-embedded scripting language).

complications after surgery. Educational purpose was indicated when the video discussed medical terminology as second nature and was addressed to healthcare professionals. Putative target audience was categorized into three groups: patients, healthcare professionals, or both. Presence in the video of an array of clinical content including pre-operative preparation, procedure demonstration, surgical technique discussion during the demonstration, postoperative care, or postoperative complications was verified by the reviewers. Videos with a significant discrepancy in scores were reassessed by a second-viewing of the videos to reach a consensus score.

Popularity analysis

The popularity of videos was evaluated with a VPI, which was first described in a YouTube video study on kyphosis (5). Popularity was assessed by VPI (like ratio × view ratio/100), where like ratio represents the like/(like + dislike) percentage, while the number of views per day determined the view ratio. A higher score indicated more popularity for the video.

Quality and reliability assessment

The GQS system, a 5-point scale rating, was first introduced by Bernard *et al.* to evaluate the educational quality of videos (*Table 1*) (6). The DISCERN instrument was applied to assess the quality of the medical information and surgical options provided in each video (*Table 2*) (7). The DISCERN questionnaire includes 16 individual items, each item on a 5-point scale. We modified the DISCERN questionnaire to 15 quality and reliability questions, with a final score ranging from 15 to 75.

Statistical analysis

GraphPad Prism 8 software and SPSS version 23.0 were used for statistical analysis. Quantitative study variables were tested for normality using the Shapiro-Wilk test.

Table 1 Global Quality Scoring (GQS) system

Point	Quality assessment of the content	Information coverage	Patient utility
1	Poor quality	None	Very unlikely to be of any use to patients
2	Poor quality	Some information present	Of very limited use to patients
3	Suboptimal flow	Some information covered but important topics are missing	Somewhat useful to patients
4	Good quality and flow	Most important topic covered	Useful to patients
5	Excellent quality and flow	Most important topic covered	Highly useful to patients

Table 2 DISCERN instrument scoring system

1. Are the aims clear?
2. Does it achieve its aims?
3. Is it relevant?
4. Is it clear what sources of information were used to compile the publication (other than the author or producer)?
5. Is it clear when the information used or reported in the publication was produced?
6. Is it balanced and unbiased?
7. Does it provide details of additional sources of support and information?
8. Does it refer to areas of uncertainty
9. Does it describe how each treatment works?
10. Does it describe the benefits of each treatment?
11. Does it describe the risks of each treatment?
12. Does it describe what would happen if no treatment is used?
13. Does it describe how the treatment choices affect overall quality of life?
14. Is it clear that there may be more than one possible treatment choice?
15. Does it provide support for shared decision-making?

DISCERN: quality criteria for consumer health information (http://www.discern.org.uk/).

Central tendency and dispersion parameters of the data in the form of standard deviation and interquartile ranges were estimated. Mann-Whitney U and Kruskal-Wallis tests were applied for non-parametric variables. Binary logistic regression analysis was performed, and odds ratio (OR) and 95% confidence interval (95% CI) were estimated. Statistical significance was set at $P<0.05$.

Results

Descriptive characteristics related to the top 50 videos from the keyword queries are shown in *Figure 2* and *Table 3*. Assessment of the videos revealed that most videos were uploaded by medical professionals (75.8%). The majority of uploaded videos were from the United States (US) (63.6%), as search queries in English were used and Internet Protocol (IP) address was based in the US (*Figure 2A*,*B*). The 50 videos pertaining to robotic thyroid surgeries and transoral thyroid surgeries added up to a total run time of 8.45 hours with a mean ± standard deviation (SD) duration of 8.1±3.7 minutes per video (*Table 3*). The videos had been viewed 261,440 times to date and the mean ± SD interval since upload was 3.6±2.6 years. All videos were in English. The videos collectively had received a total of 80 comments, 1,045 likes and 203 dislikes. Procedure information was available in 89.4% of the videos, details of the surgical

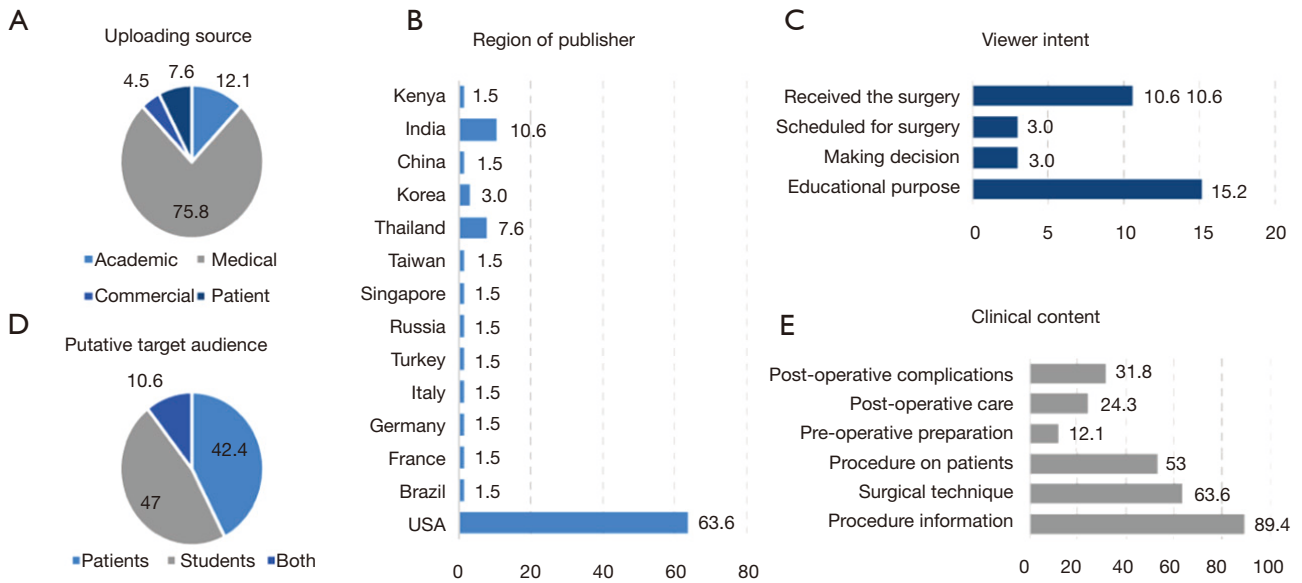

Figure 2 Descriptive statistics on the YouTube videos. (A) Uploading source distributes amongst academic, medical, commercial, and patient. (B) Region of publisher is the video's origin. (C) Viewer intent describes viewer's position. (D) Putative target audience of video's viewers. (E) Clinical content covers key components discussed in the videos.

Table 3 Effectiveness measures for YouTube videos

Video data	Mean ± SD	Median (Q1–Q3)	Range
Video properties			
Publication duration, days	1,305±957.1	1,156 (507–2,134)	65–3,253
Video duration, minutes	8.1±3.7	9.23 (4.2–12.0)	1.43–12.7
Viewer interactions			
Number of views	3,961.2±7,081.2	2,029 (446–6,193)	34–45,586
Number of comments	1.23±3.1	0 (0.0–2.0)	0–16
Number of likes	15.8±35.0	9.0 (3.0–17.0)	0–225
Number of dislikes	3.0±4.8	1.0 (0.0–5.0)	0–19
Video assessment			
Popularity (VPI score)	4.27±11.9	1.9 (0.5–3.4)	0.0–85.87
Quality (GQS score)	3.03±0.91	3.0 (2.1–3.9)	1.5–4.5
Reliability (DISCERN score)	2.79±0.54	2.8 (2.3–3.2)	1.8–4.3
Benefits score	2.98±1.55	3.0 (1.0–4.4)	1.0–5.0
Risk score	1.46±0.92	1.0 (1.0–1.5)	1.0–5.0

SD, standard deviation; Q, quartiles; VPI, video power index; GQS, global quality score.

Table 4 Correlation analysis between videos characteristics and assessment scores

Video assessment	VPI score, r (P value)	GQS score, r (P value)	DISCERN score, r (P value)
VPI score	–		
GQS score	0.14 (0.29)	–	
DISCERN score	0.08 (0.57)	0.87 (<0.001)	–
Publication duration	–2.00 (0.15)	0.09 (0.44)	0.16 (0.19)
Video duration	0.09 (0.50)	0.003 (0.97)	0.003 (0.98)
Number of comments	0.47 (<0.001)	0.001 (0.99)	0.13 (0.27)

Data is represented as correlation coefficient (r) and P values. Spearman's correlation test was applied. VPI, video power index; GQS, Global Quality Score.

techniques were discussed in 63.6%, and actual footage of surgery was demonstrated in 53% of the videos (*Figure 2E*). Postoperative complications were mentioned in 31.8% of the videos, postoperative care instructions in 24.3%, and pre-operative preparation instructions in 12.1%. Perceived intentions of the videos were 15.2% for educational purposes, 10.6% for patients who already underwent surgery, 3% for patients who are scheduled for surgery, and 3% for potential patients making a decision on surgery (*Figure 2C*). Videos that did not specify one category as perceived intent or fit multiple categories accounted for 68.2%. Putative target audience was 47% for healthcare professionals, 42.4% for patients, and 10.6% for both (*Figure 2D*).

Quality assessment median values and interquartile ranges were 1.9 (0.5–3.7) for VPI, 3.0 (2.0–4.0) for GQS, and 2.8 (2.3–3.2) for DISCERN score (*Table 3*). The benefits score from the DISCERN scoring had a median and interquartile range of 3.0 (1.0–4.6), while the risk score was 1.0 (1.0–2.0) (*Table 2*). GQS and DISCERN scores were positively correlated (r=0.876, P≤0.001) (*Table 4*).

No significant difference in popularity was found among the videos. However, higher quality and reliability-scoring videos were uploaded by academic institutions and contained less medical jargon to explain the procedure, perioperative care, and postoperative complications (*Table 5*). The linear regression model suggested that the videos with accurate procedural details or postoperative complication information significantly increased the educational quality and reliability, as they were most frequently found to be absent in the videos (*Table 6*).

Discussion

YouTube, as one of the most widely-used video sharing social platforms, is growing in daily uploads and popularity in the medical community (8). The number of patients who are utilizing online searches to enhance their understanding and aid decision-making for health-related purposes is increasing as well (9). Unfortunately, patients who rely on YouTube videos as their primary source of medical information may be influenced by biased or outdated information.

The first YouTube video study for assessing the quality and reliability of medical information was conducted by Keelan *et al.* (10). Several other studies that followed also showed consistently lower reliability and quality of medical videos (5,11-14). Videos produced by academic institutions discussing specific procedures, perioperative care instructions, risks/benefits, and those focusing on actual patient scenarios were deemed the highest in quality and reliability.

Robot-assisted thyroid surgeries continue to evolve and gain acceptance because of the equivalent complication rates and clear cosmetic superiority to traditional cervical approaches (15-20). However, robotic thyroid surgeries are still not widely performed. A majority of studies on robotic thyroid surgery are from South Korea and are based on patients who have lower body mass index and who may be undergoing thyroid surgeries for different indications from those patients with the most frequent indications for thyroidectomy in the US (21-24). In the US, robot-assisted thyroidectomy had seen a steady increase in volume from 2009 to early 2011, but then declined from mid-2011 to 2013 (25). The downtrend in the number of cases has been attributed to higher costs for robotic surgery, the steep learning curve to master the advanced technique, and the overall higher complication rate at lower-volume centers (25,26). A few meta-analyses since have shown robot-

Table 5 Association of video characteristics with popularity, quality, and reliability scores

Video characteristics	VPI score		GQS score		DISCERN score	
	Median	P value	Median	P value	Median	P value
Source						
Academic	1 (0.1–12)	0.26	4.0 (3.5–4.5)	0.010	3.3 (2.9–3.4)	0.004
Medical	4.3 (2.6–6.1)		–		2.1 (2.0–2.3)	
Commercial	1.9 (0.5–3.4)		3.0 (2.0–3.6)		2.8 (2.3–3.1)	
Patient	0.8 (0.2–1.8)		3.0 (3.0–3.7)		3.1 (2.8–3.5)	
Target audience						
Patients	1.2 (0.3–4.0)	0.58	4.0 (3.0–4.3)	0.002	3.1 (2.8–3.3)	0.032
Students	2.0 (0.9–3.5)		2.5 (2.0–3.0)		2.6 (2.1–2.9)	
Both	2.6 (1.4–6.2)		2.5 (2.0–3.7)		2.5 (2.2–3.3)	
Viewer intention						
Educational purpose	2.6 (1.2–5.4)	0.12	2.2 (2.0–3.1)	0.06	2.7 (1.9–3.0)	0.34
Decision aid	3.19 (1.1–5.2)	0.61	3.7 (3.0–4.5)	0.31	3.3 (3.0–3.6)	0.17
Postoperative care	2.9 (0.3–8.3)	0.45	3.7 (2.8–4.1)	0.08	3.1 (2.6–3.3)	0.17
Clinical content						
Procedure information	2.0 (0.8–3.4)	0.09	3.0 (2.1–4.0)	0.023	2.8 (2.3–3.2)	0.027
Surgical technique	2.0 (0.5–3.4)	0.49	2.5 (2.0–3.5)	0.010	2.7 (2.3–3.0)	0.033
Procedure on patients	1.7 (0.5–3.3)	0.89	2.5 (2.0–3.3)	0.008	2.7 (2.1–2.9)	0.019
Preoperative preparation	2.0 (0.4–4.6)	0.91	4.0 (3.5–4.5)	0.005	3.1 (2.9–3.6)	0.018
Postoperative care	1.7 (0.3–2.8)	0.51	3.7 (3.1–4.3)	0.005	3.1 (2.9–3.3)	0.009
Postoperative complications	2.0 (0.3–5.1)	0.89	4.0 (3.5–4.5)	<0.001	3.2 (3.0–3.6)	<0.001

Data is represented as median and interquartiles. Mann-Whitney U and Kruskal-Wallis tests were used. Tukey HSD was applied for multiple comparisons. VPI, video power index; GQS, Global Quality Score.

assisted transaxillary thyroidectomy to be as effective and safe as conventional cervical and endoscopic approaches when performed by high-volume surgeons (27,28).

A majority of the videos with a high VPI demonstrated lower overall quality and reliability scores. Patient-targeted videos with higher scores included sufficient procedure details as well as preoperative and postoperative instructions. Markers of high-quality videos for patient understanding included the following: a professional introduction with relevant academic and hospital credentials; the addition of visual aids for procedural content; live technique demonstrations; inclusion of medical terminology definitions; presenters speaking in concise, spaced intervals; and discussion of frequently asked questions including risks/complications, postoperative care instructions, and citation of references and resources.

Limitations of our study include a small number of reviewed videos for each keyword and inability to account for geographical bias resulting from the IP address and language selection. Transoral endoscopic thyroid surgeries have been performed over the longest period of time in Thailand, and TORT is rarely performed outside of South Korea. Procedural and perioperative care instruction videos intended for Thai and Korean patients may be of higher informational quality than the videos that were found in English. Another shortcoming of this study is that it used only two video reviewers who both have a medical background; thus, judging was not representative of the general public. The introduction of subjective bias in the video scoring may be minimized in future studies by the

Table 6 Independent predictor for higher quality and reliability of YouTube videos

Category	GQS score		DISCERN score	
	Regression coefficient (95% CI range)	P value	Regression coefficient (95% CI range)	P value
Upload source	–0.22 (–0.51 to 0.007)	0.08	–0.19 (–0.29 to 0.02)	0.09
Upload duration	–0.01 (0.00 to 0.00)	0.92	0.11 (0.00 to 0.00)	0.32
Video duration	–0.016 (–0.055 to 0.04)	0.88	0.002 (–0.03 to 0.03)	0.98
Target population	–0.26 (–0.71 to 0.23)	0.06	–0.10 (–0.30 to 0.14)	0.46
Procedure information	0.28 (0.18 to 1.41)	0.012	0.26 (0.07 to 0.82)	0.021
Surgical technique	–0.26 (–1.05 to 0.07)	0.08	–0.29 (–0.66 to 0.01)	0.06
Procedure on patients	0.05 (–0.40 to 0.59)	0.69	0.09 (–0.20 to 0.40)	0.51
Preoperative preparation	0.17 (–1.96 to 1.25)	0.14	0.03 (–0.38 to 0.50)	0.79
Postoperative care	–0.08 (–0.79 to 0.41)	0.53	–0.04 (–0.42 to 0.31)	0.77
Postoperative complications	0.30 (0.11 to 1.06)	0.016	0.45 (0.23 to 0.82)	0.001

GQS, Global Quality Score; CI, confidence interval.

inclusion of more reviewers of varying backgrounds such as healthcare consumers, medical students, and representative age groups.

Conclusions

The medical information presented in YouTube videos pertaining to robotic thyroid surgery and transoral thyroid surgery scored low in quality and reliability as patient education material. Physicians should aim to increase the quality and reliability of the videos by providing better explanations of risks for patient understanding, using visual aids, and discussing postoperative complications and care instructions to support patients' decisions on novel surgical techniques for thyroid surgery.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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