Dentistry

Activity for 2020

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Topic

Dental Hygiene

Article

Brushing, toothpaste, plaque and dentine hypersensitivity; Results of studies

Speciality

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Approved for **TWO (2)** Clinical Continuing Education Units (CEU's)

BB1(20)

The use of immersive virtual reality for pain control during periodontal scaling and root planning procedures in dental hygiene clinic

INTRODUCTION

Regular periodontal/dental care is needed to maintain teeth in the oral cavity, but unfortunately, many people avoid or delay dental care procedures because of fear of pain and/or anxiety. According to dental literature, pain and anxious expectations about pain may be the primary reasons for dental treatment avoidance; patients who experience pain may be more likely to avoid subsequent dental treatment.

According to survey data from Dental Health in the United Kingdom, about 25% of adults indicated that they would choose to suffer from their dental problems and take pain relief medication rather than going to an oral health professional for treatment. Unrelieved pain increases the likelihood of having physiological and psychological consequences, which can influence morbidity and mortality. In addition, pain management is an important aspect from the public health perspective. According to the American Pain Society, the financial consequences of pain are estimated at about $100 billion yearly. Furthermore, the indirect cost of pain, in terms of lost productivity, is estimated at about 50 million lost workdays yearly.

Dental hygiene procedures such as scaling and root planning (SRP) might be painful, unpleasant and traumatic for patients. Contact with the gingiva during dental hygiene procedures is the main reason for this discomfort and pain. For example, “when scaling in areas with deep pockets where the base of the pocket is difficult to reach, tissue distension may be unavoidable and may lead to significant pain.” Another example of a painful dental hygiene procedure is the use of the dental probe to evaluate the clinical attachment loss.

Pain management is an important element to address the patient’s fears and/or needs. A number of techniques have been developed to assist in alleviating the procedural pain. These range from pharmacological intervention to behavioral intervention; yet, pain management is still one of the main challenges in establishing regular dental visits. Used as a distraction technique during SRP, immersive virtual reality (VR) could possibly help dental hygienists make dental hygiene care less painful, thereby improving health outcomes. Virtual reality is defined as a human-computer interface that enables the user to be immersed and interact with a computer-generated environment.

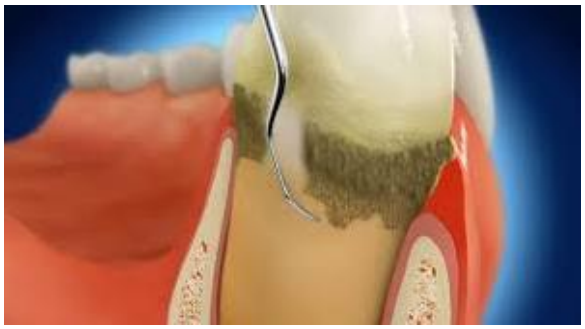
The most common applications of the VR are training simulators (flight simulators), entertainment (video games) and desensitization therapy (phobia treatment). Furthermore, VR is used in eating and body dysmorphic disorders, neuropsychological

assessment and rehabilitation. In addition, VR is used as a distraction technique for painful procedures. The use of VR as a pain management tool was initially introduced by Hoffman et al. After that, many studies examined the use of VR in reducing procedural pain in different populations and settings. The use of VR to control pain and/or anxiety in the dental setting is very limited. Therefore, the intention of this study is to answer the following research questions:

• Is the immersive virtual reality an effective pain management technique for patients undergoing SRP?

• Is the level of pain during SRP different between patients in the control group and those in the distraction group (immersive virtual reality)?

• Are the vital signs (blood pressure and pulse) different after SRP in the control group and those in the distraction group (immersive virtual reality)?



MATERIALS AND METHODS

Selection criteria

Participants in this study comprised of 50 people: 22 males and 28 females. The participants' selection was based on certain inclusion/ exclusion criteria. For inclusion, participants should be 18 years or older, in good general physical and mental health, have generalized periodontitis, need non-surgical periodontal treatment (scaling and root planning), and have at least five teeth per quadrant. Participants who have any of the following condition(s) were excluded from the study: a history of seizures or convulsive disorder, taking psychotropic drugs, history of serious vestibular abnormalities and musculoskeletal disorders.

DISCUSSION

Pharmacologic regimens, such as nonsteroidal anti-inflammatory drugs, acetaminophen and opioids, might not be enough for pain relief. Supplementary care is needed in controlling acute pain, especially in burn injuries, where multiple dressing changes and wound debridement are required. For chronic pain, concerns of opioid use and misuse, level of dependency and limited efficacy in treating specific types of pain proved the need for different treatment modalities. Treatment has been shifted in favor of non-pharmacologic alternatives, especially in a continuous need for pain control and the long course of recovery. As a non-pharmacological alternative, VR can be of benefit over conventional analgesia. The use of VR might be an alternative or adjunctive option for the treatment of pain. VR might influence the extent of opioid misuse and benefit-opioid dependent patients.

This study explores the effectiveness of virtual reality as a potential method of distraction during periodontal procedures. Distraction is considered the most common technique applied to alleviate pain during short invasive medical procedures. As a distraction method, the VR effect could be explained by McCaul and colleagues. According to McCaul and Mallet, a human has a limited capacity to pay attention.

The individual will focus on the painful stimuli to perceive pain. As a result, an individual's perception of pain is decreased when their attention is distracted away from the painful stimuli. VR has been shown to be effective in decreasing pain perception. VR is an immersive, effective and powerful distraction technique that has a positive effect on pain. The interactive aspects of VR compete for patients' attention, therefore minimizing their ability to process incoming pain signals. These advantages might be related to the fact that the participant's attention is focused on what is happening inside the virtual environment instead of in the surrounding environment.

Another theory has been proposed regarding the pain-attenuating effects of VR, which suggest that an analgesic effect could result through a sensory action (direct or indirect), such as attention, emotion, memory and other senses on pain-signaling pathways, thus producing analgesia. Analysis of functional MRI (fMRI) and functional imaging revealed an overall reduction of activities within the pain matrix with increased activity in the anterior cingulate cortex and orbitofrontal regions of the brain. Therefore, VR could be used to control a patient's perception of pain by engaging these brain regions.

The use of VR reduced the participants' awareness of pain. These findings are similar to those revealed by *Das et al*, Morris and Louw, *Hoffman et al*, *Furman et al* and *Aminabadi et al* The participants in this study reported a reduction of the amount of time spent thinking about pain when using VR, the rating of the unpleasantness of the experience, tooth and gum discomfort, and the ratings of worst pain and average pain, which are similar to the findings by *Furman et al.*

Unlike reports by *Furman et al*, the vital signs (diastolic and pulse) of participants in the current study were not associated with the use of VR This finding might be explained by the use of a virtual environment in this study that is neutral, nonviolent and inoffensive, and which did not cause a change in the vital signs. Nausea has not been associated significantly with using VR in the present study. Exposure to VR environments may cause cybersickness with symptoms that include nausea, dizziness, headache, blurred vision and feeling of moving through space (vection). The incidence of cybersickness in the virtual environment varies depending on the length of exposure, type of simulation and complexity of the devices.19 Reported findings indicated that the majority (94%) of participants did not feel nausea while experiencing the virtual world.

This might be due to the majority of cybersickness-related studies conducted on military personnel who were using simulations for much longer than typical patients. Furthermore, the military studies required the performance of very stressful and demanding missions while the patients had more relaxed experiences. According to *Wiederhold et al*,20 the use of VR in clinical practice does not appear to cause significant cybersickness-related symptoms.6 In this study, the exposure duration was short, and the simulation type was simple. Furthermore, individuals suffering from serious medical conditions were excluded from the study, which minimized the likelihood of having significant cybersickness symptoms.

This finding is similar to studies reported by *Padrino-Barrios et al*; however, it is not similar to a study reported by *Furman et al*. Therefore, individuals with high susceptibility to

cybersickness probably should not experience VR.

Regarding the VR presence and realism, the results of this study could be explained by the fact that the participant's senses are being blocked out of the real world by immersive images projected right in front of his/her eyes with the special headset. The head-mounted display provides a high-resolution visual display for each eye and stereo sounds through the headset, which increases the immersive feeling and presence in the virtual environment.

The present study showed that the majority of the participants preferred using VR during SRP. It seems that the preference was based on their satisfaction in minimizing pain and discomfort during dental hygiene care.

A randomized controlled trial evaluating the efficacy of a 67% sodium bicarbonate toothpaste on gingivitis

INTRODUCTION

The main cause of gingival bleeding is plaque build-up, especially at the gingival margin, which can in turn lead to gingivitis. Untreated gingivitis is a risk factor for periodontitis; this is a major cause of abnormal tooth mobility. Although flossing has traditionally been advocated for preventing gingivitis and plaque build-up, the evidence to support this is mixed, with studies showing limited benefit from interdental brushing or regular flossing (at least at a population level).

In contrast, a recent systematic review and meta-analysis have shown that antiplaque chemical formulations can provide significant improvements in gingival, bleeding and plaque indices. Furthermore, a number of other studies have demonstrated the beneficial effect of mouth rinses in reducing oral malodour, although a systematic review suggested that due to limited evidence, the potential effect of a specifically formulated dentifrice, a mouthwash or a tongue scraper for treating oral malodour is, in general, unclear. In particular, previous studies have demonstrated the efficacy of sodium bicarbonate toothpastes on the removal of plaque, with a suggestion that a higher concentration of sodium bicarbonate is associated with greater efficacy (in terms of mean plaque removal). Furthermore, toothpastes with high levels of sodium bicarbonate (>50%) have been shown to reduce gingival inflammation and oral malodour. These previous studies have typically been of 3-6 months duration, with a maximum strength of sodium bicarbonate of 65%. However, a review described data supporting the use of sodium bicarbonate in the management of oral malodour as being 'few and inconclusive'. The aim of this study was to determine the effects of brushing for 6 weeks with 67% sodium bicarbonate toothpaste on gingival health, compared to a 0% sodium bicarbonate toothpaste. As there is a suggestion from previous studies of a correlation between oral malodour (measured as volatile sulphur compounds [VSCs]) and gingivitis, the study also aimed to evaluate the effect of 67% sodium bicarbonate toothpaste on VSC levels.

STUDY, POPULATION AND METHODOLOGY

Trial Design

This was a single-centre, single examiner-blind, randomized, controlled, two-treatment, parallel-group study, with a 6-week intervention period conducted at a specialized research centre.

Participants

Subjects were at least 18 years of age and had a total score of at least 7 on a 'Subject's level of understanding' questionnaire (a 12-question form that tested whether the subject understood the instructions for participating in the study, such as how many times they were to attend the site, how long they had to brush their teeth for and when they were to complete their diary cards; see the online supplement). In addition, eligible subjects were in good general and mental health, with no clinically significant or relevant abnormalities. They had at least 20 gradable teeth, with mild-to-moderate

gingivitis, a positive response to bleeding on brushing (at screening) and at least 20 bleeding sites (at baseline). Otherwise, subjects were in good oral health (in the opinion of the investigator).

Key exclusion criteria were intolerance or hypersensitivity to the study materials or stated ingredients, currently active dental caries, more than three pockets with 5 mm or over, excessive calculus, other severe oral/gingival conditions, medical conditions which may influence gingival bleeding, restorations in a poor state of repair or orthodontic appliances.

RESULTS

Participants

The first subject was enrolled into the study in November 2013, with the final subject completing in January 2014. Of 198 subjects screened, 148 were randomized (74 to each group); the majority of subjects in each group completed the study (Figure 1). Most of the subjects combined the baseline and dental prophylaxis visits. The baseline demographics (Table 1) and disease characteristics (Table 2) of the randomized subjects were well balanced between the two groups, and compliance to treatment was high, with the mean number of brushings missed being 0.7 (SD 1.48) in the test group and 0.5 (1.16) in the control group. Compliance to protocol was high, with a total of seven brushings missed in the test group and five in the control group.

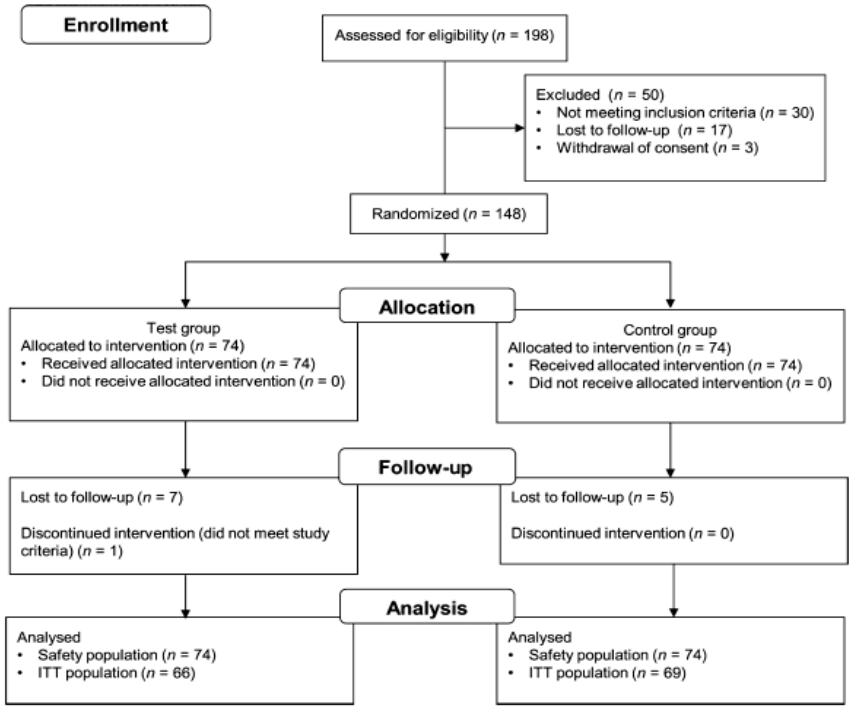


Fig. 1. Subject flow through the study.

Table 1. Subject baseline demographics (safety population)

	Test group (*N* = 74)	Control group (*N* = 74)
Male gender, n (%)	27 (36.5)	37 (50.0)
Race, n (%)		
Asian	74 (100)	74 (100)
Age, years, mean (SD)	27.7 (7.69)	28.6 (10.34)
Number of bleeding sites, n (%)		
<45	0	1 (1.4)
≥45	74 (100)	73 (98.6)
Smoking status, n (%)		
Non-smoker	71 (95.9)	72 (97.3)
Smoker	3 (4.1)	2 (2.7)

Outcomes

Primary endpoint

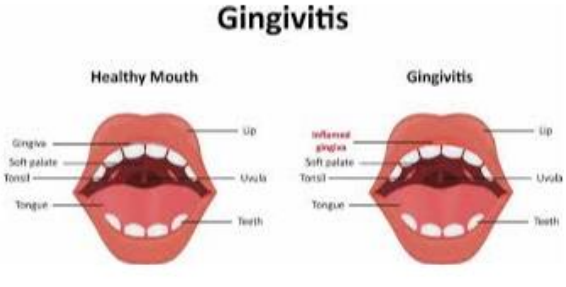
The number of bleeding sites at Week 6 was statistically lower ($P < 0.0001$) in the test group compared with the control group, with an absolute difference of _11.0 and a relative difference of _25.4% (Table 2).

Secondary endpoint

Consistent with the primary endpoint, both the MGI score and the whole-mouth BI score were significantly lower in the test group compared with the control group, with relative differences of _28.8% and _27.4%, respectively (Table 2). As described in the methods section, VSC and the components, HS and MM were not analised as planned, given the large number of values that were below the level of quantification. Although the median reductions from baseline for all parameters were greater in the test group, the differences did not reach statistical significance (Table 3).

Exploratory endpoint

Pearson's correlation coefficients between MGI and VSC components (VSC, HS, MM) and between BI and VSC components varied between 0.08 and 0.26; the large number of values below the LOQ makes these data difficult to interpret.



Discussion

This study provided evidence of the efficacy of a high-concentration sodium bicarbonate toothpaste in reducing a number of markers of poor dental health, with statistically significant reductions at Week 6 compared with the non-sodium bicarbonate toothpaste in the number of bleeding sites (25.4% reduction), the MGI (28.8% improvement) and the whole mouth BI (27.4% reduction).

Previous studies investigating the effect of sodium bicarbonate toothpastes have generally been of 3- or 6-months duration (10, 20). Zambon and colleagues report the results of a study in which 27 participants used a 65% sodium bicarbonate toothpaste and 74 used a toothpaste containing 52% sodium bicarbonate and 3% sodium percarbonate (10). The participants used these toothpastes for 6 months and were then followed up for a further 3 months. Both toothpastes resulted in significant reductions in plaque and gingival inflammation, with the 65% toothpaste being associated with a 74.5% reduction from baseline in MGI.

It is notable, therefore, that the improvements in this current study were observed as early as 6 weeks. Furthermore, although the current study only included one concentration of sodium bicarbonate toothpaste, previous studies demonstrated a dose relationship, with higher concentrations associated with greater efficacy than lower concentrations. In particular, in a single-brushing study, a 65% sodium bicarbonate toothpaste resulted in 13% mean greater plaque removal than a 20% sodium bicarbonate toothpaste (P = 0.0033). In a similar single-brushing study, both a 67% sodium bicarbonate toothpaste and a 62% sodium bicarbonate toothpaste resulted in statistically significantly greater plaque removal than a 0% sodium bicarbonate toothpaste. The current study used a concentration of 67%, so this would be anticipated to be at least as effective as the highest concentrations tested previously.

The current study was designed to examine the impact of the 67% sodium bicarbonate

toothpaste on gingival disease, and as a consequence recruited subjects with some evidence of gingival disease at baseline. Previous studies have suggested that there is a correlation between gingivitis and VSC levels, although it is not clear whether the Sulphur compounds are a marker of gingival disease, or [as some researchers have suggested] the compounds contribute to the process. However, even at low concentrations, these compounds have been shown to be highly toxic to tissues.

The researchers therefore collected VSCs in the current study and sought to evaluate the correlation with gingival disease as an exploratory outcome. However, there was no requirement for subjects to have measurable levels of VSCs at baseline – and 73% of VSC values were below the LOQ. When the available data were analysed, there was some suggestion of a greater reduction from baseline in VSC levels with the 67% sodium bicarbonate toothpaste compared with the 0% toothpaste, but limited conclusions can be drawn from this. To fully evaluate the question on the effect of a sodium bicarbonate toothpaste on VSC, a specifically designed study would be required, considering aspects such as inclusion criteria with respect to baseline VSC levels. Another potential direction for future research includes a study with both a negative control (as here) and a positive control (for example, a toothpaste containing a different concentration of sodium bicarbonate).
The current study was single center, with a study population that was 100% Asian, predominantly non-smoking, and with a high number of bleeding sites. Although this limits the generalizability of the data, the results of this study are consistent with a number of previous studies. In the first, after 6 and 12 weeks, a toothpaste containing 67% sodium bicarbonate resulted in statistically significant reductions in both the number of bleeding sites and the bleeding index compared with a 0% sodium bicarbonate toothpaste. In the second, after 2 months, the then marketed Parodontax toothpaste was associated with statistically significant reductions in gingivitis and bleeding on probing compared with both a placebo toothpaste and a commercially available non-sodium bicarbonate toothpaste. In the third study, after 6 months of use, the same marketed sodium bicarbonate toothpaste was associated with a statistically significant reduction in bleeding and plaque levels compared with a placebo toothpaste, together with a statistically significant reduction from baseline in gingivitis.

Dry brushing: Does it improve plaque removal? *A secondary analysis*

INTRODUCTION

Teeth that are consistently surrounded by inflamed gingiva have a significantly higher risk of being lost. A determinant of the initiation of gingivitis is supra-gingival plaque accumulation, which involves an established bacterial colonization on the dentition. Dental plaque control through routine oral hygiene is therefore important. It is well established that the toothbrush is effective in reducing levels of dental plaque on the surfaces of teeth, meaning that it plays an important role in the prevention of periodontal diseases. While brushing is a simple and effective means of removing dental plaque, there is clearly room for improvement.6 Oral hygiene is apparently a public and personal health issue, and improved hygiene could be expected to result in benefits in terms of periodontal disease and dental caries.

It is common practice to combine a toothbrush with dentifrice. Not only do many people like the resultant flavour and freshness, but it also provides the subjective impression of making the mouth feel clean.7 Dentifrice also adds a smooth feeling to tooth surfaces. In 1998, the concept of “dry brushing” was introduced: brushing without dentifrice and a toothbrush not wetted with water. The purpose of this was to avoid the smooth perception of tooth surfaces being the results of reduced surface tension, as provided by surfactants of a dentifrice. In addition, a recent systematic review demonstrated that brushing with a dentifrice does not improve the efficacy of mechanical plaque removal. It is suggested that dry toothbrushing increases peoples’ ability to feel the bacterial biofilm, as well as to feel the difference in dental plaque on the tooth surfaces before and after brushing.9 Patients are instructed to start brushing on the lower lingual surfaces and to brush until all of the teeth feel clean. In a second variation of the experiment, dentifrice is added, and the teeth are brushed once more. In a multicenter practice-based observational study, significant improvements in gingival bleeding were observed after six months of dry toothbrushing. Currently, there is no high-quality research that has shown that dry brushing is indeed a more effective method. Plaque removal with a dry toothbrush has not been compared to that of a prewetted toothbrush with water. Recently, we published two similar single-brushing exercises of which one included brushing with a prewetted and the other brushing with a dry toothbrush. Both published experiments were initiated as a *proof of principal* to investigate a certain theory and whether this has practical implications. These two previous experiments used a split-mouth model and were performed under the same conditions with the same participants and the same examiners. Therefore, a secondary analysis could be performed using the available data of both previous experiments concerning the effectiveness of a dry toothbrush as compared to a prewetted toothbrush.

MATERIALS AND METHODS

Recruitment and inclusion

The participants had been included in two previous experiments involving two single-brushing exercises. They had been recruited from various universities and colleges in and around Amsterdam and had been screened by a dental hygienist (MPCL). To qualify for inclusion,

the subjects were required to be ≥18 years old, right-handed brushers, classified as systemically healthy (as assessed by the medical questionnaire), periodontally healthy (scoring the Dutch periodontal screening index (DPSI) ≤3 minus) and retaining ≥5 teeth per quadrant. Excluded were those who presented the researchers with any of the following: an orthodontic appliance or a removable (partial) denture, overt caries, any pathological alterations of the oral mucosa, pregnancy or the use of medications within 2 weeks of the appointment. The latter included antibiotics or chronic use of non-steroidal anti-inflammatory drugs, although it excluded birth control pills.

DISCUSSION

Approximately 20 years ago, it was suggested that brushing without dentifrice allows the patient to more distinctly feel the layer of dental plaque before and after brushing. This was considered not to be the case with a dentifrice due to associated flavour and wetting agents.8 By the use of a secondary analysis, the aim of this study was to evaluate the effectiveness of a dry toothbrush as compared to a prewetted toothbrush on plaque removal. The overall reduction in dental plaque scores was at least 57% following a 2-minute brushing exercise (prewetted toothbrush 57%, dry toothbrush 58%).

Consequently, dry brushing did not contribute significantly to toothbrush efficacy. Based on the results of this secondary data analysis, the recommendation to use a dry toothbrush is not supported by evidence. Prewetting a toothbrush neither improved nor reduced plaque removal efficacy. The minimal 57% overall reduction in dental plaque scores found in the present analysis was higher than the 42% reduction established as the average effect that can be expected from a brushing exercise. This implies that the participants of the present experiments were above-average brushes. There are almost twice as effective as the average participant of those studies reporting efficacy according to Quigley and Hein24 plaque scores, who on average achieved a 30% reduction. Supervised brushing may have improved plaque score reduction in the current experiment. Supervision was performed to ensure that the study procedures including brushing duration were according to the protocol. The concept of “dry brushing” was introduced based on a multicenter observational study.8 However, this study, however, lacks a control group. Furthermore, for evaluating the effectiveness of interventions, a randomized controlled trial (RCT) would be more appropriate, as RCTs are generally placed at the top of the research hierarchy when considering original experimental studies. This secondary analysis used the data of two previous experiments and found a larger effect in overall reduction in dental plaque scores compared to the dental plaque score reduction as shown as the average effect of a single-brushing exercise. The advantage of the larger effect size is that it is possible to detect a difference between interventions in smaller sample numbers, whereas a smaller effect size would require larger sample sizes. Subsequently this secondary analysis shows that dry brushing does not contribute to plaque-removing efficacy. Therefore, dental care professionals should focus on several aspects of toothbrushing, such as duration, type of toothbrush and systematics rather than focusing on one specific instruction only (eg, prerinsing of dry or prewetted toothbrush). Individually tailored advice is the most important part of an oral hygiene instruction.

Is plaque regrowth inhibited by dentifrice? *A systematic review and meta-analysis with trial sequential analysis*

INTRODUCTION

Good oral hygiene results in the reduction in plaque, caries and gingivitis. Toothbrushing is effective in reducing levels of dental plaque. It is generally accepted that dentifrice should be used in combination with a toothbrush, although plaque reduction can be achieved without. Adding dentifrice to a toothbrush does not appear to improve the shear force that is exerted on the plaque biofilm through the scrubbing effect of the toothbrush filaments. But this finding does not imply that brushing without a dentifrice should be recommended primarily due to the lack of fluoride to prevent caries. As the available scientific literature suggests that dentifrices do not improve the mechanical action of brushing on plaque removal, 8 a further aspect of interest is whether dentifrice reduces plaque regrowth. Many plaque growth studies have reported a reduction in regrowth of plaque between brushings. However, evaluating this influence was complicated by the ever-present variable of the participants' toothbrushing efficacy. The mechanical action of the toothbrush during a test period obscures the antiplaque effect of the dentifrice by itself. Also, the Hawthorne effect, whereby oral hygiene practices are improved irrespective of the test product, can easily occur in oral hygiene study designs. To some incalculable degree, it could mask the true adjunctive effect of the dentifrice, making it impossible to determine whether the reduction in plaque regrowth results from very efficient brushing or from a chemical antiplaque effect of the dentifrice. One proposed alternative is to assess the effects of dentifrice ingredients on plaque regrowth independently of those of mechanical cleaning effect of a toothbrush by delivering the dentifrice formulation as a slurry in mouthwash form. To obtain a slurry, the dentifrices are mixed with water so that simple rinsing reproduces the quantity of active substance present in the oral cavity during normal toothbrushing, without the mechanical cleaning effect of toothbrushing. A suitable research model for investigating whether dentifrice can play a role as plaque-reducing agent seems to be the 4-day non brushing model developed by Addy et al15 This design has been used extensively and allows the chemotherapeutic activity of dentifrice products on dental plaque to be rapidly determined. The objective of this systematic review (SR) was therefore to systematically and critically appraise the literature on 4-day non brushing models that compared the efficacy on plaque regrowth of a dentifrice for daily use with that of water or saline only.

MATERIALS AND METHODS

This SR was prepared and described in accordance with the Cochrane Handbook for Systematic Reviews of Interventions and the guidelines of Transparent Reporting of Systematic Reviews and Meta-analyses (PRISMA statement). The protocol that details the review method was developed "a priori" following an initial discussion among the members of the research team.

Focused question

What is the efficacy of a regular dentifrice intended for daily use on regrowth of dental

plaque used as a slurry in comparison with that of water or (sterile) saline in healthy adults?

Search strategy

A structured search strategy was designed to retrieve all relevant studies. The National Library of Medicine, Washington, D.C. (MEDLINE-PubMed), the Cochrane Central Register of Controlled Trials (CENTRAL) and EMBASE (Excerpta Medica Database by Elsevier) were searched from initiation to April 2018 for appropriate papers that answered the focused question.

RESULTS

Search and selection results

The search of the MEDLINE-PubMed, Cochrane-CENTRAL and EMBASE databases resulted in 195 unique papers (for details, see Figure 1). Manual searching of the reference lists of the eight selected papers provided one additional relevant paper. Altogether, nine eligible publications in which described 25 comparisons were included in this SR.

DISCUSSION

Over recent decades, dentifrice formulations have been developed to deliver chemical and physical mediated benefits. Despite these efforts, a recent SR indicated that dentifrice appears not to provide an adjuvant mechanical action of toothbrushing on the instant removal of plaque.8 Traditionally, dentifrices have played an important role in the sense of a fresh mouth and in tooth discoloration control. In August 1960, the American Dental Association (ADA) for the first time recognized a dentifrice with fluoride to have therapeutic value in fighting tooth decay. Since fluoride dentifrices first became available, many formulation changes regarding fluoride type, concentration and abrasive systems have been made to improve stability, compatibility and bioavailability of active ingredients.58 Even chemical agents have been added for the improved treatment of bad breath, staining, caries, gingivitis, dental plaque, dental calculus, demineralization and dentinal hypersensitivity. Because plaque control plays a paramount role in the aetiology of caries and periodontal disease 60 and plaque formation on teeth cannot be stopped, disturbing plaque accumulation is of major importance. The aim of the present review was to investigate whether dentifrice can play a role as plaque-reducing agent. Nearly all the dentifrices in the included studies of this SR appeared to provide a significant inhibiting effect on plaque regrowth in comparison with rinsing with water or saline.

The 4-day no brushing model design, developed by *Addy et al*, has been extensively used to investigate the effects of mouth rinses or dentifrice slurries. For the latter, the model utilizes an aqueous dentifrice slurry and examines the effects of such treatments on plaque regrowth over a 4-day period of no oral hygiene following a dental prophylaxis. By comparison with controls, the relative biological effects of antimicrobial ingredients incorporated into dentifrices can be determined. This design approximates the dilatation of a dentifrice with saliva that occurs with normal use of such products. This study design prevents the complicating effects of mechanical toothbrushing. Consequently, the Hawthorne effect, the effect often cited as being responsible for oral health improvements of control groups that receive placebo treatments, may be absent or limited. One could question whether a slurry achieves the same antibacterial effect as that obtained by the original dentifrice. *Addy et a*l attempted to produce dentifrice slurries of comparable

concentration to that delivered by toothbrush. Therefore, 3 g/10 mL of each paste was employed, based on the normal quantity of toothpaste used on a brush was reported to be 1.45 g 62 which is diluted approximately 1 in 4 by saliva. *Moran et al* have pointed out that an antimicrobial product that is proved ineffective in such a study would also have no effect if used with a toothpaste and mechanical cleaning. The results of this SR agree with those of other studies which do include the mechanical action of toothbrushing. Experiments over a 24-hour duration confirmed toothbrushing with dentifrice to form less plaque post brushing compared with brushing with water alone. Also, experiments ranging from four days to five weeks exhibited higher inhibition of plaque regrowth by brushing with dentifrices as opposed to that by brushing with water alone. In the meta-analyses of this SR, a high heterogeneity was demonstrated for the studies that evaluated the products according to the PI of Q&H *Turesky et a*l and Plaque Area 15 indices. Since systematic reviews bring together studies that are diverse both clinically and methodologically, heterogeneity in their results is to be expected.73-75 The performed sub analysis on the reported dentifrice ingredients did not provide a clear explanation for differences between the experiments. The results could also be negatively influenced by using prophylaxis in all the studies. Because prophylaxis removes the acquired pellicle, the absence of a pellicle that serves as a reservoir could reduce the substantivity of some therapeutic ingredients. It is the question of the extent to which this has influenced the results of the included studies. Another source of clinical heterogeneity is the rinsing protocols in the included studies. The rinsing time was one minute except for the 30-second rinsing in the study by *Owens et al* It is conceivable that when the amount of plaque removal is highly dependent on the brushing time 76 this is also valid for the rinsing time. Conversely, *Paraskevas et al* observed that rinsing for 30s was sufficient for plaque-covered surfaces to come into contact with the mouthwash, and similarly Van der *Weijden et al* found no significant difference in rinsing time whether the participants rinsed for 15, 30, 30 or 60s with 0.2% chlorhexidine in the level of plaque after 72 hours of no brushing. Because of the high unexplained heterogeneity, the effect sizes and accompanying confidence intervals should be interpreted with caution. Nevertheless, given the clear direction of nearly all the observed effects in favor of using dentifrice, it is reasonable to be confident in the results presented. The meta-analysis allowed for a subgroup analysis on the reported dentifrice ingredients some of which have claimed antiplaque activity. These were sodium fluoride (NaF), sodium monofluorophosphate (MFP), stannous fluoride (SnF), triclosan (Tcs) and baking soda. Irrespective of the Plaque Index used (Q&H *Turesky et al*, Greene and Vermillion, Plaque Area 15), the Tcs product numerically exhibited the highest inhibition of plaque regrowth. Interestingly, both NaF and MFP products, which contained no specific ingredients brought forward for their antimicrobial effect, exhibited, irrespective of the Plaque Index used in all the meta-analysis (Appendices S4, S5, and S6), a significant effect on the regrowth of plaque. Evidently, dentifrices contain more ingredients which exhibit inhibition of plaque regrowth of which SLS is the most commonly used ingredient. Besides difference in means (DiffM) and 95% confidence intervals, we calculated also 95% prediction intervals. The advantage of also using prediction intervals is that it is more informative. It reflects the variation in

treatment effects over different settings, including what effect is to be expected in future patients, such as the patients that a clinician is interested to treat. The prediction intervals were all below zero and suggest that dentifrice will be beneficial when applied in at least 95% of the individual study settings, an important finding for clinical practice.

Gingival health status in individuals using different types of toothpaste

INTRODUCTION

The oral cavity harbours a complex microbiota comprised of more than 700 different bacterial species, and the resident microbiota is critical for maintenance of oral homeostasis. On a daily basis, the resident oral microbiota is almost constantly stressed by ecological perturbations such as eating and drinking. Self-performed oral hygiene is a frequent perturbation, and the magnitude of this perturbation is probably influenced by frequency, but is also dependent on choice of toothpaste. In attempts to enhance the natural salivary antimicrobial defense mechanisms, oral health products including toothpastes have been used with different added ingredients. Zendium™ toothpaste contains a triple enzyme system including amyloglucosidase, glucose oxidase and lactoperoxidase that generates the natural antimicrobial agents, hydrogen peroxide and the hypothiocyanite ion. Salivary peroxidases catalyse the oxidation of thiocyanate (SCN^-) to hypothiocyanite ($OSCN^-$) via hydrogen peroxide. Peroxidases and thiocyanate are natural constituents of saliva, whereas hydrogen peroxide also salivary proteins, lactoferrin and lysozyme are also added to the toothpaste. Lactoferrin binds iron, whereby the availability of iron as a co-factor in bacterial enzymes is reduced. Lactoferrin thereby acts as a bacteriostatic agent. Lactoferrin also exerts direct bactericidal effect on certain cariogenic bacteria, e.g. *Streptococcus mutans* as well as periodontal pathogens [for review 8]. Lysozyme breaks down peptidoglycan, which is an essential part of the cell wall of the gram-positive bacteria, and thus acts as a bactericidal agent. However, lysozyme also acts in a bacteriostatic manner through agglutination of bacteria inhibiting bacterial adhesion and colonisation [for review. It has recently been shown that the use of a toothpaste containing enzymes and proteins (Zendium™) can boost the natural salivary defences by increasing the levels of lysozyme and hydrogen peroxide *in vivo* and hypothiocyanite *in vitro* and reduce the growth and viability of oral bacteria in microbiological models. Similarly, the findings of a recent randomised clinical study on the composition of supragingival bacterial biofilms indicate that the use of a toothpaste containing enzymes and proteins can augment natural salivary defences. Specifically, by analysis of supragingival plaque samples collected from 102 subjects it was reported that use of toothpaste containing enzymes and proteins for 14 weeks resulted in a statistically significant increase in 12 gingival health-associated taxa together with a statistically significant decrease in 10 periodontitis-associated taxa. However, clinical recordings on gingival health in long term users of toothpaste containing enzymes and proteins (Zendium™) were not investigated. To address this question we employed clinical data recorded from a cohort of 305 subjects, which had used the same toothpaste for>1 year (test group: n=161 vs. control group: n=144). Accordingly, the purpose of the present investigation was to test the hypothesis that medium term use (> 1 year) of a toothpaste containing natural enzymes and proteins (Zendium™, test) is associated with a better gingival health in terms of gingival inflammation, plaque levels and gingival bleeding than medium term use of toothpastes without antimicrobial/anti-inflammatory active ingredients (control).

MATERIALS AND METHODS

Study, design and objective

This was a single blind, with respect to the clinician, monadic study. Screening visits and clinical examinations were performed from May 2016 to October 2016 at the Department of Odontology, Faculty of Health and Medical Sciences, University of Copenhagen.

Prescreening, telephone interview

A total of 10,620 potential study participants were contacted by telephone by the market research agency TNS Gallup A/S and asked to take part in this study. The participants were informed about the purpose of the telephone interview, and subsequently screened using a prescreening questionnaire concerning basic exclusion criteria including age below 18 years, residence in the Capital Region of Denmark for less than 5 consecutive years, employment in oral health care industry, insufficient or irregular oral health care, wearing partial or full dentures, having oral piercings, and use of mouthwash within the previous 4 weeks. Finally, each potential participant was asked about their toothpaste usage within the last 12 months. Participants who had used any kind of Zendium™ toothpaste continuously over the latest 12 months were eligible for inclusion in the test group. Participants who had used any other toothpaste without antimicrobial/ anti-inflammatory ingredients apart from Zendium™ were eligible for inclusion in the control group. A total of 4354 persons refused to participate and a further 5735 persons did not fulfil the inclusion criteria based on the pre-screening questionnaire. Thus, a total of 531 participants were scheduled for the screening visit.

Screening visit

A total of 386 participants attended the appointment for the screening visit, which was performed either by DB or AMLP. At the screening visit the participants provided informed consent and then answered a questionnaire with regards to general health and medication intake.
Furthermore, a clinical screening of oral health status, including presence of periodontitis and dental caries was performed. Inclusion criteria for the clinical examination included confirmation of continuous use of specific toothpaste eligible for inclusion in either of the study groups, age above 18 years and willingness to participate in the investigation. Exclusion criteria included periodontitis and/or dental caries requiring treatment, less than 20 natural teeth (excluding third molars), on-going orthodontic treatment, scale and prophylaxis in the month prior to enrolment, type 1 and type 2 diabetes, autoimmune, inflammatory systemic diseases, current antibiotic treatment within 3 months of the screening appointment as well as alcohol and drug abuse. Based on the screening visit a total of 341 subjects were invited to attend the clinical examination.

Clinical examination

A total of 305 participants completed the clinical examination, in which gingival inflammation, plaque levels and gingival bleeding were recorded at six sites of each tooth (third molars excluded).

DISCUSSION

The purpose of the present investigation was to test the hypothesis that use of fluoride toothpaste containing naturally occurring enzymes and proteins (Zendium™) for more than a year is associated with a better gingival health than use of toothpastes without ntimicrobial/anti-inflammatory active ingredients (control). The main finding was that test group who had used Zendium™ had

significantly better gingival health status than the control group in terms of gingival inflammation, plaque levels and gingival bleeding.

One way to explain the clinical findings from the present study is that the toothpaste used by the test group contains a triple enzyme system, which includes amyloglucosidase, glucose oxidase and lactoperoxidase. Saliva contains lactoperoxidase, lysozyme and lactoferrin, and salivary levels of these particular enzymes and proteins may be involved in shaping the composition of the resident oral microbiota, and therefore potentially influence oral health status. One possible explanation, which requires further research, is that use of toothpaste, which contains enzymes and proteins that are naturally present in saliva, may augment salivary defence mechanisms in balancing the oral microbiota. This assumption is supported by data from a randomised clinical trial, which studied the impact of toothpaste use for 14 weeks on the composition of the oral microbiota [10]. Notably, the use of a toothpaste containing enzymes and proteins (Zendium™) induced significant alterations to the supragingival microbial community over time in orally healthy individuals, whereas the control toothpaste did not result in a shift of the supragingival microbial community. Specifically, the use of the test toothpaste with enzymes and proteins induced a significant increase in health-associated bacterial species together with a concomitant decrease in abundance of periodontitis associated bacterial species. Thus, clinical data from the present study and microbiological data presented in are consistent with each other, and also consistent with the results of a recent controlled clinical trial on gingival health.

The supragingival microbiota has been reported to differ between orally healthy individuals with different levels of sugar intake, and smoking status seems to influence the composition of the subgingival microbiota in oral health and periodontitis, which suggest an impact of diet and lifestyle on the oral microbiota. While it is interesting to know the compositional changes of the microbiota associated with ecological perturbations such as diet, smoking and toothpaste use, such studies provides no information on bacterial phenotypes. Notably, metatranscriptomic analysis has demonstrated that smoking impacts functional signatures of the subgingival microbiota and bacterial metabolic gene expression of saliva is different in patients with periodontitis and dental caries compared to orally healthy persons. Thus in a future study it would be interesting to investigate if long term use of toothpaste with enzymes and proteins (Zendium™) also can be reflected in the metabolic gene expression of the resident microbiota. In this study, we also found that the women generally had better gingival health status than men, in terms of lower levels of gingival inflammation, plaque and gingival bleeding, which supports the findings of previous studies. In addition, participants at the age of 18–30 years had significantly higher levels of gingival inflammation than the participants from the older age groups. Their levels of plaque and gingival bleeding were also higher than those of participants aged 31–55 years, irrespective of the toothpaste use. In Denmark, the government provides free dental care to all children, up to the age of 18 years. From the age of eighteen the young adults need to find a private dentist for regular dental follow-up examination and dental treatment.

However, almost 25% of the young adults aged 18–34 years drop out of the dental service system for a period of time, and do not attend a

private dentist regularly, mainly due to the costs [23,25]. In this period they are likely to develop dental problems like gingivitis and dental caries, and this may also explain our findings of poorer gingival conditions in the young age group. In this study, gingival health status was determined by traditional clinical parameters. The continuous development of novel technologies such as metaproteomics and multiplex panels offer new opportunities for investigation of the molecular biological mechanisms underlying these findings. Thus it has been shown that salivary levels of certain immunological markers are associated with periodontitis and gingivitis.

In the present study only participants with good oral health and not requiring treatment for periodontitis or dental caries were included. Thus, the data presented in this study may not be representative of participants with manifest oral disease such as periodontitis or dental caries. Furthermore, no information on socio-economic status was recorded. Oral health status is linked with socioeconomic status, and socio-economic status has been reported to impact the composition of the oral microbiota. In this study, the participants in the test group tended to drink less soft drinks and to eat less candy than the control group, which suggest that choice of toothpaste might be associated with consumption and attitude towards health-related consumer choices.

Thus, it would be interesting to address these aspects in a future study. In conclusion, data from the present single-blinded clinical study indicate that long term use of toothpaste containing enzymes and proteins (Zendium™) is associated with better gingival health status than use of other toothpastes. Future studies, which perform simultaneous characterisation and comparison of clinical, microbiological and immunological data in persons using different types of toothpaste, may reveal the mechanisms behind the findings from the present study.

Impact of toothpaste on oral health-related quality of life in people with dentine hypersensitivity

BACKGROUND

Dentine hypersensitivity (DH] is relatively common in adults, with a prevalence of between 12 and 42%.

The defining symptom of DH is short, sharp pain unrelated to any other dental pathology or defect. This is typically assessed clinically by evaluating response to a potentially painful evaporative or tactile stimulus applied to the tooth, using either examiner-observed criteria (e.g., the Schiff Sensitivity Scale) or participant-reported verbal descriptors and/or pain rating scales. It is only recently that the wider psychosocial impacts of DH have been given much consideration. One qualitative study found that DH is experienced in complex ways in everyday life and has a wide variety of triggers and responses, not all of which are described as 'pain'. Furthermore, DH impacts functional status and the ability to participate in everyday activities including eating, drinking, tooth brushing, talking and social interactions. Oral health-related quality of life (OHrQoL) is a multidimensional construct. Tools used to capture the impact of clinical interventions on OHrQoL are of increasing interest in dentistry. With clinical efficacy of an anhydrous toothpaste containing 0.454% w/w stannous fluoride (SnF2) established in randomized, controlled clinical trials of up to 8 weeks, this study was designed to explore impact of long-term twice daily use of this toothpaste on participant-reported OHrQoL outcomes using the DHEQ and other measures in people with DH.

METHODS

This 24-week, non-comparative clinical study was conducted across two sites at a clinical research facility in Cheshire, UK (Clinicaltrials.gov: NCT02752958, registered on April 27, 2016).

Participants

Participants were aged 18–55 years, in good general health, with a self-reported history of DH between 0.5–10 years. At the screening visit, eligible participants had at least 20 natural teeth and at least two accessible, nonadjacent teeth (incisors, canines or pre-molars) with signs of erosion, abrasion or facial/cervical gingival recession (EAR), a modified gingival index score of 0 adjacent to the test area, clinical tooth mobility of ≤1 and a positive response to a qualifying evaporative (air) assessment. At the baseline visit, eligible participants had a minimum of two accessible non-adjacent teeth exhibiting sensitivity, as determined by evaporative (air) assessment (Schiff sensitivity score of ≥2).

Excluding factors included: a chronic debilitating disease that could affect study outcomes; any condition causing dry mouth; tongue/lip piercings; dental implants; treatments that could interfere with pain perception or cause dry mouth or use of antibiotics during the study/within 2 weeks of baseline; pregnancy; breastfeeding; a known/suspected allergy/intolerance to study materials/ingredients; dental prophylaxis or participation in a study or investigational drug use within 4 weeks, desensitizing treatment, tooth bleaching or use of a DHindicated oral care product within 8 weeks, scaling or

root planning within 3 months or gross periodontal disease or treatment of such within 12 months of screening.

DISCUSSION

This long-term study in individuals with DH investigated the impact on OHrQoL of twice daily brushing with an anhydrous SnF2-based toothpaste. While clinical efficacy (up to 8 weeks) has previously been demonstrated for this toothpaste in randomized controlled clinical trials, this is the first study evaluating its longer term benefits (24 weeks). This study had a relatively large sample size and number of participants who completed the study, adding validity to the results. Overall, the psychosocial OHrQoL results paralleled the biomedical results observed in this and other clinical trials. Pain assessment results confirmed the performance of the DH-targeted toothpaste, in line with literature reported RCT's, with change from baseline of DH statistically significant after 4 weeks and a continued decline in Schiff sensitivity scores throughout the study. In comparison to the previous studies of this toothpaste, at 8 weeks use, changes from baseline were of a similar magnitude, dropping below the score of '2' needed to rate a tooth as being hypersensitive. The baseline participant reported LMS data was similar to that shown in a dental practice-based study and results here showed that all the LMS themes questioned regarding pain (Description, Duration, Intensity, Tolerability) decreased significantly over the 24 weeks.

While pain assessments are standard for a clinical trial to show treatment efficacy, DH can also be described as a set of sensations including 'itching' and 'shivering' and like 'needles' or 'brain freeze'. Impact of these sensations on a study participant's everyday life was specifically explored with the DHEQ.

Responses to DHEQ Section 1 questions, which examine physical impact of DH, showed statistically significant improvements from 4- or 8-weeks treatment indicating that over the course of the study, sensations were rated as less intense, less bothersome and more tolerable.

Awareness that DH might occur can increase a person's pain-avoiding habits. As such, decreases in scores assessing DH impact are favourable when examining a treatment's effectiveness.

Improvements were shown in all DHEQ Section 2 OHrQoL domains. Pain and physical impact decrease was reflected from 4 weeks' treatment in the Restrictions domain, which questioned issues participants encountered related to eating. It has been shown previously that modifying eating and drinking habits may be a negative consequence of DH. This study confirms that this need can be reduced by twice daily brushing with the anti-sensitivity toothpaste used here.

The Adaptations domain showed a statistically significant improvement after 8 weeks. As this domain informs on how individuals avoid stimuli that provoke DH (foods in particular) and on coping strategies employed to mitigate effects of these stimuli, improvement in this domain is expected to follow improvements in the Restrictions domain. Likewise, the Social Impact domain informs on restrictions participants impose on themselves when eating/interacting with others and how this impacts them in a social setting; statistically significant improvements were demonstrated in this domain after 8 weeks.

The Emotional Impact domain, which pays regard to anxiety and annoyance that individuals perceive from their DH, showed statistically significant improvements from baseline after 4 weeks. Emotional impact has

previously been reported to be a component of DH; hence, it is important that treatment with an anti-sensitivity toothpaste was shown to decrease this domain score. Twelve weeks was required before a statistically significant improvement in the Identity domain was demonstrated, consistent with previous studies where Identity was generally the domain with the least change from baseline. As this domain relates to how an individual perceives themselves in the context of their health and/or age, it is possible that this self-perception domain is slower to change than more tangible areas such as eating restrictions/adaptations. Interestingly, the Global Oral Health question showed little improvement until Week 24. This question has previously been shown to correlate poorly with clinically derived sensitivity assessments such as the Schiff Sensitivity Score.

CONCLUSION

In conclusion, long-term twice daily use of a 0.454% w/w SnF2 anti-sensitivity toothpaste provides an important range of clinically proven oral health benefits together with a beneficial and increasing positive impact on OHr-QoL measures. The study treatment was generally well tolerated.

The use of immersive virtual reality for pain control during periodontal scaling and root planing procedures in dental hygiene clinic

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A randomized controlled trial evaluating the efficacy of a 67% sodium bicarbonate toothpaste on gingivitis

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Dry brushing: Does it improve plaque removal?
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Gingival health status in individuals using different types of toothpaste

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Impact of toothpaste on oral health-related quality of life in people with dentine hypersensitivity

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QUESTIONNAIRE

BB1(20) PART 2

Brushing, toothpaste, plaque and dentine hypersensitivity; Results of studies

INSTRUCTIONS

- Read through the article and answer the multiple choice questions provided below
- **Some questions may have more than one answer**; in which case you must please **mark all the** correct answers

Is plaque regrowth inhibited by dentifrice?

Introduction

Question 1: Is it TRUE or FALSE that adding dentifrice to a toothbrush improves the shear force that is exerted on the plaque biofilm through the scrubbing effect of the toothbrush filaments?

- **A:** TRUE
- **B:** FALSE

Question 2: The effect whereby oral hygiene practices are improved irrespective of the test product, is called which of the following?

- **A:** The placebo effect
- **B:** The Stockholm effect
- **C:** The Hawthorne effect
- **D:** The potentiation effect

Discussion

Question 3: Since fluoride dentifrices first became available, which of the following were done?

- **A:** Formulation changes were made regarding fluoride type, concentration and abrasive systems
- **B:** These changes improved stability and compatibility
- **C:** These changes did not affect the bioavailability of the dentifrice
- **D:** None of the above

Question 4: Chemical agents were added for the improved treatment of which of the following?

- **A:** Staining
- **B:** Dental plaque and gingivitis
- **C:** Bad breath
- **D:** Caries
- **E:** Dentinal hypersensitivity

Question 5: It is conceivable that when the amount of plaque removed IS highly dependent on brushing time, this will also be valid for rinsing time. Against this background which of the following statements are TRUE?

- **A:** *Paraskevas et al* observed that rinsing for 30s was insufficient for plaque-covered surfaces to come into contact with the mouthwash
- **B:** *Van der Weijden et al* found significant differences in rinsing time when the participants rinsed for 15,30 or 60s with 0,2% chlorhexidine
- **C:** Despite heterogeneity, and given the clear direction of nearly all the observed effects in favour of using dentifrice, it was reasonable to conclude that dentifrice inhibits plaque regrowth
- **D:** All the above

Gingival health status in individuals using different types of toothpaste

Introduction

Question 6: Is it TRUE that the purpose of this study was to test the hypothesis that medium term use (>1 year) of a toothpaste containing natural enzymes and proteins, is associated with a better gingival health in terms of gingival inflammation, plaque levels and gingival bleeding than medium term use of toothpastes without antimicrobial / anti-inflammatory active ingredients?

- **A:** YES
- **B:** NO

Question 7: Exclusion criteria for this study included which of the following?

- **A:** Periodontitis
- **B:** Type 1 and 2 diabetes
- **C:** Current antibiotic treatment within three months of screening
- **D:** Current use of anti-inflammatory medication
- **E:** All the above

Discussion

Question 8: Regarding the role of enzymes, which of the following statements are TRUE?

- **A:** Saliva contains lactoperoxidase, lysozyme and lactoferrin
- **B:** A toothpaste that contains enzymes and proteins that are naturally present in saliva, may augment the salivary defense mechanisms in balancing the oral microbiota
- **C:** The use of a test toothpaste with enzymes and proteins induced a significant increase in health-associate bacterial species together with a concomitant decrease in abundance of periodontitis associated bacterial species
- **D:** None of the above

Impact of toothpaste on oral health-related quality of life in people with dentine hypersensitivity

Background

Question 9: Is it TRUE or FALSE that dentine hypersensitivity's defining symptom is short, sharp pain related to other dental pathology or defect?

- **A:** YES
- **B:** NO

Discussion

Question 10: The set of sensations associated with dentine hypersensitivity, include all the following, except for ……?

- **A:** Itching
- **B:** Like needles
- **C:** Burning
- **D:** Shivering
- **E:** Brain freeze

End

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ANSWER SHEET

BB1 (20) PART 2

Brushing, toothpaste, plaque and dentine hypersensitivity; Results of studies

	A	B	C	D	E		A	B	C	D	E
1						6					
2						7					
3						8					
4						9					
5						10					

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