Analyzing Content and Quality of YouTube™ Videos on Removal of Amalgam Fillings

Mehmet Buldur[1] , Fatma Aytac Bal[2]

[1] Canakkale Onsekiz Mart University, Faculty of Dentistry, Department of Restorative Dentistry, Canakkale, Türkiye.
[2] Biruni University, Faculty of Dentistry, Department of Restorative Dentistry, Istanbul, Türkiye.

Correspondence Author: Mehmet Buldur
E-mail: dtmehmetbuldur@gmail.com
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ABSTRACT

Objective: The objective of this study was to analyze the information quality and content of operational videos available on YouTube™ regarding removal of amalgam fillings.

Methods: The videos were determined using the words "Removal of amalgam fillings" and "Replacement of amalgam fillings" in the YouTube™ search section. 85 videos were included for analysis. Demographics of videos, viewers' interactions, and viewing rates were evaluated. The videos were analyzed in two parameters in terms of audio-visual quality and the SMART (Safe Mercury Amalgam Removal Technique) protocol steps.

Results: It was determined that dentist accounts ranked first (62%) in the distribution of video sources. While only 19% of the videos were of "Excellent" audio-visual quality, 49% were rated as "Moderate" and 33% were rated as "Poor". In the SMART evaluation, while only 10% of the videos got the "Maximal Useful" score, the majority of the videos got the "Slightly Useful" score (58%). There was no statistical relationship between the "View Rate" and "Interaction Index" variables of the videos *(p> 0.05).*

Conclusions: Operational videos about removal of dental amalgam fillings should be uploaded to YouTube™ after approval by the experts of the subject. Students should be warned about videos which contain insufficient information. Videos should be prepared in line with current information in the literature.

Keywords: Dental amalgam; E-learning; Mercury; Social media; Toxicity.

1. INTRODUCTION

Nowadays, medical documents, seminars and YouTube™ videos available on the internet are more popular than traditional learning methods (researching through books, journals, and conferences) (1). Over 80% of web-based search activities are for seeking medical information and support (2). At the same time, the internet is an area where professionals and laypersons share their experiences and knowledge (3). While specialist physicians continue to be the most important source of information in guiding patients' decisions, the effect of internet-based information on patients is also clearly visible (4).

YouTube™, an online video sharing platform, is the second most popular website in the world after Google. Almost 5 billion videos are watched per day on YouTube™, and the average user spends an average of 18:35 minutes per day on YouTube™ (5). There are academic studies which analyze the nature and quality of the information on YouTube™

videos, which include topics from the fields of medicine and dentistry to the treatments and prevention methods of various diseases (2). YouTube™ videos are not reviewed by a controller due to the nature of this platform, and videos can be of low or high quality from different sources and/or often non-standard (6). This means that videos on YouTube™ could potentially contain incorrect or incomplete information. Most studies agree that YouTube™ contains scientifically incorrect and sometimes misleading details which can harm patients' health (7,8). Information disseminated through videos can be published and shared on the internet without any institutional or quality control; therefore, it is critical to determine whether the information shared is correct, incorrect or incomplete (9). It has been stated that audio-visual methods improve patients' knowledge more than traditional written and oral information (10). However, it has been shown that the information gathered from patient-sourced videos is often potentially misleading (11).

Ease of access to social media is countered by studies investigating the content and quality of YouTube™ videos and focusing on the relationship between social media and dental treatments such as root canal treatments, orthognathic surgery, dental implants, teeth whitening, and botulinum toxin for bruxism (7,11–14).

With the increasing number of patients requesting replacement of amalgam fillings, it has come to the fore that some protective measures should be taken against mercury toxicity during restoration removals. In a study conducted in 2019, mercury vapor released in particles formed during the removal of amalgam restorations was evaluated. While it was assumed that amalgam particle surfaces could oxidize over time, which may reduce evaporation, it was noted that dental particles produced from amalgam fillings during filling removal produced mercury vapor above threshold levels for a significant period of time (15). In another study, a significant localized source of mercury vapor was identified on amalgam that may be present for hours after preparation with the bur. It was shown that micron amounts of amalgam particles produced from dental high-speed drilling process generated measurable amounts of mercury vapor that often exceeded occupational safety thresholds (15). In addition, the World Dental Federation (FDI) recommends avoiding direct skin contact and sources of mercury vapor, including mercury, freshly mixed dental amalgam, and particles formed during the extraction of dental amalgam (16).

In today's world, in which access to information has rapidly increased, significant concerns have been raised about the potential adverse health effects of mercury exposure released from dental amalgam restorations in patients (17). Besides, in the World Health Organization (WHO) report, the statement "Recent research suggests that mercury may not have a threshold at which some adverse effects occur" is included (18). A protocol has been established that protects patients, physicians and clinical staff from mercury vapor that may be released during amalgam removal (19). There is no study in the literature analyzing the existence of protective protocols to be followed during amalgam removal in YouTube™ videos. The objective of this study was to analyze the information quality and content of operational videos available on the YouTube™ platform regarding the removal of dental amalgam restorations.

2. METHODS

The research was designed as a cross-sectional study. The study videos consisted of YouTube™ (https://www.YouTube.com) videos containing operational videos on removing dental amalgam material from the tooth. The screening took place between 09.00-18.00 on January 22, 2021. A new account was created before the search, and the historical data and cookies of the computer used were deleted. The search filter used was the default filter "Sort by relevance".

The videos were determined using the words "Removal of amalgam fillings" and "Replacement of amalgam fillings"

in the YouTube™ search section. It was shown that most YouTube™ users searched the first 60–200 videos and only scanned the top 30 videos (20). Based on the percentage measurement values of the methods to be studied in the literature review, the total sample size was n=84, with an effect size of 0.4, a power of 90%, and a margin of error of 0.05, using the G-POWER program. In this study, the first 200 videos were determined for each search term. Initially, non-English videos, duplicate videos, and irrelevant videos, such as other medical field advertisements and financial advice videos, were excluded from the study. In the second evaluation, non-operational videos (Conference, Lecture, Animation etc.) were excluded, depending on the purpose of the study. The number of videos excluded from the study is as indicated in Figure 1.
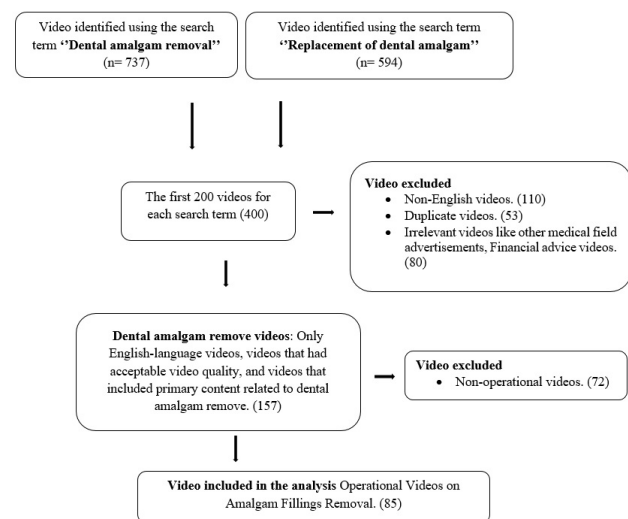

Figure 1. *Video Selection Workflow*

Evaluation of videos were made by two observers (M.B. and F.A.B) who were experienced in restorative dentistry. The few differences between observers in the evaluation criteria in the study were overcome by using two methods. The Safe Mercury Amalgam Removal Technique (SMART) protocol is a "yes-no" assessment without subjective data. To find out the reason for the difference between them, the observers watched the video together and gave a common score.

Prior to the audio-visual assessments, the researchers evaluated 10 videos (on different video subjects but on the same evaluation criteria) representing each score for each criterion. The correlation coefficient between the measurements was found to be 0.969, and a statistically significant, positive and very high-level relationship was obtained (*p=.000*). Since the audio-visual evaluation is a subjective evaluation and includes subjective comments, the final score was given by taking the average of the observers in the score differences in this criterion. Since the research was conducted on public internet data, it was decided that ethics committee approval was not required.

The data regarding view numbers, durations, comments, 'likes' and 'dislikes', and upload date were calculated for each video in our research. Viewers' interactions were calculated based on the interaction index ([likes – dislikes]/total views × 100%) and view rate (views/days after upload × 100%).

The account that uploaded the videos reviewed in this study to YouTube™ were classified under the following headings: Dentist/specialist, clinic/hospital/university, layperson, and other. According to their content, the videos were classified under three titles:

1. Only removal of dental amalgam fillings,

2. Removal and replacement of new restorations,

3. Safe removal of dental amalgam restoration procedures.

The videos were analyzed in two different parameters in terms of audio-visual quality and the presence of the Safe Mercury Amalgam Removal Technique (SMART) protocol steps (19). Audio-visual quality was graded by the researchers as "Excellent", "Moderate", or "Poor". The parameters considered in the assessment of audio-visual quality consisted of the following data: flow of video, information accuracy, quality of images or animations, video subtitles, and the extent to which the title included the projected video content (21).

Videos are graded between 0-20 according to the scores they get from the criteria specified in the SMART protocol (19), (Table 1). In this context, while they got 1 point for each criterion shown or mentioned in the video, they could not get any points from the wrong application or criteria not in the video.

Table 1. SMART (Safe Mercury Amalgam Removal Technique) Protocols

1	An amalgam separator must be properly installed and regularly maintained to ensure that mercury amalgam wastes are not released into the effluent leaving the practice.
2	Every room where mercury-containing fillings are removed must have a high-volume air filtration system (such as an at source oral aerosol vacuum and an adequate filtration system capable of absorbing the formed mercury vapor and amalgam particles).
3	Windows should be opened to reduce the mercury concentration in the environment. (If it is possible)
4	Before the procedure, the patient should be given a slurry of charcoal, chlorella or similar adsorbent to rinse and swallow.
5	Protective gowns and drapes should be used for the dentist, staff and patient.
6	The dentist and staff in the room should wear non-latex nitrile gloves.
7	The dentist and staff in the room should wear face shields and a hair/head cover.
8	The dentist and all dental staff in the room should wear a properly sealed, respirator-grade mask for mercury filtration.
9	A head/face/neck barrier should be used to protect the patient's skin and clothing.
10	External air or oxygen supplied to the patient through a nasal mask should also be used to ensure that the patient does not inhale any mercury vapor or amalgam particles during the procedure.
11	A rubber dam made of non-latex nitrile material should be used.
12	A saliva ejector should be placed under the rubber dam to reduce patient exposure to mercury.
13	During removal of amalgam filling, an oral aerosol vacuum should be used close to the operation area.
14	High-speed evacuation provides better capture when equipped with a non-essential but preferred cleaning device.
15	It requires copious amounts of water to reduce ambient mercury levels, and a conventional high-speed drain device to capture mercury discharges.
16	Amalgam needs to be cut into pieces and removed in as large pieces as possible.
17	After the removal process is completed, the patient's mouth should be rinsed with a slurry of charcoal, chlorella or similar adsorbent.
18	Dentists should follow local regulations regarding the proper handling, cleaning and/or disposal of mercury-contaminated components, clothing, equipment, room surfaces, and flooring in the office.
19	During the opening and maintenance of suction traps in operating rooms or the main suction unit, dental staff should use the appropriate personal protection equipment described above.
20	It should be noted that as a safety precaution, the IAOMT does not recommend removal of amalgam fillings for pregnant or breastfeeding women.
	Total: 20 Points: Not Useful (0p), Slightly Useful (1-5p), Moderately Useful (6-10p), Very Useful (11-15p), Maximal Useful (16-20)

In this study, the descriptive statistics of the data are given as number, percentage, mean and standard deviation. As the first step in analyzing the data, the assumption of normality was checked with the Shapiro Wilk test. The Kruskal Wallis test was used to examine the difference between the averages of three or more independent and non-normally distributed groups. The Bonferroni Post Hoc test was performed to identify the group or groups that made the difference. In order to examine the relationship between continuous variables, the Spearman correlation was used when the normal distribution assumption was not met. The Fisher's Exact Test was applied in the cases

where the sample size assumption was not provided in the analysis of categorical variables. The Kendall's Tau correlation analysis was conducted to examine the relationship between categorical and ordered variables and continuous variables. Analyzes were carried out using the IBM SPSS Statistics 25 program. The statistical significance level was set as *p<0.05.*

3. RESULTS

Descriptive analyzes are as stated in Table 2**.** In the classification made according to the video content, the videos containing the highest number of safe amalgam removal protocols (42% – n= 36) were included [Only removal of dental amalgam fillings (25% – n=21), Removal and replacement new restorations (33% – n=28)]. The distribution of videos in different video sources and the number of videos in these sub-groups were determined according to the evaluations received from the SMART score, and audio-visual quality (Fig.2). The Fisher's Exact test was used to examine the relationships between the video distributions based on audio-visual quality/SMART scores/Video sources variables. There was no statistically significant relationship between the variables in terms of video distributions *(p>0.05).*

The Kendall's Tau correlation analysis was performed to evaluate the relationship between the "Interaction Index" and "Viewing Rate" values with audio-visual quality and SMART score (Table 3). As a result of the correlation analysis, "Interaction Index" had a positive correlation with audio-visual quality and SMART score *(p <0.05).* In addition, while there was a positive correlation between "Viewing Rate" and "Audio-visual quality" *(p< 0.05),* there was no statistically significant correlation between "Viewing

Rate" and SMART scores *(p> 0.05).* In addition, Spearman correlation was calculated to examine the relationships between the "Interaction Index" and "Viewing Rate" variables. There was no statistically significant correlation between the "Viewing Rate" and "Interaction Index" variables *(p>0.05)* (Table 3).

There is no statistically significant difference between the groups formed according to the SMART assessment in terms of "Interaction Index" and "Viewing Rate" mean values *(p>0.05)* (Table 4). None of the videos scored zero points. There are two videos with the lowest SMART score (1p) and seven videos with the highest score (20p). The number of views of one of the videos with the lowest SMART score (1p) is 674.827. This number is the 2nd highest number of views in the study. The SMART score of the video with the highest number of views is 4p, and the lowest one is 3p. The SMART score of the video with the highest ''Interaction Index'' value is 3p, while the SMART score of the video with the highest ''Viewing Rate'' is 4p. Among the seven videos that received full SMART score (20p), the most viewed video was the 4th most watched video with 129.564 times.

As a result of the analysis, a statistically significant difference was found between the mean value of the "Interaction Index" and "Viewing Rate" variables according to the audio-visual quality score groups *(p<0.05)* (Table 4). In the "Interaction Index" variable, a statistically significant difference was found between the mean value of the "Poor" and "Excellent" groups *(p=,001).* In the "Viewing Rate" variable, a statistically significant difference was found between the mean value of the "Poor" group and the mean value of the "Moderate" and "Excellent" groups *(p=.028 and p=.037).*
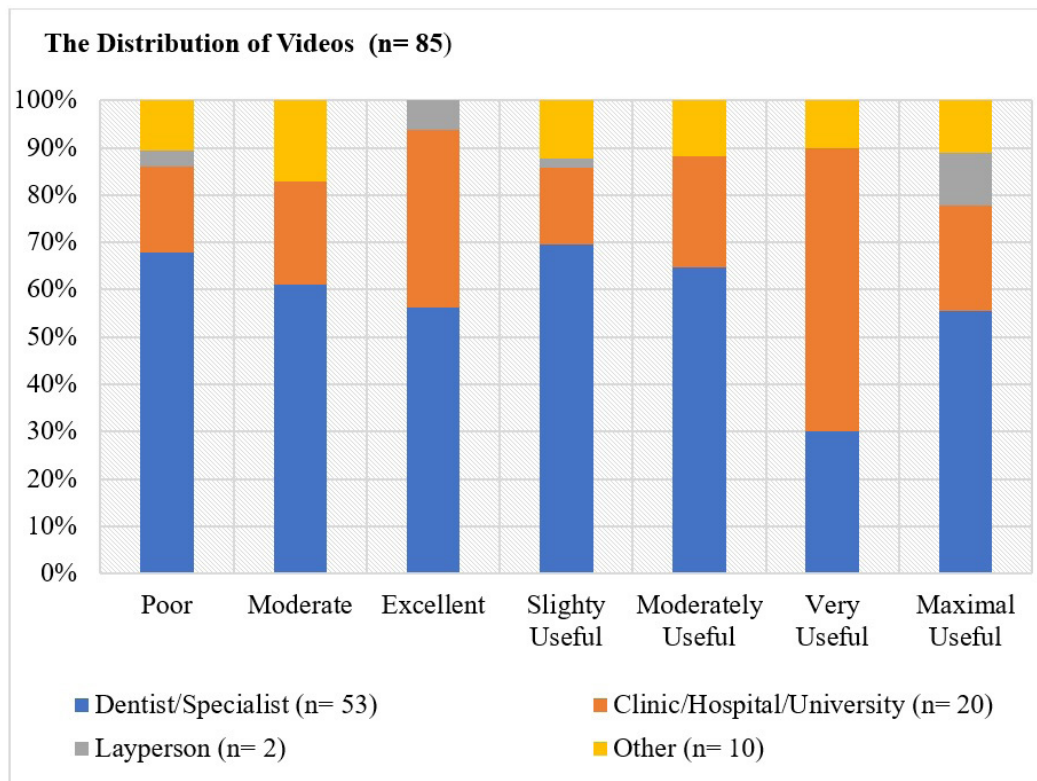
Table 2. Descriptive statistics of videos

	Minimum	Maximum	Mean	Standard Deviation
Number of views	13	1267533	37863.6	156.180.13624
Duration in minutes	0.16	30	4.6642	5.62949
Number of likes	0	9568	195.5765	1045.55743
Number of dislikes	0	425	13.4706	51.03677
Days since upload	26	4351	1491.8941	980.97557
Number of comments	0	417	30.4937	76.89485
Interaction index	-4.17	38.46	1.2055	4.52222
Viewing rate	2.45	130270.61	2854.2152	14477.03127

Table 3. Correlation analysis evaluating the relationship between "Interaction Index" and "Viewing Rate" values, Audio-visual quality, and SMART score

	Audio-Visual Quality		SMART Scores		Viewing Rate	
	Rho	p	Rho	p	Rho	*p*
Interaction Index	.307	.000*	.217	.011*	.122	.266
Viewing Rate	.240	.005*	.159	.059		

Spearman correlation: (Interaction index, Viewing Rate) Significance level (p>0.05)

Kendall's Tau correlation analysis (Interaction index , Audio Visual Quality and SMART Scores / Viewing Rate, Audio Visual Quality) *(p<0.05)

The Distribution of Videos (n= 85)

Legend:
- ■ Dentist/Specialist (n= 53)
- ■ Clinic/Hospital/University (n= 20)
- ■ Layperson (n= 2)
- ■ Other (n= 10)

Figure 2. The distribution of videos in different video sources and the number of videos in these sub-groups were determined according to the evaluations they received from SMART Score and Audio-visual quality. (Fisher's Exact test: (p>0.05)).

Table 4. The relationship between groups in the evaluation made according to SMART scores and Audio-visual quality rating

SMART Scores									Audio-Visual Quality						
	Slightly Useful (n= 49)		Moderately Useful (n= 17)		Very Useful (n= 10)		Max Useful (n= 9)		p	Poor (n= 28)		Moderate (n= 41)		Excellent (n= 16)		p
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD	
Interaction Index	1.509	5.933	0.806	0.836	0.521	0.184	1.0623	0.722	.058	1.69	7.21	0.92	2.69	1.078	0.849	.002*
Viewing Rate	4138.37	18977.86	741.63	1181.76	2061.86	2992.73	733.50	1176.75	.164	804.69	2025.61	4650.84	20589.48	1837.029	4248.32	.012*

SMART scores; Kruskal–Wallis test= Significance level (p > 0.05)

Audio-Visual Quality; Kruskal–Wallis test= Significant difference between groups *(p < 0.05)

Bonferroni correction= (Interaction index/p=.001) ''Poor'' higher than ''Excellent''

        = (Viewing Rate/p=.028 ve p=.037) ''Moderate'' and ''Excellent'' higher than ''Poor''

SD, standard deviation

4. DISCUSSION

The information provided by YouTube™ videos is not subject to peer review and is not pre-evaluated by the authors in the relevant field. This situation revealed the necessity of analyzing the videos in the related field. There are many studies evaluating Youtube™ videos on topics related to dentistry and general health (1,2,7–9,12–14,22–25). Our study is the first to analyze YouTube™ videos on removing dental amalgam fillings.

Dental amalgam is an alloy mixture of metallic mercury and mainly silver, tin, copper, and zinc, and its potential risk for chronic mercury toxicity is one of its major drawbacks (26). The use of amalgam fillings has been banned or restricted in Sweden, Norway, Denmark and Germany since 2008. In addition, as of 2018, the European Parliament has accepted a ban on the use of amalgam in clinical practice for children under 15 years of age and pregnant or breastfeeding women (27). Although the use of dental amalgam has decreased in favor of resin-polymer-based restorative materials in the last decade, many people will have amalgam fillings in their teeth for decades because well-placed dental amalgam restorations usually remain in the mouth for many years (26,28).

When the results of the recently published studies evaluating Youtube™ videos on dentistry are examined, it is seen that the "Viewing Rate" and "Interaction Index" variables are in a wide range. Although there are studies with similar results to the "Interaction Index" rate of the study (24, 25), it was determined that the closest one to our study was a study on cleft lip and palate (24). There is no correlation between "Viewing Rate" and "Interaction Index" in our study. In the "Viewing Rate" and "Interaction Index" equations, the "Total number of views" parameter is the numerator in one equation and the denominator in the other. In addition, the continuous increase in the time from the day the videos are uploaded to the present reduces the possibility of correlation between these two evaluation parameters. However, another study investigating a similar relationship found a correlation between these two variables in some subgroups (12).

Most of the videos in this study were uploaded from the accounts of dentists and professional institutions (hospitals, universities and clinics). The number of videos from non-professional uploaders is less. Among the videos that we did not include in the study, there are quite a lot of lay user videos that mention dental amalgam-mercury toxicity. However, since the videos in our study are operational videos, it is normal for professional uploaders to be in the majority. There are similar studies with the same parallel results (13,24,25). In this study, the video with the highest interaction index belongs to a non-professional uploader. Conversely, the video with the lowest interaction index was uploaded from a dentist's account. There are also studies which differ in terms of interaction levels between sources (13,22). In addition, there are studies in the literature indicating that non-professional uploaders share more videos on related health issues (12,23). Since the interaction values depend on the liking criteria of the viewers, we can say that whether the uploader is a dentist or non-professional does not directly affect the viewers' liking or watching the videos.

In the evaluation made according to the scores they got from the SMART protocol, more than half of the videos were in the "Slightly useful" category. In parallel with our research, although there are studies in which low information videos are more common (21–23), there are also some studies in which moderate and high information videos are more (12,13,24). There is also a positive correlation between the "Interaction Index" of the videos in the study and their SMART scores. It can be said that the videos that receive more interaction are those that contain more information about preventive measures during amalgam removal. The use of detailed equipment and the explanation of protective measures in the videos for dental amalgam removal may attract the attention and appreciation of the viewers; however, they are supposed to know all protective measures in order for the viewers to notice the videos that do not contain these protective measures. This is not something expected from the ordinary audience. Measures against mercury vapor toxicity are rare in video content. It is thought that the results of the study on mercury vapor emitted from dental amalgam particles have not yet increased the awareness of dentists on this issue (15, 29).

We can say that the audio-visual quality of the videos in our study is in correlation with the "Viewing Rate" and "Interaction Index" rates. This indicates that features, such as video resolution and sound quality, good flow, and presence of subtitle, directly affect the viewing and interaction of the users. These positive features can attract the attention of ordinary viewers, regardless of the content of the video and the accuracy of the information it contains. The ranking according to the number of videos in the groups was determined as Moderate> Poor> Excellent. This ranking is different from two studies in which the same assessment method was used before (14,24). In the other two studies, the least number of videos are in the "Poor" category. Also, in the present study, the most watched video and the video with the highest "Interaction Index" are in the "Poor" audio-visual category. The videos with the highest "Viewing Rate", the most liked video, and the most commented video are in the "Moderate" audio-visual category. Only 4 of the 16 videos that received "Excellent" rating are in the "Maximal useful" group in the SMART classification. In addition, of the 57 videos with moderate and above audio-visual quality, 30 of them have a SMART score of moderate and above. This situation reveals that the number of useful videos in the study is insufficient in terms of the criteria evaluated.

The "Slightly useful" part of the videos uploaded by dentists constitutes the subgroup with the highest number of videos (n= 34). More than half of the "Excellent" and "Maximal useful" videos were uploaded to Youtube™ by dentists. 17% of the videos uploaded by dentists are in the "Excellent" group, whereas 9 % are in the "Maximal useful" group. Besides, the majority of the videos in the "Poor" and "Minimal useful" groups were also uploaded to YouTube™ by

dentists. The distribution in these rates (the fact that dentists have more videos with both high and low scores compared to other uploaders) is related to the fact that the majority of the uploaders of the videos are dentists.

YouTube™ video content is highly variable. Therefore, search results can constantly change as interests and video viewing times change over time. There may be inconsistencies in the search results because new videos are added every day or old videos are deleted. Also, the order of search results changes with interaction and time. Therefore, the limitation of the current study is that the data collection method is instantaneous, as in similar studies. Another limitation is the keywords used in the research. In this study, we performed two independent searches using the keywords "Removal of dental amalgam fillings" and "Replacement of amalgam fillings". However, some patients or physicians may use other search terms and reach different results. In addition, although the process of removing amalgam restorations is common all over the world, the evaluation of the videos only in English is among our limitations. The oldest video in our study is 12 years ago. One of our limitations is that it is practically difficult to evaluate the videos of the old years according to the literature knowledge and technical possibilities of their own period. However, establishing temporally separate evaluation criteria does not match the purpose of our study. The fact that viewers still have access these videos requires them to be evaluated in terms of today's conditions. Another limitation of our study is the SMART rating scale created for the study. It is used for an overall assessment of compliance with the precautions to be taken during operations. Perhaps in other studies, related videos can be evaluated better with different evaluation criteria. In addition, only operational videos were evaluated in our study. The information contained in non-operational videos should also be analyzed.

5. CONCLUSION

Within the limitations of this study, although social media provides a great advantage in terms of reaching a wide audience, it can also cause the misinformation to be easily spread to a wide audience with the same method. Operational videos about the removal of dental amalgam fillings should be uploaded to YouTube™ after approval by the experts of the subject. In addition, the technical features of operational videos are supposed to be better. In the study, there are videos containing current literature information on the preventive measures recommended during amalgam filling replacement. However, the rate of these videos should increase. More studies are needed to investigate the quality of the content of related videos on the change of dental amalgam fillings on different social media platforms.

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