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Quality of information on YouTube about artificial intelligence in dental radiology

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Abstract

Objectives: This study was designed to investigate Artificial Intelligence in Dental Radiology (AIDR) videos on YouTube in terms of popularity, content, reliability, and educational quality.

Methods: Two researchers systematically searched about AIDR on YouTube on January 27, 2020, by using the terms "artificial intelligence in dental radiology," "machine learning in dental radiology," and "deep learning in dental radiology." The search was performed in English, and 60 videos for each keyword were assessed. Video source, content type, time since upload, duration, and number of views, likes, and dislikes were recorded. Video popularity was reported using Video Power Index (VPI). The accuracy and reliability of the source of information were measured using the adapted DISCERN score. The quality of the videos was measured using JAMAS and modified Global Quality Score (mGQS) and content via Total Concent Evaluation (TCE).

Results: There was high interobserver agreement for DISCERN (intraclass correlation coefficient [ICC]: 0.975; 95% confidence interval [CI]: 0.957–0.985; P: 0.000; $P < 0.05$) and mGQS (ICC: 0.904; 95% CI: 0.841–0.943; P: 0.000; $P < 0.05$). Academic source videos had higher DISCERN, GQS, and TCE, revealing both reliability and quality. Also, positive relationship of VPI with mGQS (30.1%) (P: 0.035) and DISCERN (38.1%) (P: 0.007) is detected. The scores revealed 51.9% relationship between mGQS and DISCERN (P: 0.001); and educational quality predictor scores revealed 62.5% relationship between TCE and GQS (P: 0.000).

Conclusion: Despite the limited number of relevant videos, YouTube involves reliable and quality videos that can be used by dentists about learning AIDR.

KEYWORDS
artificial intelligence, deep learning, dental radiology, internet, YouTube

1 | INTRODUCTION

YouTube is a free video sharing service that became the largest and most popular video hosting platform and second largest search engine. second to only Google.[1] Convenience of access from personal computers, laptops, tablets, and smart phones facilitates gaining data from the loaded videos. Traditional learning methods, such as searching through books, journals, conferences, and consultations; are not as popular as medical Web-based databases, webinars, and YouTube videos.[2] On the other hand, video uploading is not subject to quality evaluation
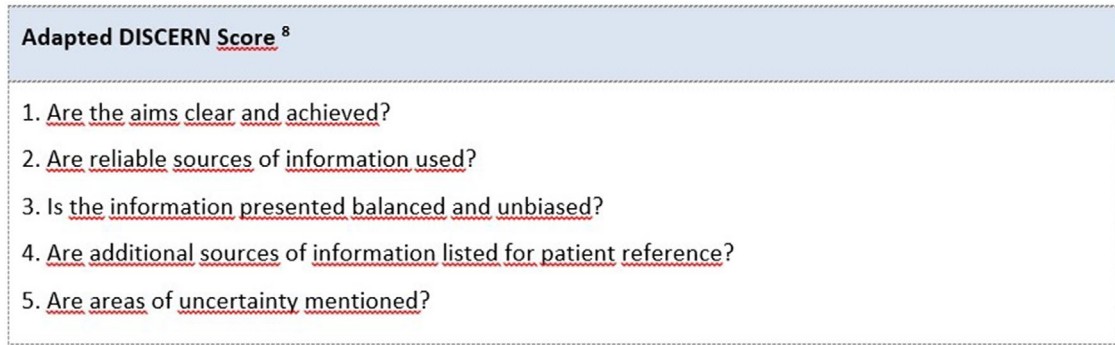
Adapted DISCERN Score [8]

1. Are the aims clear and achieved?

2. Are reliable sources of information used?

3. Is the information presented balanced and unbiased?

4. Are additional sources of information listed for patient reference?

5. Are areas of uncertainty mentioned?

FIGURE 1 Adapted DISCERN score, for reliability of information

or preliminary review, thus validity of the data is a great concern.[3,4] There are a number of academic studies about diverse branches of medicine and a few newly introduced studies about dentistry involving YouTube.[5-8] The investigations depend on determining reliability and quality of information in dentistry, using a range of appropriate discipline-specific search terms.

Numerous studies reveal that the content quality of information for laypersons on health on websites is mostly poor.[9,10] Quality-based studies of YouTube content for information concerning dentistry (ie, orthodontics, botulinum toxin for bruxism, impacted canines, dental implants, etc) have been performed.[7,11-13] Literature reviews reveal that quality and accuracy of information on Artificial Intelligence in Dental Radiology (AIDR) have yet to be evaluated.

The trending topic in dental radiology in recent years is artificial intelligence. The purpose of this study was to evaluate the popularity, content, reliability, and educational quality of the information source of the videos on AIDR on YouTube for dentists.

2 | METHODS

2.1 | Video selection

The YouTube online library (https://www.youtube.com) was searched using the terms "Artificial Intelligence In Dental Radiology (AIDR)," "Machine Learning In Dental Radiology (MIDR)," and "Deep Learning In Dental Radiology (DLDR)" on January 27, 2020. The search was performed in English and the first 60 videos based on each term were recorded for evaluation.[1]

Two independent researchers, a dentomaxillofacial radiologist and an endodontist with at least 10 years of experience, viewed and assessed the videos. The YouTube account of 1 of the researchers was used for the study. Since the study involved evaluation of public-open videos, no

ethical board approval was taken. Popularity, content, reliability, and educational quality of information in the videos were evaluated.

Video exclusion criteria were: non-English, duplicate, irrelevant, sustained (videos > 15 minutes), no sound or visuals, and advertisements. Videos that did not meet these criteria were accepted and evaluated as relevant videos. All related video links were sorted by "sort by view-count" with no additional filters.

2.2 | Assessment of videos

The number of views, running time, days since upload, number of likes and dislikes were determined. The popularity of the videos were evaluated using the Video Power Index (VPI) by the following formula: like ratio x view ratio/100. Video characteristics were analyzed under 2 headings: Video Source (1). Academic, (2). Dentist, (3). Trainer, (4). Medical, (5). Engineer, (6). Commercial, and (7). Other) and Video Content (1). Information on AI, (2). Educational, (3). AI teaching technique, (4). Software, (5). Advertisement).

A brief DISCERN tool was developed to help identify the reliability of information on the Web by patients, general consumers, and caregivers.[14] A modified version of the DISCERN tool, developed by Kılınc and Sayar,[7] was used as the second scoring system to evaluate accuracy and reliability by using a five-point scale. The total modified DISCERN score was calculated for five questions (Figure 1) (score 0−25) and reliability was evaluated as poor, generally poor, moderate, good, and excellent.

The educational quality of the videos was evaluated through multiple scales for enforcing the subheadings of quality parameters (Figure 2). JAMAS, modified Global Quality Score (mGQS), and Total Concent Evaluation (TCE) were used for the assessment of educational quality. The JAMAS (Journal of the American Medical

JAMA Benchmark Criteria[4]

Authorship	Author and contributor credentials and their affiliations should be provided.
Attribution	All copyright information should be clearly listed, and references and sources for content should be stated.
Currency	The initial date of posted content and dates of subsequent updates to content should be provided.
Disclosure	Conflicts of interest, funding, sponsorship, advertising, support, and video ownership should be fully disclosed.

Modified Global Quality Score (mGQS)

Score Description

1. Poor quality, poor flow of video, most information missing, not at all useful for dentists

2. Generally poor quality and poor flow, some information listed but many important topics missing, of very limited use to dentists

3. Moderate quality, suboptimal flow, some important information is adequately discussed but others poorly discussed, somewhat useful for dentists

4. Good quality and generally flow. Most of the relevant information is listed, but some topics not covered, useful for dentists

5. Excellent quality and flow, very useful for dentists

Total Content Score

1. Is definiton of AI clear and adequate?

2. Is there information on the procedure of AI?

3. Are advantages of AI mentioned?

4. Are disadvantages of AI mentioned?

5. Is there information on the cost?

6. Does the video involve dental radiology and radiographies?

FIGURE 2 Journal of American Medical Association Score (JAMAS), modified global quality score and total concent evaluation for quality evaluation of information on AIDR

Association Scale) benchmark criteria (score 0−4), suggested by Silberg et al.,[4] consists of 4 individual criterion. One point is assigned for the presence of each item and the scale provides a nonspecific assessment of source quality. A total score of 4 indicates high source quality, whereas a score of zero indicates poor quality.

The 5-scale Global Quality Score (GQS) is used to determine quality and educational quality of videos.[15] Although the scale mentions lay people as subjects, in this study a modified version was used for dentists (mGQS). The total scoring range of 0−5 indicates poor, generally poor, moderate, good, and excellent. More information on the mGQS questions is presented in Figure 2.

While both JAMAS and mGQS are valid scales to determine educational quality, the limits regarding the information content is not framed. To assess the AIDR information, we used a six-item "Total Content Evaluation (TCE)" grading for this topic. TCE asks about an extensive definition of AI; explanation of AI procedures; the advantages, disadvantages, and cost of the system; as well as attributes to dental radiology. One point is assigned for each present criteria, with a maximum possible score of six, where 0 indicates a poor source of educational quality. Regarding information on dental radiology, the related branch of dentistry was determined for each video. The GQS and TCE criteria are shown in Figure 2. Thus, the

limitations and educational quality of the information in videos were determined by using JAMAS, mGQS, and TCE together.

2.3 | Statistical analysis

Appropriateness of the parameters to normal distribution was evaluated with the Shapiro−Wilks test while evaluating the study data, and it was determined that the parameters did not show normal distribution. The Kruskal−Wallis test (post hoc Mann Whitney U test) was used to compare quantitative data as well as descriptive statistical methods (mean, standard deviation, median, frequency). To examine the relationships between parameters, we used Spearman's rho correlation analysis. For interobserver agreement, the Kappa fit coefficient was calculated for qualitative data and ICC for quantitative data. Significance was evaluated at the level of $P < 0.05$. IBM SPSS Statistics 22 (IBM SPSS, Turkey) software was used for the statistical analyses.

3 | RESULTS

A total of 240 videos were examined in the study; 185 videos were excluded. All evaluations were made based on the remaining 55 videos. The outcomes of the search terms are as follows: 23 videos (41.8%) for AIDR, 8 (14.5%) for MLDR, and 24 (43.6%) for DLDR.

Descriptive statistics involving video characteristics, video source, and content are stated in Table 1. Of the relevant videos, 54.5% included information about dental radiology and 72.6% had content involving branches of dentistry, mainly orthodontics. The agreement level among observers in terms of dental radiology involvement is 96.3% (Kappa*: 0.963; P: 0.000; $P < 0.05$), Also, interobserver agreement in terms of involved dental specialties is 100% (Kappa**: 1.000; P: 0.000; $P < 0.05$) (Table 2).

The mean VPI is 2803781.2 ± 13161190.4 (range, 0 to 90872760). The DISCERN scoring (scale of 0 to 25) for observers 1 and 2 are 15.98 and 15.82, respectively; the interobserver agreement level for the DISCERN score is 97.5% (ICC: 0.975; 95% CI: 0.957 to 0.985; P: 0.000; $P < 0.05$). Mean JAMAS (scale of 0 to 4) is 3.75 ± 0.44 (range, 3 to 4). Mean mGQS scores (scale of 0 to 5) for observers 1 and 2 are 3.44 and 3.47, respectively; and interobserver agreement level is 90.4% (ICC: 0.904; 95% CI: 0.841 to 0.943; P: 0.000; $P < 0.05$). The mean for TCE (scale of 0 to 6) is 2.89 ± 1.20.

Table 3 displays the evaluation of scores according to video source and video content. Evaluations based on video source reveal that academic videos had significantly higher DISCERN, GQS, and TCE in comparison to other sources

TABLE 1 Descriptive statistics of the videos

Video characteristics	Min	Max	Median
No. of views	19	757273	1706
Duration in seconds	38	890	350
Days since upload	26	1110	474
No. of likes	0	12000	20
No. of dislikes	0	633	1
Video source	**n**		**%**
Academic	24		43.6
Dentist	5		9.1
Trainer	4		7.3
Medical	3		5.5
Engineer	9		16.4
Commercial	7		12.7
Other	3		5.5
Video type			
Information on AI	9		16.4
Educational	14		25.5
AI teaching technique	17		30.9
Software	14		25.5
Advertisement	1		1.8

($P < 0.05$). However, VPI and JAMAS averages are nonsignificant according to the video source ($P > 0.05$).

Regarding video content; information on AI revealed significantly higher TCE ($P < 0.05$), and software revealed higher JAMAS ($P < 0.05$) in comparison to other sources. No specific relationship was found between VPI, GQS, and DISCERN score averages according to video contents ($P > 0.05$).

Correlations of all scales involving VPI, JAMA, mGQS, TCE, and DISCERN) scorings are presented in Table 4. We identified a positive relationship between VPI and mGQS (30.1%) (P:.035), representing quality; and between VPI and DISCERN (38.1%) (P: .007), representing quality and reliability. VPI displayed nonsignificant relationship with JAMAS or TCE ($P > 0.05$). The DISCERN tool showed a positive relationship with TCE (30.7%) (P: .023), and mGQS (51.9%) (P: .000), representing relationship of reliability and quality. On the other hand, JAMAS outcomes proved no significant relationship with mGQS or TCE ($P > 0.05$). Predictors of quality versus reliability revealed a 44.5% relationship between JAMAS and DISCERN (P: 0.001). As predictors of educational quality, the highest relationship, 62.5%, was found between TCE and mGQS (P: 0.000).

4 | DISCUSSION

YouTube can be readily accessed both by lay people and dental professionals, and our study highlights the volume

TABLE 2 Interobserver agreement for dental radiology and involved dental specialties

		1st Observer		2nd Observer		
		n	%	n	%	Kappa
Dental radiology involved	None	25	45.5	26	47.3	0.963[a]
	Periapical	30	54.5	29	52.7	
Involved dental specialties	None	20	36.4	20	36.4	1.000[b]
	Orthodontics	28	50.9	28	50.9	
	Endodontics	6	10.9	6	10.9	
	Prosthodontics	1	1.8	1	1.8	

High agreement among observers (Kappa[a]: 0.963; P: 0.000; $P < 0.05$), (Kappa[b]: 1.000; P: 0.000; $P < 0.05$).

TABLE 3 Evaluation of scores according to video source and video content

	Mean $\pm$ SD (median)				
	VPI	JAMAS	DISCERN	TCE	mGQS
Video source					
Academic	949479.5 $\pm$ 2148727.8 (773)	3.67 $\pm$ 0.48 (4)	18.42 $\pm$ 4.68 (20)	3.21 $\pm$ 0.93 (3)	3.75 $\pm$ 0.9 (4)
Dentist	182 $\pm$ 89.3 (221.8)	3.8 $\pm$ 0.45 (4)	18 $\pm$ 2 (19)	2.4 $\pm$ 0.55 (2)	3.8 $\pm$ 0.45 (4)
Trainer	1215459.4 $\pm$ 1855253.3 (235575.2)	3.25 $\pm$ 0.5 (3)	13.25 $\pm$ 4.99 (12.5)	3 $\pm$ 1.41 (3.5)	3.25 $\pm$ 1.5 (4)
Medical	7010.3 $\pm$ 12121.6 (21.3)	4 $\pm$ 0 (4)	11.67 $\pm$ 6.35 (8)	1 $\pm$ 1 (1)	2 $\pm$ 1 (2)
Engineer	15903788.7 $\pm$ 33673699.9 (1390940)	3.78 $\pm$ 0.44 (4)	14.11 $\pm$ 4.37 (13)	3.56 $\pm$ 1.51 (3)	3.33 $\pm$ 1 (4)
Commercial	350106.8 $\pm$ 597552.4 (362)	4 $\pm$ 0 (4)	15.86 $\pm$ 5.87 (16)	2.14 $\pm$ 0.9 (2)	3.29 $\pm$ 0.76 (3)
Other	207.7 $\pm$ 155.8 (140.8)	4 $\pm$ 0 (4)	7 $\pm$ 1.73 (8)	2.67 $\pm$ 1.15 (2)	2.67 $\pm$ 0.58 (3)
P	**0.248**	**0.111**	**0.012[a]**	**0.021[b]**	**0.044[*]**
Video content					
Information on AI	375405.7 $\pm$ 1117443.8 (479.5)	3.78 $\pm$ 0.44 (4)	14.33 $\pm$ 7.02 (13)	3.67 $\pm$ 1.12 (4)	3.78 $\pm$ 1.09 (4)
Educational	437148.9 $\pm$ 645040.3 (303.8)	3.86 $\pm$ 0.36 (4)	17.14 $\pm$ 5.08 (19)	2.21 $\pm$ 0.97 (2)	3.36 $\pm$ 0.93 (4)
AI teaching technique	9141943 $\pm$ 24037220.3 (30766.3)	3.47 $\pm$ 0.51 (3)	16.65 $\pm$ 4.61 (16)	3.59 $\pm$ 0.8 (3)	3.71 $\pm$ 0.85 (4)
Software	59510.7 $\pm$ 108777.3 (357.5)	3.93 $\pm$ 0.27 (4)	15.86 $\pm$ 4.97 (16.5)	2.29 $\pm$ 1.2 (2.5)	3.07 $\pm$ 1 (3)
P	**0.244**	**0.035[d]**	**0.387**	**0.001[e]**	**.121**

Kruskal Wallis Test P[a]: .012, P[b]:.021, P[c]:.044, P[d]:.035, P[e]:.001, $P < 0.05$.

TABLE 4 Correlations of the scores

		VPI	Total content evaluation	JAMAS	GQS	DISCERN
VPI	r	1	0.231	0.002	0.301	0.381
	P		0.11	0.990	0.035[a]	0.007[a]
Total content evaluation	r	0.231	1	−0.018	0.625	0.307
	P	0.110		0.898	0.000[a]	0.023[a]
JAMAS	r	0.002	−0.018	1	0.093	0.445
	P	0.990	0.898		0.501	0.001[a]
GQS	r	0.301	0.625	0.093	1	0.519
	P	0.035[a]	0.000[a]	0.501		0.000[a]
DISCERN	r	0.381	0.307	0.445	0.519	1
	P	0.007[a]	0.023[a]	0.001[a]	0.000[a]	

Spearman's rho correlation analysis.
[a] $P < 0.05$.

of information available regarding AIDR. Video information is not peer reviewed, may not be evidence based, and is not subject to quality controls, and these limitations may lead to irrelevant or missing content.[3] On the other hand, our study found that 33% of lay people believe in the accuracy of health-related information sourced on the most popular websites.[16] A review regarding learning outcomes of digital, social, and mobile technologies on healthcare professionals revealed that approximately half of the related articles (49.6%) reported accuracy of the evaluative outcomes.[17] Due to the lack of evidence-based information on the reliability and quality that YouTube videos on AIDR have on dental professionals, the results of this study are of great importance.

Search terms in this study were selected within a broad terminology to describe the usage of AIDR, and were more likely to reflect dentists' usage during an Internet search. Fifty-five videos were analyzed among 240, most of which were excluded due to irrelevancy (42.2%). The rate of relevancy among search terms were 43.6% for DLDR, 41.8% for AIDR, and 14.5% for MLDR. Since literature searches revealed no similar studies, it was not possible to make comparisons for matching or similar terms. While videos generally involved information on deep learning/artificial intelligence, only 54.5% of the relevant videos had information about dental radiology.

General video assessments included number of views, running time, time since upload, and number of likes and dislikes; on the other hand, the VPI index was selected as a more accurate way to evaluate video popularity. Many up-to-date YouTube studies evaluate each of these criteria independent from one another, while VPI indexing shows benefits from the calculations (like ratio × view ratio/100). Negative prediction of reliability arising from dislikes are excluded from the scope of VPI index.[11,15] The relationship of video source and video content was found to be unrelated to VPI averages in this study ($P > 0.05$). Thus, we can state there is poor relationship of VPI in evaluation of AIDR videos based on video source and content. Based on the video source, the highest VPI was detected for the engineer group. Regarding video type, the highest TCE was detected for information on AI and AI teaching techniques. While VPI does not evaluate negative parameters, number of dislikes were evaluated separately. The number of dislikes were generally low (29.8727 ± 93.17527), and this outcome increases the prediction of VPI. The VPI outcomes of this study are in agreement with several previous studies that evaluated the popularity of YouTube videos.[11,12,17]

In this AIDR-specific study, the DISCERN score was 15.98 (score 0 to 25), the mean JAMAS was 3.75 (score 0 to 4), the mGQS was 3.47 (score 0 to 5), and the TCE was 2.89 (score 0 to 6). The results suggest that the reliability of the information on AIDR obtained from YouTube is good/moderate and quality results provided good/moderate information regarding the types of scorings, respectively. Regarding video source, academic videos had the highest DISCERN scores, as well as the highest JAMAS, mGQS, and TCE scores. Our deduction agrees with the results of previous analyses on academic source videos on YouTube, revealing high reliability and quality.[11,18]

JAMAS and mGQS are validated quality assessment tools that are preferred for being reproducible.[19] The impact of this article is based mainly on using multiple scoring scales for assessing reliability (DISCERN) and quality (JAMAS, GQS, and TCE). As well as determining accurate reliability, 3 scales for quality proved and reinforced consistent results. Although several studies generated content scores, as well as GQS or JAMAS, to evaluate quality, the multiple score analyzing in this study supported and enhanced the impact of each scoring system for the term AIDR.[10,15,17,19] The interobserver agreement results in our study are also of great importance.

The study limitations include a small number of relevant videos and the YouTube platform selected as the sole video archive for evaluation. Assuming that most dental professionals would sort using YouTube's the default settings, no filters were selected for sorting the videos. As a result, filtering may have caused more relevant videos on the search terms. As the website content changes in relation to the wide range and number of videos uploaded every second, another limitation may arise from sorting the videos on a particular date.

5 | CONCLUSION

YouTube videos related to "Artificial Intelligence in Dental Radiology" can be assessed by dental professionals as reliable and high-quality educational data. Academic videos provide higher content values. On the other hand, VPI does not prove accuracy for video source or content. Although there is an evolving number of studies on AIDR, the number of relevant videos involving the same term is still limited. An increased number of academic source videos are needed to understand the evolution of AIDR.

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