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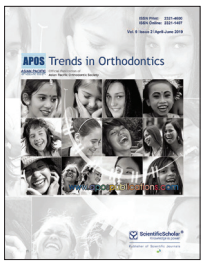

Original Article

Investigation of the effects of YouTube videos about orthognathic surgery on people using machine learning-based emotion analysis algorithm

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ABSTRACT

Objectives: This study aims to analyze the comments about orthognathic surgery-themed YouTube videos through artificial intelligence and remarking the emotional effects of videos on people.

Material and Methods: In this study, the keyword "orthognathic surgery" was searched on YouTube. In pursuit of recording sub-video comments, comments were analyzed with a machine learning-based emotion analysis algorithm.

Results: One thousand one hundred and forty-five comments were analyzed in the study. 2 of 4 surgery videos contain real surgery images. Two videos are animated videos about the details of the surgery. Emotions described in comments are sorted as fear (43.7%), joy (21%), anger (14.6%), and sadness (11.6%). Where comments are reviewed in the aspect of sentiment, negative comments were dense (59.3%), respectively, followed by positive (18.3%), very negative (10.6%), and very positive (2.7 %). Regarding sentiment, differences in comments on real and animation surgery videos are statistically significant ($P < 0.05$). A significance level of very negative comments was higher in real surgery videos ($P = 0.015$).

Conclusion: Different video formats, animation or real videos, may be used for informing, but we think that watching real surgical operation videos may increase people's preoperative anxiety.

Keywords: Orthognathic surgery, Social media, Artificial intelligence

INTRODUCTION

The Internet has been commonly used in the contemporary modern world due to advancements in information technology. These advancements presented a new communication opportunity known as social media. Social media can be defined as platforms where users convene together and interact socially. The possibility of people commenting on photos, videos, and ideas and providing opportunities for people to exchange their views through comments augments the power of social media. Access of patients to health information and their awareness increased via frequent internet usage.[1] This state has also influenced dentistry; most patients search via the Web about their treatment.[2] YouTube, a social media platform, allows users to upload, watch, and comment on videos. It is possible to reach videos in many different categories on YouTube. Furthermore, there are many informative videos on medicine and dentistry. Research illustrates that 8 of 10 internet users access health information online.[3,4] Despite orthognathic surgical operations,

where jaws are being relocated, being relatively safe, any complication may occur as seen in a surgical procedure. Sufficient notification of patients about risks is essential for giving informed and valid consent.[5,6] Most patients strive to fill information gaps via social media platforms like YouTube. Many kinds of videos have been uploaded to YouTube, and users may access those videos immediately. Delli *et al*.[7] noted that videos about patient experiences might contain misleading information. Hegarty *et al*.[8] remarked that most YouTube videos providing information about orthognathic surgery have "low" information quality, so they asserted that YouTube is unreliable.

Studies reviewed the content of YouTube videos, but the effects of videos on users were not searched. This study aims to analyze the comments about orthognathic surgery-themed YouTube videos through artificial intelligence and note the emotional effects of videos on people. This study investigated the video about orthognathic surgery and how it affected the watchers.

MATERIAL AND METHODS

Study design

In this study, the keyword "orthognathic surgery" was searched on YouTube on January 20, 2022, at 11.38 am. Contents were sorted according to relevancy. The first four videos were included in the study [Table 1]. After the comments under the video were recorded, they were analyzed using a machine learning-based sentiment analysis algorithm. Only English comments were included in the study. Comments written in other languages and those composing only emoji and symbols were excluded. Irrelative answers to comments were also excluded. Ethics committee approval was not necessary because the public data were used.

Analysis of comments

Emotions underlying video comments were analyzed with the *CrystalFeel* algorithm, a well-attested sensitivity analytics technology. Usage of this algorithm has increased in recent years.[9-12] *CrystalFeel* is an emotion analysis algorithm to analyze emotional properties in many output dimensions. *Crystalfeel* was developed by A*STAR's Institute of High-Performance Computing (Singapore) researchers who are studying affective and social intelligence. *CrystalFeel* analyzes emotional properties in text after a text input is given. The software produces two output types according to intensity points: sentiment category and emotion category. Intensities are mentioned as continuous values varying between 0 and 1. The continuous value 0 means that this text states emotion intensity never or at a shallow level, and one means that this text states intensity at very high levels. According to Plutchik's Emotion Wheel [Figure 1], fear-anger and sadness-joy are the emotional couples of opposite experiences.[13] *CrystalFeel* algorithm determines five emotions: fear, anger, joy, sadness, and no specific emotion.

Anger is an unpleasant emotional condition characterized by intense, uncomfortable, and hostile reactions to a provocation, trauma, or threat. It generally has many physical and mental effects. In this software, anger includes a range of emotions, such as annoyance, irritation, aggravation, fury, and rage.

Fear is an unlikeable emotion caused by a perceived threat, misery, or damage. Fear causes escaping from threats and also results in freezing or paralysis in extreme conditions. Software fear intensity is measured using a range of negative emotions, succoncernern, anxiety, worrfearred, dread, horror, and terror.

Sadness is an ungracious emotion characterized by disadvantage, loss, desperation, and disappointment. It generally causes silence, stagnation, isolation from others, and depression under extreme conditions. In this software, sadness intensity is measured by a range of emotions, such as helplessness, disappointment, melancholy, sorrow, and grief.

Joy is a positive emotion caused by kindness or satisfaction. It can mean extreme happiness or enthusiasm of spirit. In English, "Joy" may mean a very special happy feeling. Joy intensity may be measured through pleasure, happiness, ecstasy, excitement, hope, pride, gratitude, and compassion.

Table 1: Information about the videos included in the study.

Channel	Duration	Name of the video
Dentalk!	4.39 min	ORTHOGNATHIC surgery - All about JAW realignment surgery © *https://www.youtube.com/watch?v=g1vQRYrdKEQ*
Alila Medical Media	2.15 min	Corrective Jaw (Orthognathic) Surgery, Animation. *https://www.youtube.com/watch?v=fw2brzBw3Q0*
Richardsons Face Hospitals	4.27 min	Maxillary Orthognathic Surgery - How the Jaw is broken before advancing *https://www.youtube.com/watch?v=rtgE9nzCIVM*
Dr. Alexander Antipov	13.11 min	Orthognathic Double jaw Surgery (before and after) Behind scenes. *https://www.youtube.com/watch?v=VKNI7q0mYOk*

CrystalFeel also distinguishes the five types of sentiment: very negative, negative, neutral or mixed, positive, and very positive [Table 2]. As a result of the analysis, the software reports the most distinctive sentiment and emotion categories. Researchers may see details and samples of the CrystalFeel algorithm from the website *www. socialanalyticsplus.net*/crystalfeel/.

Reliability

Randomly, 229 comments from the research were selected to evaluate the reliability of the analysis. This number covers 20% of analyzed comments. These comments were analyzed by a native English speaker and an experienced oral and maxillofacial surgeon without knowing the results from the *CrystalFeel* algorithm. Afterward, results from the *CrystalFeel* algorithm and the obtained ones were compared. Regarding emotion, there was a good agreement between reviewers and *Crystalfeel* software (Kappa = 0.652). Similarly, there was a good agreement between reviewers and *Crystalfeel* software regarding sentiment (kappa = 0.785).

Statistical analysis

Data were analyzed through IBM Statistical Package for the Social Sciences software V23. A Chi-square test was used to compare the comments for videos containing animation and real surgery videos. Analysis results were presented as frequency (percent) for categorical data. Significance was considered as $P < 0.05$. Parameter consistency between reviewers and *Crystalfeel* software was determined through Kappa analysis.

RESULTS

The study analyzed one thousand one hundred and forty-five comments. 2 of 4 surgery videos contain real surgery

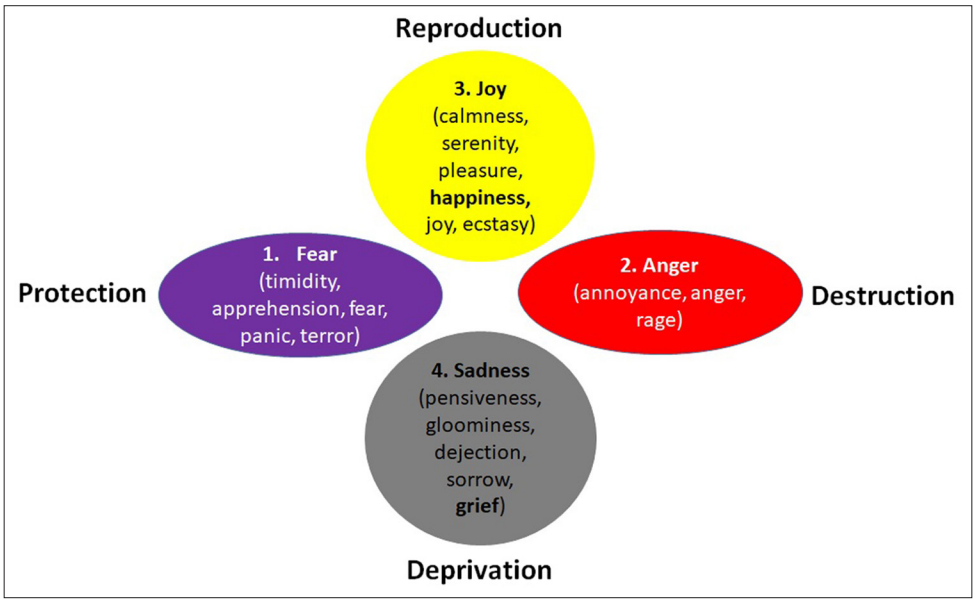

Figure 1: Plutchik's emotion wheel.

Table 2: Examples of comments with their emotion and sentiment.

Emotion	Sentiment	Comments
Fear	Very negative	Omg the surgery and the healing process must be painful. I need this surgery but also I'm scared.
Anger	Negative	Can braces fix overbite? I'm kinda mad that as a kid my dentist never told me to get braces, I would've gotten it fixed for free. Now I have to pay multiple thousands (maybe around 5k..). Currently always putting my jaw to the front.
Joy	Very Positive	I had this surgery 5 weeks ago and then another lower jaw surgery 2 weeks after. My results already are incredible, I finally have the smile and bite I always dreamed of.
Sadness	Negative	Can I fixed my jaw... My lower jaw is ahead than uper jaw. I feel very upset for this problem.... Anyone can help me please where I have to go I mean right place for treatment.. Thanks
No specific emotion	Neutral or mixed	I am getting the last surgery shown in 1 year.

images. Two videos are animated videos about the details of the surgery. Emotions described in comments are sorted as fear (43.7%), joy (21%), anger (14.6%), and sadness (11.6%). Where comments are reviewed in the aspect of sentiment, negative comments were dense (59.3%), respectively, followed by positive (18.3%), very negative (10.6%), and very positive (2.7%) [Figure 2]. The difference between real and animated surgery videos is statistically insignificant in emotion (P = 0.292) [Table 3]. In the aspect of sentiment, differences in comments on real and animation surgery videos are statistically significant (P < 0.05) [Table 4]. A significance level of very negative comments was higher in real surgery videos (P = 0.015).

DISCUSSION

With increased internet and social media usage, patients may access information about surgical operations unboundedly by watching videos from various browsers.[14,15] The Internet has become a health information resource with searches about treatments, symptoms, drugs, and treatment costs. People report that such information improves their health, affects treatment decisions, and directs them to share new information with healthcare providers.[16] As search engines and medical websites are popular initial points for health information, 25% of people are directed to social media websites.[1,17] In previous studies, YouTube video content was generally reviewed regarding reliability.[8,18] This study investigated the video about orthognathic surgery and how it affected the watchers. Videos mainly cause fear as an emotion and negative as a sentiment.

Anxious patients are less cooperative during dental procedures, more likely to postpone or cancel their appointments, and are generally dissatisfied with their dental treatment. Orthognathic surgery is a treatment that requires a multidisciplinary approach. Often, patients undergo orthognathic surgery after receiving orthodontic treatment. Previous studies have reported that state anxiety levels are high in patients awaiting orthodontic treatment but return to normal within the 1st year.[19] Yildirim and Karacay[20] reported that patients' dental anxiety and state anxiety scores are high before orthodontic treatment but decrease after 3 months as patients become familiar with their orthodontist and orthodontic treatments. Anxiety and curiosity may persist in patients who will undergo orthognathic surgery after receiving orthodontic treatment. The videos that the patient watches on social media platforms such as YouTube may affect their emotional state. This situation may negatively affect the orthodontist's treatment process.

Anxiety is an emotional reaction resulting from the activation of an autonomous neural system with the expectation of a future threat or a stressed condition.[21] Oral surgery is known to cause high anxiety, among other procedures.[22] In maxillofacial surgery, management of perioperative anxiety is still difficult.[23] Studies show that uncertainties about the procedures are one of the most important factors promoting anxiety in patients in oral surgery.[22,24] Some factors such as personal characteristics, previous experiences, real-time conditions, social impact, challenging ability, and unboundedly accessed information from sources like the Internet are reported to relatively affect the anxiety levels of patients.[25-27] Although free access to information about some subjects seems advantageous, the effect of using this tool for surgery is not clear on patients' anxiety. Conflicting results regarding the effectiveness of different information formats are reported in the literature. Kazancioglu *et al.*[27] claimed that patients watching similar operations from a website are more anxious depending on their clinical experiences. Torres-Lagares *et al.*[28] reported that informed consent videos containing surgical procedures should be avoided because of the increasing anxiety of patients. Tanıdır *et al.*[25] found that dubbed videos, subtitled mute videos, and oral informing videos did not significantly increase the anxiety level of patients. Omezli *et al.*[29] reported that patients tended to be anxious if they watched videos about surgical procedures before surgery. In this study, negative emotions, especially fear and negative sentiment, were formed in the viewers. *CrystalFeel* software measures a range of negative emotions linked with fear, like concern, anxiety, worry, fear, dread, horror, and terror. Therefore, we can say that watching orthognathic surgery videos on platforms like YouTube may cause an increase in anxiety in people.

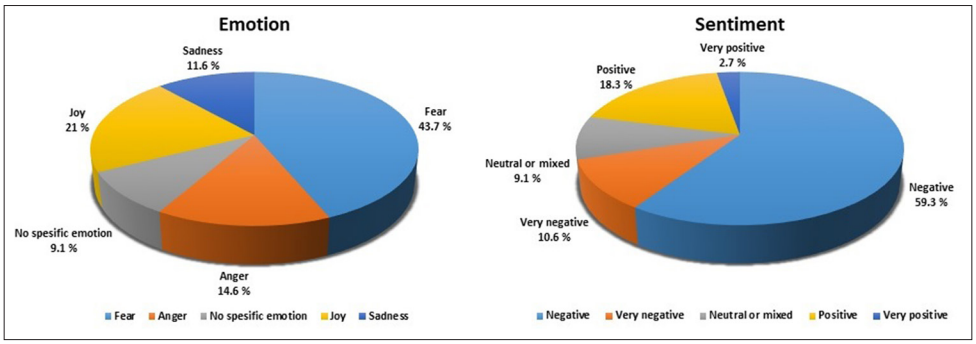

Figure 2: Distribution of comments by emotion and sentiment scores.

Table 3: Distribution of comments by emotion scores.

Emotion	Real video group	Animation video group	*P*-value
	n (%)	*n* (%)	
No spesific emotion	57 (9.8)	48 (8.5)	
Fear	246 (42.3)	254 (45.1)	
Anger	96 (16.5)	71 (12.6)	0.292
Joy	121 (20.8)	119 (21.1)	
Sadness	62 (10.6)	71 (12.6)	
Total	582 (100)	563 (100)	

Table 4: Distribution of comments by sentiment scores.

Sentiment	Real video group	Animation video group	*P*-value
	n (%)	*n* (%)	
Neutral or mixed	57 (9.8)	48 (8.5)	
Very Negative	75 (12.9)[a]	46 (8.2)[b]	
Negative	329 (56.5)	350 (62.2)	0.015*
Positive	100 (17.9)	109 (19.4)	
Very Positive	21 (3.6)	10 (1.8)	
Total	582 (100)	563 (100)	

*Significant at the $P<0.05$ level. There is statistical significance between the columns with different superscripts

Despite being popular, there are some contradictory proofs of how online searches affect relations between patients and healthcare professionals. Some researchers assert that patients usually share information from online searches with healthcare professionals, and healthcare professionals consider this situation positive. Those patients are more informed and aware and accept online searches as more beneficial than harmful.[30,31] On the contrary, other researchers claim that patients share online information less with healthcare professionals, and most have negative attitudes toward online research.[32,33] These recent studies show that healthcare professionals are usually unaware of online information searches of their patients and perceive web-searching patients as misinformed and anxious; online content is hard to review, and they worry about patients behaving according to web searches.[31-34] In this study, patients are described to learn about surgical complications, personal treatment experiences, and treatment costs from their comments on YouTube videos. It is seen that people can easily access real surgery videos prepared for healthcare professionals.

Patient cooperation depends on many factors, including communicating effectively with the treating clinician.[35] Advanced communication improved patient satisfaction and awareness, and motivated harmony was needed during treatment.[36] Evidence about the effects of social media on patient-doctor relations is limited. More studies are needed on using peer-generated health information or the perception of this type of content. Studies on this subject are limited because of the small sample size, insufficient response rates, and lack of details.[37,38] Studies show that half of healthcare providers think that social media intervenes in relations with patients and that patients may be misinformed and worried about forums for complaining healthcare professionals.[37] In this study, people gather negative sentiments from videos about orthognathic surgery, and this situation causes fear. Real surgery videos cause more negative sentiment than animation surgery videos. As most people watching videos are assumed to have orthognathic surgery needs, this pre-consultation situation may negatively affect patient-doctor relations.

CONCLUSION

YouTube contains many videos about orthognathic surgery. When we look at the comments on these videos, which people can easily access, we see that they cause negative emotions and sentiments. Real surgery videos have more negative effects. Different video formats, animation or real videos, may be used for informing, but we think that watching real surgical operation videos may increase people's preoperative anxiety.

Authors' contributions

AA: Concept, design, literature review, writing, materials, supervision, data collection and processing, analysis and interpretation; OKO: Critical review, supervision, materials, analysis and interpretation.

Ethical approval

Institutional Review Board approval is not required as public data was used.

Declaration of patient consent

Patient's consent was not required as there are no patients in this study.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the

writing or editing of the manuscript and no images were manipulated using AI.

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