

Public's perceptions on over-the-counter tooth whitening: a YouTube™ videos review and analysis

Percepções do público sobre o clareamento dentário de venda livre: uma revisão e análise de vídeos do YouTube™

Percepciones del público sobre el blanqueamiento dental de venta libre: revisión y análisis de videos de YouTube™

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Abstract

This study aimed to explore the public's perception on the use of over-the-counter tooth whitening (OCTW) from the analysis of videos deposited in a social media service. A cross-sectional, qualitative, and quantitative study was developed using YouTube™ as a search platform. Videos with personal reviews on the use of OCTW products (toothpaste [WT], strips [WS], whitening pens [WP], and charcoal-based products [WC]) were selected, visualized, and transcribed in verbatim. Transcriptions were analyzed using a content analysis model including seven thematic categories: perceptions of results, adverse effects, using aspects, financial aspects, sensorial perceptions, expectations, and truthfulness in video production. Variables related to engagement and features of the videos were collected and descriptively analyzed. In total, 104 videos were included in the study. Videos about WS (43.9%), followed by WT (22.7%) and WC (16.0%) were the most viewed on the platform. Tooth sensitivity was frequently reported for WS (57.1%) and WT (18.2%). Periodontal tissue disorders were specially noticed in WC and WS videos (16% and 14.3%, respectively). WC showed the highest level of satisfaction in the results (88.8%) and sponsorship for its use. In conclusion, OCTW products can be marketing influenced and applied without professional counselling and they may cause adverse effects. This fact points out the importance of qualified recommendations specially informing the buyer about undesirable or harmful effects to the dental and periodontal tissues.

Keywords: Tooth whitening; Social media; Internet; Patient-reported outcomes.

Resumo

Este estudo teve como objetivo explorar a percepção do público sobre o uso do clareamento dentário sem prescrição (CDSP) a partir da análise de vídeos depositados em um serviço de mídia social. Foi desenvolvido um estudo transversal, qualitativo e quantitativo, utilizando o YouTube™ como plataforma de busca. Vídeos com comentários pessoais sobre o uso de produtos de CDSP (creme dental clareador [CDC], tiras [TC], canetas clareadoras [CC] e produtos à base de carvão [PC]) foram selecionados, visualizados e transcritos na íntegra. As transcrições foram analisadas por meio de um modelo de análise de conteúdo que incluiu sete categorias temáticas: percepções de resultados, efeitos adversos, aspectos de uso, aspectos financeiros, percepções sensoriais, expectativas e veracidade na produção do vídeo. Variáveis relacionadas ao engajamento e características dos vídeos foram coletadas e analisadas descritivamente. No total, 104 vídeos foram incluídos no estudo. Os vídeos sobre TC (43,9%), seguidos de CDC (22,7%) e PC (16,0%) foram os mais vistos na plataforma. A sensibilidade dentária foi frequentemente relatada para TC (57,1%) e CDC (18,2%). Distúrbios do tecido periodontal foram especialmente notados nos vídeos de PC e TC (16% e 14,3%, respectivamente). O PC apresentou o maior nível de satisfação nos resultados (88,8%) e patrocínio para sua utilização. Em conclusão, os produtos de CDSP podem ser influenciados pelo marketing e aplicados sem aconselhamento profissional e podem causar efeitos adversos. Este fato ressalta a importância de recomendações qualificadas, especialmente informando o comprador sobre efeitos indesejáveis ou prejudiciais aos tecidos dentários e periodontais.

Palavras-chave: Clareamento dental; Mídias sociais; Internet; Medidas de resultados relatados pelo paciente.

Resumen

Este estudio tuvo como objetivo explorar la percepción del público sobre el uso de blanqueamiento dental de venta libre (BDVL) a partir del análisis de videos depositados en un servicio de redes sociales. Se desarrolló un estudio transversal, cualitativo y cuantitativo utilizando YouTube™ como plataforma de búsqueda. Se seleccionaron, visualizaron y transcribieron textualmente videos con reseñas personales sobre el uso de los productos BDVL (pasta de dientes [PD], tiras [TB], bolígrafos blanqueadores [BB] y productos a base de carbón [PC]). Las transcripciones fueron analizadas utilizando un modelo de análisis de contenido que incluye siete categorías temáticas: percepciones de resultados, efectos adversos, aspectos de uso, aspectos financieros, percepciones sensoriales, expectativas y veracidad en la producción de videos. Se recopilaron y analizaron descriptivamente variables relacionadas con el compromiso y las características de los videos. En total, se incluyeron en el estudio 104 videos. Los videos sobre TB (43,9 %), seguidos de PD (22,7 %) y PC (16,0 %) fueron los más vistos en la plataforma. La sensibilidad dental se informó con frecuencia para TB (57,1%) y PD (18,2%). Los trastornos del tejido periodontal se notaron especialmente en los videos PC y TB (16% y 14,3%, respectivamente). PC mostró el mayor nivel de satisfacción en los resultados (88,8%) y patrocinio para su uso. En conclusión, los productos BDVL pueden verse influenciados por la comercialización y aplicarse sin asesoramiento profesional y pueden causar efectos adversos. Este hecho destaca la importancia de recomendaciones cualificadas que informen especialmente al comprador sobre efectos indeseables o nocivos para los tejidos dentales y periodontales.

Palabras clave: Blanqueadores dentales; Medios de comunicación sociales; Internet; Medición de resultados informados por el paciente.

1. Introduction

White teeth are considered an important pattern of beauty in society (Martin et al., 2016). For this reason, tooth whitening is one of the most requested procedures in current dental practice, however, a tooth whitening procedure carried out under professional supervision can be considered expensive (Demarco et al., 2009; Martin et al., 2016). Therefore, alternative bleaching options have considerably increased in the market, such as prefabricated stock trays, whitening strips, charcoal-based products, and paint-on application systems, assuring a tooth whitening effect. These products can be used at home, without any supervision, and are widely available for purchase at pharmacies, supermarkets, and e-commerce sites (Eachempati et al., 2018; Naidu et al., 2020).

Considering the impact of the internet social media in today's society, several biomedical areas have been using qualitative research in online social networks to assess health issues (Chou et al., 2011; Yoo & Kim, 2012). YouTube™ is an online video-sharing platform used by people all over the world to spread videos publicly that records more than three billion views a day and 800 million users each month. Social media can offer an unrestricted environment for the public to share their stories and express feelings instantly and freely, which could be a concern in face-to-face interviews. This facilitates self-disclosure and helps individuals discuss sensitive issues or venture opinions without fear of embarrassment or negative judgments (Hamzah et al., 2014). On the other hand, this virtual platform allows a quickly and massive diffusion of information without

peer review and restrictions. Therefore, the information can be disclosed without any scientific basis or professional review leading to an unsafe practice of tooth whitening.

The impact of social media is already recognized by dental professionals as a source for patients to exchange their knowledge and experiences with dentistry practices. Some studies have been published analysing patients' opinions on YouTube™ videos in orthodontics and pediatric appointments or aesthetic dental treatments (Gao et al., 2013; Livas et al., 2018; Simsek et al., 2020). Considering that dental bleaching is one of the most sought-after aesthetic procedures in dentistry, there is a widespread availability of over-the-counter whitening products. This study aimed to explore the general public's perceptions on use of over-the-counter tooth whitening products, from the analysis of videos on YouTube™.

2. Methodology

Study Design

A cross-sectional, qualitative and quantitative study was designed using YouTube™ as a search platform to evaluate the public's perspective on over-the-counter tooth whitening products (OCTW). Videos related to personal reviews on OCTW according to four domains (i) toothpaste, (ii) strips, (iii) paint-on application systems, and (iv) charcoal-based products were selected, watched, and transcribed in verbatim. Variables related to video engagement and features were collected. The variables considering the content analysis were collected and qualitatively and quantitatively analysed and described.

Videos Search

YouTube™ (San Bruno, California, EUA) videos were retrieved according to four domains for tooth whitening products according to the keywords: teeth whitening toothpaste review, teeth whitening strips review, teeth whitening pen review and teeth whitening charcoal review. Considering that most YouTube™ users only observe the first three pages of the search (Desai et al., 2013), the first 50 videos of each domain were selected and a total of 200 YouTube™ link videos were stored in an Excel spreadsheet (Microsoft Office, Microsoft, Redmond, Washington, EUA) to subsequent appraisal. "Sort by relevance" was the only search filter used to select the most popular videos available. All searches were carried out on the same day (5th May 2020) by a single researcher (TTM) and, in order to avoid biases of recent searches, a new user account was created, and an anonymous tab was used. Videos in duplicates among the domains searched were excluded.

Eligibility Criteria

A video was included in the study when it was in English and when it expressed views or experiences of a self-declared layperson with no formal dental training on any aspect of tooth whitening. A video was excluded if: (1) it was not related to tooth whitening, (2) it was purely an advertisement, (3) it was purely for entertainment (e.g. comedy), (4) it contained only the views of self-declared dental professionals, (5) it was in a language other than English, (6) its production quality did not allow to discern the meaning of the speech or conversation, or (7) it was a review with more than one product and if there was no detailed information about the product or the whitening product was other than those searched. No data restrictions were made. All the retrieved videos were independently reviewed by two team members (MCF and TTM) and classified as included or excluded according to the eligibility criteria. In cases of doubts or ambiguities, discussions were made among authors until a consensus was reached.

Video Transcription and Data Extraction

The selected videos were divided among three team members (MSF, LSP, and FAVJ) to be transcribed in verbatim on Word software (Microsoft Office). The YouTube™ transcription tool was used to support in the video transcription. After the

transcription, a panel of two members with operative dentistry expertise (MCF and TTM) read thoroughly the transcriptions and watched each video carefully to ensure that the context was precisely understood and documented. In case of divergence, the member responsible for the video transcription was consulted. Besides the pure verbatim transcriptions, from each included video, the following data were collected: Youtuber's gender, duration time length of the video, number of likes, views, and number of followers of the user who uploaded the video. The data collection was made on Excel spreadsheet by two team members (MCF and MSF) and reviewed by a third one (TTM). The data collection was carried out on the same day to avoid internet turnover. A descriptive analysis was used to summarize the data.

Content Analysis

Thematic content analysis was applied to examine the videos' transcriptions and no analysis software was used (Gao et al. 2013). As the content analysis is not a standardized instrument, a pilot study was performed to test and create a category system considering an inductive step-by-step content analysis model (open coding method). For the pilot study, two of the most visualized videos in each domain of whitening products were used (n=8). Two independent reviewers (MCF and TTM) analysed the transcriptions manually by means of line-by-line coding. Codes were developed mainly through an inductive method (e.g. as they emerged from the data). During theme development and coding, any ideas, preliminary assumptions, and theoretical reflections were noted and considered in the analysis.

The process of open coding led to a clustering of substantive codes with similar content into thematic categories. To be included in a specific thematic category, the codes related to the theme should be expressed at least four times in the pilot videos' transcriptions. In total, seven thematic categories were identified: (i) results perceptions, (ii) adverse effects, (iii) using aspects, (iv) financial aspects, (v) sensorial perceptions, (vi) expectations, and (vii) truthfulness. Discussions were carried out whenever there were disagreements until consensus was reached by the researchers.

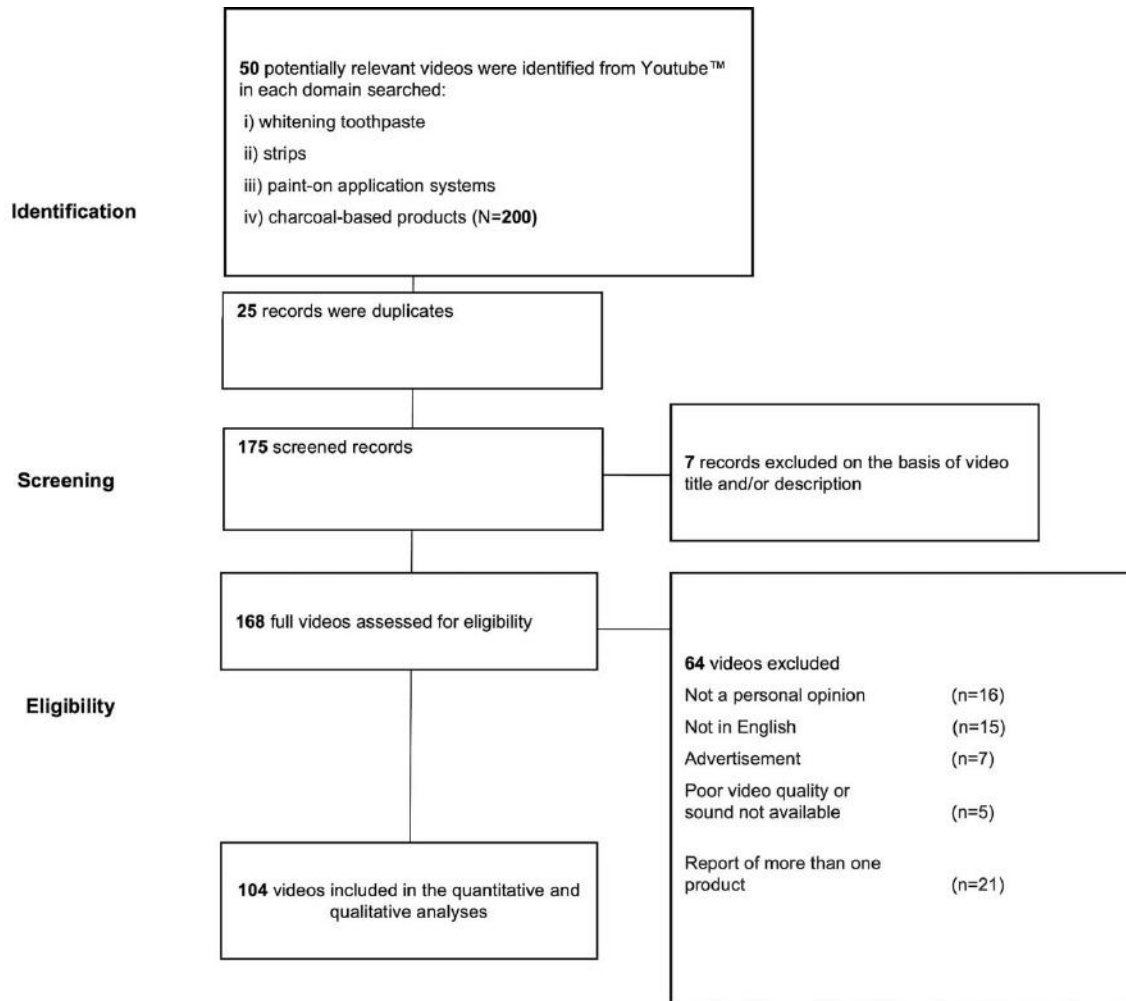
According to the codes and thematic categories identified in the pilot study, all the YouTube™ videos were analysed using a deductive step-by-step analysis model with seven thematic categories enclosing two to three codes each (analytical categories). All transcriptions were analysed and codified by two independent researchers (TTM and MCF) to double-check all codes labelled. Quotes from each code representing analytical category were collected and used as base to the discussion. A Microsoft Excel (version 16.54 - 21101001) spreadsheet containing all codes organized according to the thematic categories served as storage to all data collection.

3. Results and Discussion

Videos selection

The search retrieved 200 video records and after the removal of duplicates, 175 titles were screened. The appraisal of titles and videos descriptions resulted in 168 records to be assessed according to eligibility criteria. One hundred and four videos met the inclusion criteria (Figure 1) and were included for qualitative and quantitative analysis: 22 videos on toothpaste, 35 on strips, 22 on paint-on application systems, and 25 on charcoal-based products for tooth whitening.

Figure 1. Flowchart of the Youtube™ videos screening considering OCTW products for tooth whitening according four domains: toothpaste, strips, paint-on application systems and charcoal-based products.



Source: Authors,

Videos characteristics and popularity

Characteristics of the included videos are shown in Table 1. Reviews from female gender were more prevalent than reviews from male gender for all types of whitening products. Strips (42.9%) followed by toothpaste (22.7%) and charcoal-based products (16.0%) for tooth whitening were the most visualized and liked videos. Considering those videos with more than 1.000 likes, strips (31.4%) followed by charcoal-based products and whitening toothpastes (13.6%) were the most liked videos. Videos on paint-on application systems were the least liked among all.

Table 1. Characteristics and popularity of the 104 videos assessed and distributed by the over-the-counter whitening products, n (%)

Variable	Charcoal-based products	Toothpastes	Paint-on application-systems	Strips	Total
Youtuber gender					
Female	20 (80.0)	14 (63.6)	19 (86.4)	21 (60.0)	74 (71.2)
Male	5 (20.0)	8 (36.4)	3 (13.6)	14 (40.0)	30 (28.8)
Time length					
≤5 min	10 (40.0)	13 (59.1)	7 (17.5)	10 (28.6)	40 (38.5)
>5 ≤ 10 min	12 (48.0)	7 (31.8)	10 (45.5)	17 (48.6)	46 (44.2)
>10 min	3 (12.0)	2 (9.1)	5 (22.7)	8 (22.9)	18 (17.3)
# Views					
≤10K	8 (32.0)	7 (31.8)	12 (54.5)	8 (22.9)	35 (33.7)
> 10K ≤ 100K	13 (52.0)	10 (45.5)	9 (40.9)	12(34.3)	44 (42.3)
>100 K	4 (16.0)	5 (22.7)	1 (4.5)	15 (42.9)	25 (24.0)
# Likes					
≤ 1k	18 (81.8)	18 (81.8)	22 (100.0)	23 (65.7)	85 (81.7)
> 1k ≤ 10k	3 (13.6)	3 (13.6)	0 (0.0)	11 (31.4)	17 (16.3)
> 10k	1 (4.5)	1 (4.5)	0 (0.0)	1 (2.9)	2 (1.9)
	25 (24.0)	22 (21.2)	22 (21.2)	35 (33.7)	104 (100)

Source: Authors,

Content Analysis Findings

The content analysis findings are shown as quantitative data in Table 2. A qualitative analysis and critical discussion over each thematic category are above-mentioned.

Table 2. Quantitative distribution (absolute numbers and relative frequencies %) of the selected videos according to whitening product and each analytical category found in the content analysis.

Thematic category	Analytical category	Charcoal-based products			Toothpaste			Paint-on application-systems			Strips		
		Yes	No	Not reported	Yes	No	Not Reported	Yes	No	Not Reported	Yes	No	Not Reported
Adverse effects	Sensitivity	1 (4.0)	6 (24.0)	18 (72.0)	4 (18.2)	3 (13.6)	15 (68.2)	3(13.6)	8 (36.4)	11 (50.0)	20 (57.1)	5 (14.3)	10 (28.6)
	Periodontal injuring	4 (16.0)	0 (0.0)	21 (84.0)	0(0.0)	1 (4.5)	21 (95.5)	0 (0.0)	4 (18.2)	18 (81.8)	5 (14.3)	3 (8.6)	27 (77.1)
Whitening effects results	Satisfaction	22 (88.8)	2 (8.0)	1 (4.0)	16 (72.7)	5(22.7)	1 (4.5)	17 (77.3)	5 (22.7)	0(0.0)	30 (85.7)	4 (11.4)	1 (2.9)
	Frustration	5 (20.0)	0 (0.0)	20 (80.0)	5 (22.7)	0 (0.0)	17 (77.3)	7 (31.8)	1 (4.5)	14 (63.6)	12 (34.3)	0 (0.0)	23 (65.7)
	Displeasure	2(8.0)	1 (4.0)	22 (88.0)	7 (31.8)	1(4.5)	14 (63.7)	6 (27.3)	1 (4.5)	15(68.2)	16(45.7)	1 (2.9)	18 (51.4)
Expectancy	Result assured by product	6 (24.0)	0 (0.0)	19 (76.0)	8 (36.4)	0 (0.0)	14 (63.6)	8(36.4)	0(0.0)	14 (63.6)	8 (22.9)	0 (0.0)	24 (77.1)
	Result expectation by user	5(20.0)	0 (0.0)	20 (80.0)	3(13.6)	0 (0.0)	19 (86.4)	10 (45.5)	0(0.0)	12 (54.5)	14 (40.0)	0 (0.0)	21 (60.0)
Financial aspects	Sponsored video	11(44.0)	9 (36.0)	5 (20.0)	3 (13.6)	11(50.0)	8(36.4)	2 (9.1)	14(63.6)	6(27.3)	2(5.7)	20(57.1)	13(37.1)
	Costs involved *High cost = Yes **Low cost= No	1 (4.0)	4 (16.0)	20 (80.0)	5(22.7)	4(18.2)	13(59.1)	0 (0.0)	5 (22.7)	17 (77.3)	9(25.7)	5(14.3)	21(60.0)

Table 2. (Continued)

Thematic category	Analytical category	Charcoal-based products			Toothpaste			Paint-on application-systems			Strips		
		Yes	No	Not Reported	Yes	No	Not Reported	Yes	No	Not Reported	Yes	No	Not Reported
Using aspects	How to use	17(68.0)	0 (0.0)	8(32.0)	13 (59.1)	0 (0.0)	6 (17.1)	20 (90.9)	0 (0.0)	2 (9.1)	29 (82.9)	0 (0.0)	6 (17.1)
	Indiscriminate use	7(28.0)	0 (0.0)	18(72.0)	7 (31.8)	0 (0.0)	15 (68.2)	5 (22.7)	0 (0.0)	17 (77.3)	3 (8.6)	0 (0.0)	32 (91.4)
	Easy to use	6 (24.0)	8 (32.0)	11 (44.0)	5 (22.7)	1 (4.5)	16 (72.7)	4 (18.2)	3 (13.6)	15 (68.2)	8 (22.9)	3(8.6)	24 (68.6)
Sensorial perceptions	Dental Aesthetic	9 (36.0)	0 (0.0)	16 (64.0)	8(36.4)	0 (0.0)	14 (63.6)	6 (27.3)	0 (0.0)	16(72.7)	22 (62.9)	0 (0.0)	13 (37.1)
	Other	19 (76.0)	0 (0.0)	6 (24.0)	15 (68.2)	0 (0.0)	7 (31.8)	9 (40.9)	0 (0.0)	13 (59.1)	16 (45.7)	0 (0.0)	19 (54.3)
Truthfulness	Honesty	4 (16.0)	0 (0.0)	21 (84.0)	7 (31.8)	0 (0.0)	15 (68.2)	4 (18.2)	0 (0.0)	18 (81.8)	9 (25.7)	0 (0.0)	26 (74.3)

Notes: When the information was disclosed in the video content, the response was listed under the columns “Yes” or “No”, whereas if the information was not mentioned it was listed under “Not reported”; for e.g. Sensitivity: was present as disclosed by 1 (4%), was not present as disclosed by 6 (24%), and it was not mentioned (as present or absent) by 18 (72%) of the videos on charcoal-based products, respectively. (* |** for cost variables = * High cost ** Low Cost). Source: Authors,

Adverse effects: Sensitivity and Periodontal effects

Sensitivity was mainly reported in strips whitening videos (57.1%) followed by toothpastes ones (18.2%). This can be explained by the fact that the strips and toothpaste are the type of whitening product with a considerable amount of hydrogen peroxide (Demarco et al., 2009). Periodontal effects were seen only in charcoal-based products and in whitening strips videos (16% and 14.3% of the videos respectively). These adverse effects could be related to the high abrasiveness and hydrogen peroxide present respectively in the charcoal-based products and in whitening strips which could be responsible for injuring the periodontal tissue (Demarco et al., 2009; Franco et al., 2020).

Hydrogen and carbamide peroxide have been described as the main active principles of professional dental bleaching. They are considered as safe, but dental sensitivity and mucosal irritations may occur due to their use (Goldberg et al., 2010). Clinical studies have been showing that tooth sensibility (mild to severe) occur in 35-50% of the patients during bleaching (Donassollo et al., 2021; Meireles et al., 2008). In the present study, a similar report about sensitivity was observed in those videos where youtubers were using whitening strips (about 55%). Considering that these products can be easily purchased, and their use may be solely based on the product's instructions without professional counselling, there is important concern about the use of this specific OCTW product.

In addition, the indiscriminate use of the other OCTW products for long periods as well as the excess of product on applications could cause severe reactions (quotes #22, 133 and 140). These findings reinforce the importance of professional supervision during tooth whitening procedures and during management of adverse effects. This fact also implies the need of a restricted regulation to be available on the market.

Video #133: "my teeth are actually kind of hurt and it's like... like I just want like this sharp pain be gone away"

Video #22: "I noticed that my gum got a little bit irritated in an area due to me scrubbing the powder"

Video #140: "It hurts like it comes to a point where you can't eat nothing. It really does become so important where you can't really eat nothing"

About the whitening results

Three different analytical categories were extracted from videos about whitening results thematic category: satisfaction, frustration, and displeasure. Charcoal-based product videos showed more reports on satisfaction category followed by whitening strips (quotes #45 and 53). The use of charcoal powder for tooth whitening has not been scientifically shown to be effective (Franco et al., 2020). However, a previous study discussed that the perception of whiter teeth may occur due to the contrast with the dark colour of the charcoal, or due to the superficial wear induced by the high abrasiveness of the powder (Franco et al., 2020). In addition, it is important to highlight that charcoal-based products were the products with the highest percentage of sponsored videos which in some way could compromise the veracity of the reports presented. Regarding whitening strips, the literature has shown satisfactory results for the whitening effect (Demarco et al., 2009; Gerlach & Barker, 2004). A systematic review found similar results between the use of whitening strips and the at-home bleaching technique with 10% carbamide peroxide, however tooth sensitivity was much more pronounced in the whitening strips group (Gerlach & Barker, 2004), in agreement with the reports found in the present study.

Video #45: "I really loved this product; it whitened my teeth a lot."

Video #53: "I personally I think it worked, man. I think my teeth definitely look a little bit wither, look a little bit brighter..."

The strips and paint-on application systems were the whitening products with more frustration reported (34.3%; and 31.8%). Frustration could be explained by a feeling of unfulfilled expectations (Aina et al., 2020). This high number of frustrations related to these two products may be associated with the appealing advertisements related to them, in which, for example a three-tone whitening is promised in a two-minute daily application. The paint-on products were the domain with the higher percentages of expectations by user (45.5%), followed by whitening strips (40%), which confirms this theory (quotes #71 and 96). Furthermore, another possible explanation is that these are products with hydrogen or carbamide peroxide in their compositions which could lead to a higher level of sensitivity and frustration on the part of Youtubers (quote #151).

Video #71: "do I see a difference? Hmmm to be honest I thought it was going to be brighter than my future, but it is not that white, but it did, it got like a tint lighter. To be honest, I thought I was going to be like when I opened my mouth everybody was going to turn to Helen Keller like 'I can't see'"

Video #96: "I really am just kind of getting frustrated because I'm personally not really noticing a lot changing"

Video #151: "I'm going to be so tired but the fact I've not been able to sleep all night because my sensitivity is so bad! I don't know if it's just because I'm prone to sensitivity or like my teeth have always reacted negatively to the product, but in all honesty like I don't really want to use it again"

Considering the displeasure analytical category, the whitening products with more reports were whitening strips (45.7%) followed by whitening toothpastes (31.8%). Again, negative feelings regarding the use of whitening strips may be related to the occurrence of adverse effects reported previously. Negative feelings regarding the use of whitening toothpastes may be related to the small (if any) whitening perception (quote #127) as similarly do charcoal-based products. Most whitening toothpastes do not have any bleaching agent; however, they act by removing extrinsic pigments superficially due to the abrasiveness of their composition 18.

In addition, many other displeasure quotes were not only related to the final whitening results but related to displeasure experienced during the use of the products, such as the lack of clear instructions and complaints about the use (quotes #40, 66 and 127). These aspects reinforce the importance of professional orientation during the whitening treatment.

Video #40: "this product came with no instructions; it was just loose like this in the bag. Therefore, I'm not sure how often you'd be able to actually apply this and for it to still be safe"

Video #66: "I didn't like it, to be completely honest I hated the whole process. For like ten times I run to the sink to spit everything out from my mouth because it was it's like a jelly gluey textured that's like collecting in your mouth while it's melting, it sounds so disgusting, it was disgusting, trust me"

Video #127: "That was a waste of 27 dollars"

Expectancies about whitening products

Expectancy quotes were divided into result promised by the product and result expectation by the user. Whitening toothpastes and paint-on products were the types with more reports about the result promised by the product (both with 36.4%), this means that the promise offered by the whitening products during the advertising caught the attention of YouTube™ users. It was noticed that some products promise results that are incompatible with reality (quotes #28, 38, 42 and 43).

Video #28: "The product promises that it will naturally whiten your teeth up to at least 14 shades whiter. It will also make your enamel stronger"

Video #38: "It says it's supposed to whiten without bleach or peroxide, we simply brush on like toothpaste results in as little as one use"

Video #42: "Put it on toothpaste brush in your tooth for two minutes and, boom, you got celebrity white teeth"

Video #43: "Stains discoloration and bacteria are attracted to the highly absorbent charcoal particles to its surface is left detoxified brighter and whiter first design to do is remove deep stains and discoloration"

Paint-on application systems and whitening strips products had higher percentages of expectations by users (45.5% and 40%, respectively). The user expectations are strongly related to the type of advertising in the mainstream media, including the great importance of what is transmitted in social media. Very appealing advertisements can lead to high expectations on the part of users that may not be filled after use, leading to reports of frustration (quotes #20, 58 and 128).

Video #20: "I am really curious to try this"

Video #58: "The expectations are that it will make my teeth becomes one shade whiter in 70 seconds"

Video #128: "I am super excited to try it"

Financial aspects

Financial aspects such as the presence of sponsorship in the video and how the Youtubers consider the price of OCTW treatment (low or high cost) were taken into consideration. It is known that Youtubers have become important influencers in the consumption decisions of their audiences. They take on the role to offer their followers an insight into the brands they like and use, and they give advice on which products their followers should use or not, therefore this can be considered as a marketing tool (De Jans et al., 2018). This form of marketing with influencers' social media contributions is considered a form of advertising whenever influencers receive a compensation (free products or financial payment) or when advertisers take control over the content published (e.g., final approval of post) (EASA, 2018). When charcoal-based videos were analysed, they were the most sponsored videos from the four product domains (44%) as exemplified by the following quotes (quotes #02, 08,12, 18 and 20).

Considering that charcoal-based products reviews may be a marketing tool, the results about satisfaction of these products should be evaluated with caution. Nowadays, charcoal-based dental whitening products are widely available for purchase from pharmacies, supermarkets, and e-commerce sites. Although manufacturers promise the whitening, remineralization, antimicrobial, and antifungal properties of charcoal-based dentifrices, there is no substantial scientific evidence for these properties. Recently, Franco et al. (2020) (Franco et al., 2020) have shown that charcoal-based powder products do not seem to have any whitening effect, but an expressive number of Youtubers indicate satisfaction with its bleaching effect. A plausible explanation is that a placebo effect has occurred, or the sponsor could be influencing the users and consequently their perceptions about the actual results. In addition, similar trends can be seen for the paint-on products where only 9% of the videos were sponsored and a satisfaction level about results were lower than charcoal-based products. Surprisingly, the paint-on products have shown significant tooth whitening effects among OCTW products (Kim et al., 2018), but users reported a high dissatisfaction results level confirming the trend mentioned.

Video #02: "I've got an email from an Australian company called carbon cocoa and they were like 'girl, we'll send you our ultimate whitening kit if you make a video about it'"

Video #08: "A few months ago, I've got an email from a company called pink charcoal and they asked me if I was interested in reviewing their product"

Video #12# " Pink charcoal reached out to me and asked if I wanted to test out their products"

Video #18: " I got the product from an Australian company, so they contacted me and asked if I would like to try out their product"

Video #20: "I was contacted by the company of carbon cocoa"

Video #22 "This product was actually sent for me for free"

In this section, the Youtubers' comments on the prices of the whitening products were also reviewed. OCTW products are considered as an alternative to treat tooth discoloration with lower cost than traditional professional-prescribed products (Donly et al., 2007). These products could reduce inequity in the access to the health system, reducing the cost of treatments. It is expressed by comments made by users on the whitening strips (quote #150).

Video #150: "I got these off of Amazon they are a little bit pricey but compared to professional whitening, it's way cheaper and you get to do it in your own home, which is really convenient"

According to the Youtubers, the most expensive OCTW products were the strips followed by toothpastes. Toothpastes are not the most expensive products when compared to other OCTW products, however, in most of the videos, youtubers compared the price of whitening toothpastes with regular toothpastes and not with other whitening products. Probably, due to this fact, the price of the toothpaste was considered high by the users (quotes #58, 64). Although some whitening toothpaste may have an added bleaching agent (e.g., hydrogen peroxide), most of them are similar in composition to regular toothpastes.

On the other hand, the use of strips was quoted as a special product designed to have a professional whitening effect at home. In this context, strips whitening products may be considered cheaper than professional whitening in-office, but expensive when compared with the other OCTW methods (quote # 153).

Video #58: " it is expensive for me it is twice the price of the regular toothpaste I usually use so..."

Video #64: "now this is the most expensive product I use in my whitening routine"

Video #153 "... it's gonna remove years of stains within that hour so these strips are powerful..."

Aspects of the use

According to Melo et al. (2006) (Melo et al., 2006), companies usually invest twice as much in marketing than in research, which indirectly brings a potentially risky situation: abusive drugs use by insufficiently informed consumers. Irresponsible publicity, quality of the health care, and difficult access to the health services can contribute to the spread of self-medication (Pereira et al., 2007) and to the indiscriminate use of the OCTW whitening products. This indiscriminate use of the OCTW products was shown in specific quotes (#57, 139 and 71).

Video #57: I have tried to use other ones like a month ago I tried dial a smile that white and enlightening one I didn't like it I didn't like it at all I had like gel I didn't like it and I also used one from another brand that was like a brush kind of thing or something...

Video #139: "I'm gonna be using a whole entire box of white strips in one day open..."

Video #71: "...I'm getting all these products trying them on my body seeing if they work on my teeth on my face on my as you guys know ..."

According to YouTube™ regulations, only people over 18 years of age are allowed to post content. However, it is known that this platform is accessed by people of all ages. This directs attention to teenagers and children using OCTW products. Despite some recommendations, whitening treatments are indicated to patients aged 15 years and above. Young patients such as children and teenagers are strongly susceptible to the irrational use of medications (Pereira et al., 2007), and this should be taken into consideration regarding OCTW products.

The great majority of the Youtubers reported the way they used each OCTW product. This massive report about 'how to use the whitening product' reflects the lack of clear instructions about the use of the product (quote #40) and reinforces the importance of qualified professional recommendations.

In general, the charcoal-based products were the easiest whitening products to be used followed by toothpaste and strips. Contradictory, the charcoal-based products showed some difficulties in use in 32% of the videos. The main complaints were related to the presentation of the product that is usually powder (quotes #20, 16, 22, 28 and 40).

Toothpaste whitening products were considered easy to be used because they could be incorporated in the personal daily hygiene routine (quote #59). Whitening strips products are produced aiming to avoid the use of stock trays. Then, adhesive strips containing bleaching agents are adhered to the teeth, where they release the active ingredient during short time periods. The possibility to adhere the strip to the tooth without dentist interference (building the individual stock tray) may be considered as the main reason for the use of this product.

Video #20: "when I opened the jar the product went everywhere" and "I have a huge mess to clean up now"

Video #16: "I've got this all over my face..."

Video #22: "The carbon coco it is a little bit messy, so you have to careful when you are using it" and "It creates a mess on your sink"

Video #28: "It is quite messy, and it can stain your clothes"

Video #40: "the primary problem with this product I find is the mess that it creates and from what I can see this is going to be the same for any of these charcoal dust style based products as you brushing the charcoal particles just catapults all over the room now you can control it and get it mainly in the sink, but you have to sort of bury your head within the basin in order to control the spread".

Video #59: "I think it works wonderfully easy to use takes maybe an extra minute to brush your teeth if well it's like two minutes to brush your teeth really is that bad, I use it maybe a little bit more".

Sensorial perceptions about the whitening products

Perceptions are processes in which people selecting, organizing, and interpreting sensations came from a sensory impression — to see, to hear, to taste, to smell, and to feel (Gärdenfors, 2006). During the content analysis of the videos, several sensory aspects of products were noticed (quotes #3, 47 and 132). According to Krishna (2011) (Krishna, 2011), the touch, taste,

smell, and appearance of products affect our emotions, memories, perceptions and consequently the preference and choice of consumption of a product.

Video #3: "smells good smells like mince is very minty fresh"

Video#47: "it doesn't smell like anything" and "this has a weird taste"

Video#132: "I love the toothpaste it's very clean minty makes my breath smell amazing but the thing about the pen is the best part I love this I love that after you put it on it doesn't taste like chemically or gross, I love that I can just apply it and then go to bed "

The human perceptions are directed to a sensory marketing (Lindstrom, 2008), leading each person's perceptions to a relevant and specific purchasing behaviour experience. By acting on the users' perceptions, the Youtubers can create a deeper and more personal relationship with the products (Nadanyiova et al., 2018). This explanation confirms the findings that charcoal-based products and whitening toothpaste were those products with more sensorial perception reports and with the most visualized videos (more than 10 k) among products.

In this thematic category, the analytical category related to visual perception of Youtubers about their dental aesthetic was also collected. In general, more than 30% of the videos in each OCTW domains mentioned this category. Videos related to strips were those with more reports about this subject. It can be explained because the product is designed to be used in substitution of professional treatment. It is known that professional dental bleaching is effective to whiten teeth (Matis et al., 2000; Meireles et al., 2014) and the strips should have similar effect. Therefore, the aesthetic appeal seems to consolidate the use of whitening strips.

Truthfulness through the review

Truthfulness of the videos was evaluated when the Youtubers mentioned that the videos were produced with honesty. However more than 68.2% of all videos included did not report aspects about honesty in the videos' reviews. This means that caution must be taken in the interpretations related to whitening results expressed by them. It is especially important for the charcoal-based products where only 16% of the videos reported to be an honest review of the product followed by the high level of satisfaction and sponsored by market commerce.

4. Final Considerations

This study discussed the public's perceptions from YouTube™ users about the use of the over-the-counter whitening products. It was observed that the great majority of the users were satisfied with the whitening results, regardless of the fact that not all of these products are able to promote a real whitening effect such as seen in charcoal-based ones. The influencers' social media contribute greatly to the promotion and use of such products. Nevertheless, reports about frustrations were made by users. Complaints were more evident about paint-on application systems, which could be associated with the product's advertisement appeal and the dissatisfaction with the results.

Considering the specific universe of Youtubers, they reported that the manufacturer's instructions for correct use of these products were unclear. The high number of videos showing step-by-step instructions on how to use the OCTW product reinforces this finding and highlights the need of clear regulation, once these products can be purchased at pharmacies, supermarkets, and e-commerce sites.

Adverse effects such as tooth sensitivity and periodontal tissues irritations were not a common report for all OCTW

products. However, a similar pattern of tooth sensitivity was observed in Youtubers regarding the use of whitening strips and in patients exposed to tooth bleaching in clinical studies. These findings reinforce the importance of professional supervision during tooth whitening procedures and adverse effects management.

Considering that OCTW products can be easily acquired, it is important to consider the massive marketing influence in the consumption of these products. Furthermore, their use which may be solely based on the product's instructions without professional counselling, presumes the importance of qualified recommendations specially informing the buyer about undesirable or harmful effects, and in addition informing that self-application of bleaching products without specialized management can result in injuries to the dental and periodontal tissues.

This study showed the point of view from YouTube users regarding over-the-counter tooth whitening products. However, new investigations considering the perceptions from dental professionals and dental products company could bring additional placements and considerations about the issue.

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