Dentistry

Activity for 2020

Activity No: BB1 (20) 2023 PART 1

Topic

Dental Hygiene

Article

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

Speciality

DA / OH

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.

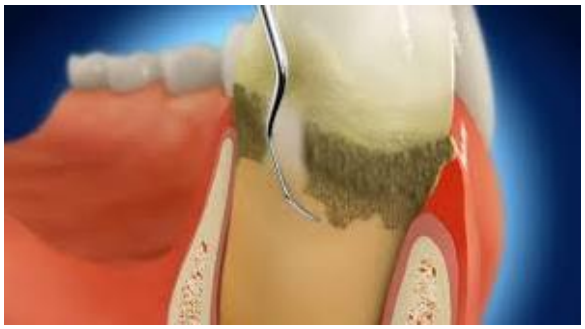
The most common applications of the VR are training simulators (flight simulators), entertainment (video games) and desensitization therapy (phobia treatment). Furthermore, VR is used in eating and body dysmorphic disorders, neuropsychological

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.

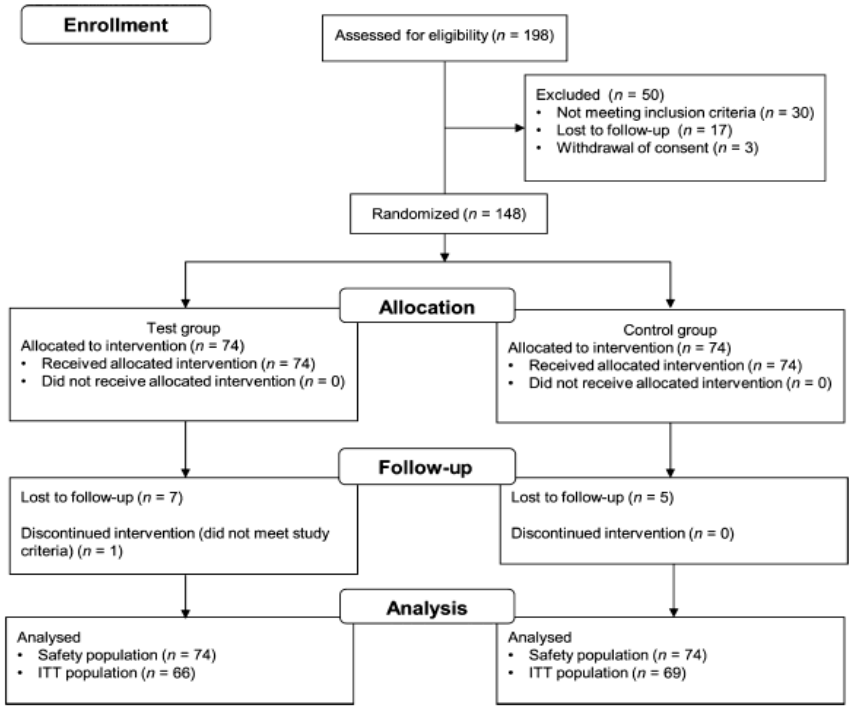


Fig. 1. Subject flow through the study.

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

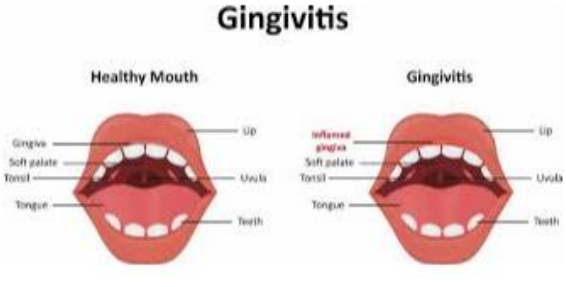
The number of bleeding sites at Week 6 was statistically lower ($P < 0.0001$) in the test group compared with the control group, with an absolute difference of _11.0 and a relative difference of _25.4% (Table 2).

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

R E FE R E N C E S

1. Tripp DA, Neish NR, Sullivan MJ. What hurts during dental hygiene treatment. *J Dent Hyg*. 1998;72(4):25-30.
2. Das DA, Grimmer KA, Sparnon AL, McRae SE, Thomas BH. The efficacy of playing a virtual reality game in modulating pain for children with acute burn injuries: a randomized controlled trial. *BMC Pediatr*.2005;5(1):1.
3. Huang D, Wun E, Stern A. Current treatments and advances in pain and anxiety management. *Dent Clin North Am*. 2011;55(3):609-618.
4. Berry PH, Covington EC, Katz JA, Miaskowski C, Dahl JL, American Pain Society. Pain: current understanding of assessment, management,and treatments. [Internet]. 2012 May [cited 2013 Apr 8]. https://www.americanpainsociety.org/education/content/enduringmaterials.html. Accessed January 2018.
5. Morris LD, Louw QA, Somers KG. The effectiveness of virtual reality on reducing pain and anxiety in burn injury patients a systematic review. *Clin J Pain*. 2009;25(9):815-826.
6. Essex-Lancaster G. Oral hygiene assessment: soft deposits, plaque,biofilm, calculus, and stain. In: Darby ML, Walsh MM, Kuhn S, eds. *Dental Hygiene Theory, and Practice*, 2nd edn. St. Louis, MO: Elsevier; 2003:258-457.
7. Virtual Reality. VPL research. [Internet]. 2009 [cited 2013 Apr].https://www.vrs.org.uk/virtual-reality-profiles/vpl-research.html. Accessed March 2018.
8. Hoffman H, Patterson D, Carrougher G. Use of virtual reality foradjunctive treatment of adult burn pain during physical therapy: a controlled study. *Clin J Pain*. 2000;16(3):244-250.
9. Steele E, Grimmer K, Thomas B, Mulley B, Fulton I, Hoffman H.Virtual reality as a pediatric pain modulation technique: a case study. *CyberPsychol Behav*. 2003;6(6):633-638.10. Gershon J, Zimand E, Lemos R, Rothbaum BO, Hodges L. Use of virtual reality as a distractor for painful procedures in a patient with pediatric cancer: a case study. *CyberPsychol Behav*. 2003;6(6):657-661.
11. Furman E. Virtual reality distraction for pain control during periodontal scaling and root planning procedures. *J Am Dent Assoc*.2009;140(12):1508-1516.
12. Sharar S, Miller W, Teeley-Soltani M, Hoffman G, Jensen M,Patterson D. Applications of virtual reality for pain management in burn-injured patients. *Expert Rev Neurother*. 2008;8(11):1667-1674.
13. Hawker GA, Mian S, Kendzerska T, French M. Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and. Constant Osteoarthritis Pain (ICOAP). *Arthritis Care Res (Hoboken)*. 011;63(11):240-252.
14. Varni JW, Walco GA, Katz ER. A cognitive-behavioral approach to pain associated with pediatric chronic disease. *J Pain Symptom Manage*. 1989;4(4):238-421.
15. Aminabadi N, Erfanparast L, Sohrabi A, Oskouei SG, Naghili A.The impact of virtual reality distraction on pain and anxiety during dental treatment in 4–6 year-old children: a randomized controlled clinical Trail. *J Dent Res Dent Clin Dent Prospects*.2012;6(4):117-124.
16. Witmer BG, Singer MJ. Measuring presence in virtual environments:a presence questionnaire. *Presence (Camb)*. 1998;7(3):225-240.
17. Gupta A, Scott K, Dukewich M. Innovative technology using virtual reality in the treatment of pain: does it reduce pain via distraction, or is there more to it? *Pain Med*. 2018;19:151-159.
18. Li A, Montano Z, Chen V, Gold J. Virtual reality and pain management: current trends and future directions. *Pain Manag*.2011;1(2):147-157.
19. LaViola JJ. A discussion of cybersickness in virtual reality environments.*ACM SIGCHI Bull*. 2000;32(1):47-55.
20. Wiederhold BK, Wiederhold MD. *Virtual Reality Therapy for Anxiety Disorder: Advances in Evaluation and Treatment*, 1st edn. Washington, DC: American Psychological Association Publishing; 2005:11-92.
21. Padrino-Barrios C, McCombs G, Diawara N, De Leo G. The use of immersive visualization for the control anxiety during oral debridement.*J Dent Hyg*. 2015;89(6):372-377.

How to cite this article: Alshatrat SM, Alotaibi R, Sirois M, Malkawi Z. The use of immersive virtual reality for pain control during periodontal scaling and root planning procedures in dental hygiene clinic. *Int J Dent Hygiene*. 2019;17:71–76. https://doi.org/10.1111/idh.12366

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

References

1 Ledingham J, Warrell D, eds. Concise Oxford Textbook of Medicine.Oxford, Oxford University Press, 2000.
2 Scottish Dental Clinical Effectiveness Programme. Prevention and Treatment of Periodontal Diseases in Primary Care. Dundee: Scottish Dental Clinical Effectiveness Programme; 2010.
3 Poklepovic T, Worthington HV, Johnson TM et al. Interdental brushing for the prevention and control of periodontal diseases and dental caries in adults. Cochrane Database Syst Rev 2013; 12: CD009857.
4 Berchier CE, Slot DE, Haps S, Van der Weijden GA. The efficacy of dental floss in addition to a toothbrush on plaque and parameters of gingival inflammation: a systematic review. Int J Dent Hyg 2008; 6: 265–279.
5 Serrano J, Escribano M, Rold_an S, Mart_ın C, Herrera D. Efficacy of adjunctive anti-plaque chemical agents in managing gingivitis: a systematic review and meta-analysis. J Clin Periodontol 2015; 42 (Suppl 1): S106–S138.
6 Dadamio J, Van Tournout M, Teughels W, Dekeyser C, Coucke W, Quirynen M. Efficacy of different mouthrinse formulations in reducing oral malodour: a randomized clinical trial. J Clin Periodontol 2013; 40: 505–513.
7 Blom T, Slot DE, Quirynen M, Van der Weijden GA. The effect of mouthrinses on oral malodor: a systematic review. Int J Dent Hyg 2012; 10: 209–222.
8 Slot DE, De Geest S, van der Weijden FA, Quirynen M. Treatment of oral malodour. Medium-term efficacy of mechanical and/or chemical agents: a systematic review. J Clin Periodontol 2015; 31: 42.
9 Putt MS, Milleman KR, Ghassemi A et al. Enhancement of plaque removal efficacy by tooth brushing with baking soda dentifrices:results of five clinical studies. J Clin Dent 2008; 19: 111–119.
10 Zambon JJ, Mather ML, Gonzales Y. A microbiological and clinical study of the safety and efficacy of baking-soda dentifrices. Compend Contin Educ Dent Suppl 1996; 17: S39–S44.
11 Brunette DM. Effects of baking-soda-containing dentifrices on oral malodor. Compend Contin Educ Dent Suppl 1996; 17: S22–S32.
12 Dadamio J, Laleman I, Quirynen M. The role of toothpastes in oral malodor management. Monogr Oral Sci 2013; 23: 45–60.
13 Pavolotskaya A, McCombs G, Darby M, Marinak K, Dayanand NN. Sulcular sulfide monitoring: an indicator of early dental plaque-induced gingival disease. J Dent Hyg 2006; 80: 11.
14 Zhou H, McCombs GB, Darby ML, Marinak K. Sulphur by-product: the relationship between volatile sulphur compounds and dental plaque-induced gingivitis. J Contemp Dent Pract 2004; 5: 27–39.
15 Newby EE, Hickling JM, Hughes FJ, Proskin HM, Bosma MP. Control of oral malodour by dentifrices measured by gas chromatography. Arch Oral Biol 2008; 53(Suppl 1): S19–S25. Elsevier.
16 Rosenberg M, McCulloch CA. Measurement of oral malodor: current methods and future prospects. J Periodontol 1992; 63: 776–782.
17 Saxton CA, van der Ouderaa FJ. The effect of a dentifrice containing zinc citrate and Triclosan on developing gingivitis. J Periodontal Res 1989; 24: 75–80.
18 Lobene RR, Weatherford T, Ross NM, Lamm RA, Menaker L. Amodified gingival index for use in clinical trials. Clin Prev Dent 1986; 8: 3–6.
19 GSK Consumer Healthcare. Data on file: Study RH01530.
20 Kakar A, Lomax A, Siddiqi M, Wang N, Ghosh S, Bosma M. Evaluate the efficacy of different concentrations of sodium bicarbonate toothpastes. J Periodontal Res 2014; 93(Spec Iss B): Abstract 754.

21 Akwagyriam I, Lomax A, Targett D et al. Plaque removal efficacy of four dentifrices in single brushing model. J Dent Res 2013; 92 (Spec Iss A): Abstract 3328.
22 Ratcliff PA, Johnson PW. The relationship between oral malodor, gingivitis, and periodontitis. A review. J Periodontol 1999; 70: 485–489.
23 Ng W, Tonzetich J. Effect of hydrogen sulfide and methyl mercaptan on the permeability of oral mucosa. J Dent Res 1984; 63: 994–997. 24 Johnson PW, Tonzetich J. Sulfur uptake by type I collagen frommethyl mercaptan/dimethyl disulfide air mixtures. J Dent Res 1985; 64: 1361–1364.
25 Yankell SL, Emling RC. Two month evaluation of Parodontax dentifrice. J Clin Dent 1988; 1(Suppl A): A41–A43.
26 Yankell SL, Emling RC, Perez B. Six-month evaluation of Parodontax dentifrice compared to a placebo dentifrice. J Clin Dent 1993; 4: 26–30.

Dry brushing: Does it improve plaque removal?
R E FE R E N C E S

1. Lang NP, Karring T. *European Workshop on Periodontology, 1st Proceeding*. Axelsson P, Session III Mechanical Plaque Control. Quintessence Publishing Co, London. 1994:219-243.
2. DeVore CH, Beck FM, Horton JE. Plaque score changes based primarily on patient performance at specific time intervals.*J Periodontol*. 1990;61:343-346.
3. Prasad KV, Sreenivasan PK, Patil S, Chhabra KG, Javali SB, DeVizio W. Removal of dental plaque from different regions of the mouth after a 1-minute episode of mechanical oral hygiene. *Am J Dent*. 2011;24:60-64.
4. Van der Weijden FA, Slot DE. Efficacy of homecare regimens for mechanical plaque removal in managing gingivitis a meta review. *J Clin Periodontol*. 2015;42:77-91.
5. Loe H, Theilandee E, Jensen SB. Experimental gingivitis in man. *J Periodontol*. 1965;36:177-187.
6. Morris AJ, Steele J, White DA. The oral cleanliness and periodontal health of UK adults in 1998. *Br Dent J*. 2001;25:186-192.
7. Valkenburg C, Slot DE, Bakker EW, Van der Weijden FA. Does dentifrice use help to remove plaque? A systematic review. *J Clin Periodontol*. 2016;43:1050-1058.
8. O'Hehir TE, Suvan JE. Dry brushing lingual surfaces first. *J Am Dent Assoc*. 1998;129:614.
9. O'Hehir TE. The new standard for prevention. *Auxiliary*. 2011;21:20. 10. Van der Sluijs E, Slot DE, Hennequin-Hoenderdos NL, Van Leeuwen M, Van der Weijden GA. Prebrushing rinse with water on plaque removal: a split-mouth design. *Int J Dent Hyg*. 2017;15:345-351.
11. Van der Sluijs E, Slot DE, Hennequin-Hoenderdos NL, Van der Weijden GA. A specific brushing sequence and plaque removal efficacy: a randomized split-mouth design. *Int J Dent Hyg*. 2018;16:85-91.
12. Swart E, Schmitt J. STandardized Reporting Of Secondary data Analyses (STROSA)—a recommendation. *Z Evid Fortbild Qual Gesundhwes*. 2014;108:511-516.
13. Swart E, Bitzer EM, Gothe H, et al. A Consensus German Reporting Standard for Secondary Data Analyses, Version 2 (STROSA-STandardisierte BerichtsROutine für SekundärdatenAnalysen). *Gesundheitswesen*. 2016;78:145-160.
14. Schulz KF, Altman DG, Moher D. CONSORT 2010 statement: updated guidelines for reporting parallel group randomized trials. *Ann Intern Med*. 2010;152:726-732.
15. Hoffmann TC, Glasziou PP, Boutron I, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *BMJ*. 2014;348:g1687.16. Gómez SM, Danser MM, Sipos PM, Rowshani B, van der Weijden GA. Tongue coating and salivary bacterial counts in healthy/gingivitis subjects and periodontitis patients. *J Clin Periodontol*. 2001;28:970-978.
17. Bentley CD, Disney JA. A comparison of partial and full mouth scoring of plaque and gingivitis in oral hygiene studies. *J Clin Periodontol*.1995;22:131-153.
18. Webdocument. Dublin, Ireland: Randomness and Integrity Services Ltd. www.random.org. Accessed March 29, 2018.
19. Silness J, Löe H. Periodontal disease in pregnancy (II). Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand*. 1964;22:121-135.
20. Van der Weijden GA, Danser MM, Nijboer A, Timmerman MF,Van der Velden U. The plaque removing efficacy of an oscillating/rotating toothbrush. A short term study. *J Clin Periodontol*.1993;20:273-278.

Is plaque regrowth inhibited by dentifrice?
RE FE R E N C E S

1. Axelsson P, Nyström B, Lindhe J. The long-term effect of a plaque control program on tooth mortality, caries and periodontal disease in adults: results after 30 years of maintenance. *J Clin Periodontol*. 2004;31:49-757.
2. Van der Weijden GA, Slot DE. Efficacy of homecare regimens formechanical plaque removal in managing gingivitis a meta review. *J Clin Periodontol*. 2015;42:S77-S91.
3. Rosema NA, Hennequin-Hoenderdos NL, Versteeg PA, van Palenstein Helderman WH, van der Velden U, van der Weijden GA.Plaque-removing efficacy of new and used manual toothbrushes–a professional brushing study. *Int J Dent Hyg*. 2013;11:237-243.
4. Van der Weijden GA, Danser MM, Nijboer A, Timmerman MF,van der Velden U. The plaque-removing efficacy of an oscillating/rotating toothbrush. A short-term study. *J Clin Periodontol*.1993;20:273-278.
5. Danser MM, Timmerman MF, Jzerman Y, Piscaer MI, van der Velden U, van der Weijden GA. Plaque removal with a novel manual toothbrush (X-Active) and the Braun Oral-B 3D Plaque Remover. *J Clin Periodontol*. 2003;30:138-144.
6. Paraskevas S, Rosema NA, Versteeg P, Timmerman MF, van derVelden U, van der Weijden GA. The additional effect of a dentifrice on the instant efficacy of toothbrushing: a crossover study. *J Periodontol*. 2007;78:1011-1016.
7. Van der Weijden GA, Slot DE. Oral hygiene in the prevention of periodontal diseases: the evidence. *Periodontol 2000*. 2011;55:104-123.
8. Valkenburg C, Slot DE, Bakker EW, Van der Weijden FA. Does dentifrice use help to remove plaque? A systematic review *J Clin Periodontol*. 2016;43:1050-1058.
9. Badersten A, Egelberg J. Effect of dentifrices and toothbrushing on dental plaque. *Tandlakartidningen*. 1972;64:770-773.
10. De la Rosa M, Zacarias Guerra J, Johnston DA, Radike AW. Plaque growth and removal with daily toothbrushing. *J Periodontol*.1979;50:661-664.
11. Stean H, Forward GC. Measurement of plaque growth following toothbrushing. *Community Dent Oral Epidemiol*. 1980;8:420-423.
12. Lobene R, Soparkar P, Newman M. Plaque removing effectiveness of brushing with dentifrice or water. *J Dent Res*. 1983;62:199.
13. Harrap GJ. Assessment of the effect of dentifrices on the growth of dental plaque. *J Clin Periodontol*. 1974;1:166-174.
14. Claydon N, Hunter L, Moran J, Wade W, Kelty E, Movert R,et al. A 6-month home-usage trial of 0.1% and 0.2% delmopinol mouthwashes (I). Effects on plaque, gingivitis, supragingival calculus and tooth staining. *J Clin Periodontol*. 1996;23:220-228.
15. Addy M, Willis L, Moran J. Effect of toothpaste rinses compared with chlorhexidine on plaque formation during a 4-day period. *J Clin Periodontol*. 1983;10:89-99.
16. Binney A, Addy M, Newcombe RG. The effect of a number ofcommercial mouthrinses compared with toothpaste on plaque regrowth. *J Periodontol*. 1992;63:839-842.
17. Arweiler NB, Auschill TM, Reich E, Netuschil L. Substantivity of toothpaste slurries and their effect on reestablishment of the dental biofilm. *J Clin Periodontol*. 2002;29:615-621.
18. McClanahan SF, Bollmer BW, Court LK, McClary JM, Majeti S,Crisanti MM, et al. Plaque regrowth effects of a triclosan/pyrophosphate dentifrice in a 4-day non-brushing model. *J Clin Dent*. 2000;11:107-113.
19. Higgins JP, Green S. *Cochrane Handbook for Systematic Reviews of Interventions*. Chichester: Wiley-Blackwell; 2011.
20. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses:

the PRISMA statement.*BMJ*. 2009;339:b2535.
21. Van der Weijden F, Dell'Acqua F, Slot DE. Alveolar bone dimensional changes of post-extraction sockets in humans: a systematic review. *J Clin Periodontol*. 2009;36:1048-1058.
22. Keukenmeester RS, Slot DE, Putt MS, Van der Weijden GA. The effect of sugar-free chewing gum on plaque and clinical parameters of gingival inflammation: a systematic review. *Int J Dent Hyg*.2013;11:2-16.
23. Higgins JPT, Deeks JJ, (editors). Chapter 7: Selecting studies and collecting data. In: Higgins JPT, Green S (editors), *Cochrane Handbook for Systematic Reviews of Interventions*. Chichester, UK: Jon Wiley & Sons; 2008.
24. Greene JC, Vermillion JR. The oral hygiene index: a method for classifying oral hygiene status. *J Am Dent Assoc*. 1960;61:172-179.25. Quigley GA, Hein JW. Comparative cleansing efficiency of manual and power brushing. *J Am Dent Assoc*. 1962;65:26-29.
26. Turesky S, Gilmore ND, Glickman I. Reduced plaque formation by the chloromethyl analogue of victamine C. *J Periodontol*.1970;41:41-43.
27. Shaw L, Murray JJ. A new index for measuring extrinsic stain in clinical trials. *Community Dent Oral Epidemiol*. 1977;5:116-120.
28. DerSimonian R, Laird N. Meta-analysis in clinical trials. *Control Clin Trials*. 1986;7:177-188.
29. IntHout J, Ioannidis JP, Rovers MM, Goeman JJ. Plea for routinely presenting prediction intervals in meta-analysis.*BMJ Open*. 2016;6:e010247.
30. Ioannidis JP, Patsopoulos NA, Evangelou E. Uncertainty in heterogeneity estimates in meta-analyses.
BMJ. 2007;335:914-916.
31. Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ*. 1997;315:629-634.
32. Sterne JA, Gavaghan D, Egger M. Publication and related bias in meta-analysis:power of statistical tests and prevalence in the literature.*J Clin Epidemiol*. 2000;53:1119-1129.
33. Schwarzer G. Meta: an R package for meta-analysis.
R News.2007;7:40-45.
34. Schwarzer G, Carpenter JR, Rücker G. *Meta-analysis with R*. Berlin, Germany: Springer; 2015.
35. Viechtbauer W. Conducting meta-analyses
in R with the metaforpackage. *J Stat Softw*. 2010;36:1-48.
36. DeMets DL, Lan KK. Interim analysis: the alpha spending function approach. *Stat Med*. 1994;13:1341-1352.
37. O'Brien PC, Fleming TR. A multiple testing procedure for clinical trials. *Biometrics*. 1979;35:549.
38. Wetterslev J, Thorlund K, Brok J, Gluud C. Trial sequential analysis may establish when firm evidence is reached in cumulative meta-analysis. *J Clin Epidemiol*. 2008;61:64-75.

Gingival health status in individuals using different types of toothpaste

References

[1] B.J. Paster, S.K. Boches, J.L. Galvin, R.E. Ericson, C.N. Lau, V.A. Levanos, et al.,
Bacterial diversity in human subgingival plaque, J. Bacteriol. 183 (June (12))(2001) 3770–3783.
[2] F.E. Dewhirst, T. Chen, J. Izard, B.J. Paster, A.C. Tanner, W.H. Yu, et al., The human oral microbiome, J. Bacteriol. 192 (October (19)) (2010) 5002–5017.
[3] P.D. Marsh, E. Zaura, Dental biofilm: ecological interactions in health and disease, J. Clin. Periodontol. 44 (March (Suppl. 18)) (2017) S12–S22.
[4] M. Sanz, D. Beighton, M.A. Curtis, J.A. Cury, I. Dige, H. Dommisch, et al., Role of*A.M.L. Pedersen et al. Journal of Dentistry 80 (2019) S13–S18*
17 microbial biofilms in the maintenance of oral health and in the development of dental caries and periodontal diseases. Consensus report of group 1 of the Joint EFP/ORCA workshop on the boundaries between caries and periodontal disease, J. Clin. Periodontol. 44 (March (Suppl. 18)) (2017) S5–S11.
[5] J. Tenovuo, K.M. Pruitt, Relationship of the human salivary peroxidase system to oral health, J. Oral Pathol. 13 (December (6)) (1984) 573–584.
[6] E.L. Thomas, T.W. Milligan, R.E. Joyner, M.M. Jefferson, Antibacterial activity of hydrogen peroxide and the lactoperoxidase-hydrogen peroxide-thiocyanate system
against oral streptococci, Infect. Immun. 62 (February (2)) (1994) 529–535.
[7] A. Welk, C. Meller, R. Schubert, C. Schwahn, A. Kramer, H. Below, Effect of lactoperoxidase on the antimicrobial effectiveness of the thiocyanate hydrogen peroxide
combination in a quantitative suspension test, BMC Microbiol. 9 (July) (2009)134.
[8] A.M.L. Pedersen, D. Belstrom, The role of natural salivary defences in maintaining a healthy oral microbiota, J. Dent. 80 (2019) S3–S12.
[9] A. Cawley, S. Golding, A. Goulsbra, M. Hoptroff, S. Kumaran, R. Marriott, Microbiology Insights into boosting salivary defences through the use of enzymes and proteins, J. Dent. 80 (2019) S19–S25.
[10] S.E. Adams, D. Arnold, B. Murphy, P. Carroll, A.K. Green, A.M. Smith, et al., A randomised clinical study to determine the effect of a toothpaste containing enzymes and proteins on plaque oral microbiome ecology, Sci. Rep. 7 (February)(2017) 43344.
[11] R.R. Lobene, T. Weatherford, N.M. Ross, R.A. Lamm, L. Menaker, A modified gingival index for use in clinical trials, Clin. Prev. Dent. 8 (January (1)) (1986) 3–6.
[12] R.R. Lobene, P.M. Soparkar, M.B. Newman, Use of dental floss. Effect on plaque and gingivitis, Clin. Prev. Dent. 4 (January (1)) (1982) 5–8.
[13] C.A. Saxton, F.J. van der Ouderaa, The effect of a dentifrice containing zinc citrate and Triclosan on developing gingivitis, J. Periodontal Res. 24 (January (1)) (1989) 75–80.
[14] P.D. Marsh, T. Do, D. Beighton, D.A. Devine, Influence of saliva on the oral microbiota, Periodontol. 2000 70 (February (1)) (2016) 80–92. [15] C. Dawes, A.M.L. Pedersen, A. Villa, J. Ekstrom, G.B. Proctor, A. Vissink, et al., The functions of human saliva: a review sponsored by the World Workshop on Oral
Medicine VI, Arch. Oral Biol. 60 (June (6)) (2015) 863–874.
[16] V. de AP, A.M. Gregio, M.A. Machado, A.A. de Lima, L.R. Azevedo, Saliva composition and functions: a comprehensive review, J. Contemp. Dent. Pract. 9 (March (3)) (2008) 72–80.
[17] S. Daly, J. Seong, R. Newcombe, J. Nicholson, M. Edwards, N. West, A randomized clinical trial to determine the effect of a toothpaste containing enzymes and proteins on gum health over 3 months, J. Dent. (2018).
[18] M.K. Keller, C.A. Kressirer, D. Belstrom, S. Twetman, A.C.R. Tanner, Oral microbial profiles of individuals with different levels of sugar intake, J. Oral Microbiol. 9 (1) (2017) 1355207.
[19] M.R. Mason, P.M. Preshaw, H.N. Nagaraja, S.M. Dabdoub, A. Rahman, P.S. Kumar, The subgingival microbiome of clinically healthy current and never smokers, ISME J. 9 (January (1)) (2015) 268–272.
[20] A.Y. Shchipkova, H.N. Nagaraja, P.S. Kumar, Subgingival microbial profiles ofsmokers with periodontitis, J. Dent. Res. 89 (November (11)) (2010) 1247–1253.
[21] S.M. Dabdoub, S.M. Ganesan, P.S. Kumar, Comparative metagenomics reveals taxonomically idiosyncratic yet functionally congruent communities in periodontitis, Sci. Rep. 6 (December) (2016) 38993.
[22] D. Belstrom, F. Constancias, Y. Liu, L. Yang, D.I. Drautz-Moses, S.C. Schuster, et al.,Metagenomic and metatranscriptomic analysis of saliva reveals disease-associated microbiota in patients with periodontitis and dental caries, NPJ Biofilms
Microbiomes 3 (2017) 23.
[23] L.B. Christensen, P.E. Petersen, M. Steding-Jessen, Consumption of dental services among adults in Denmark 1994–2003, Eur. J. Oral Sci. 115 (Jun(3)) (2007) 174–179.
[24] E. Mamai-Homata, H. Koletsi-Kounari, V. Margaritis, Gender differences in oral health status and behavior of Greek dental students: a meta-analysis of 1981, 2000, and 2010 data, J. Int. Soc. Prev. Commun. Dent. 6 (Jan-Feb(1)) (2016) 60–68.
[25] F. Scheutz, J. Heidmann, Determinants of utilization of dental services among 20- to 3-year old Danes, Acta Odontol. Scand. 59 (Aug(4)) (2001) 201–211.

[26] D. Belstrom, R.R. Jersie-Christensen, D. Lyon, C. Damgaard, L.J. Jensen, P. Holmstrup, et al., Metaproteomics of saliva identifies human protein markers specific for individuals with periodontitis and dental caries compared to orally healthy controls, PeerJ 4 (2016) e2433.
[27] J. Liukkonen, U.K. Gursoy, P.J. Pussinen, A.L. Suominen, E. Kononen, Salivary concentrations of interleukin (IL)-1beta, IL-17A, and IL-23 vary in relation to periodontal
status, J. Periodontol. 87 (December (12)) (2016) 1484–1491.
[28] U.K. Gursoy, E. Kononen, P. Pradhan-Palikhe, T. Tervahartiala, P.J. Pussinen, L. Suominen-Taipale, et al., Salivary MMP-8, TIMP-1, and ICTP as markers of advanced
periodontitis, J. Clin. Periodontol. 37 (June (6)) (2010) 487–493.
[29] N. Rathnayake, S. Akerman, B. Klinge, N. Lundegren, H. Jansson, Y. Tryselius, et al., Salivary biomarkers of oral health: a cross-sectional study, J. Clin. Periodontol. 40 (February (2)) (2013) 140–147. [30] D. Belstrom, C. Damgaard, E. Kononen, M. Gursoy, P. Holmstrup, U.K. Gursoy, Salivary cytokine levels in early gingival inflammation, J. Oral Microbiol. 9 (1)(2017) 1364101. [31] M. Gursoy, U.K. Gursoy, T. Sorsa, R. Pajukanta, E. Kononen, High salivary estrogen and risk of developing pregnancy gingivitis, J. Periodontol. 84 (September (9)) (2013) 1281–1289.
[32] T. Morelli, M. Stella, S.P. Barros, J.T. Marchesan, K.L. Moss, S.J. Kim, et al., Salivary biomarkers in a biofilm overgrowth model, J. Periodontol. 85 (December (12))
(2014) 1770–1778.
[33] P.E. Petersen, D. Bourgeois, H. Ogawa, S. Estupinan-Day, C. Ndiaye, The global burden of oral diseases and risks to oral health, Bull. World Health Organ. 83 (September (9)) (2005) 661–669.
[34] D. Belstrom, P. Holmstrup, C.H. Nielsen, N. Kirkby, S. Twetman, B.L. Heitmann, et al., Bacterial profiles of saliva in relation to diet, lifestyle factors, and socioeconomic
status, J. Oral Microbiol. 6 (2014). *A.M.L. Pedersen et al. Journal of Dentistry 80 (2019) S13–S18*
S18

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

References

1. Cunha-Cruz J, Wataha JC. The burden of dentine hypersensitivity. In: Robinson PG, editors. Dentine Hypersensitivity: Developing a personcentred
approach to oral health. London: Elsevier Inc. 2015. Chp 3.
2. West NX, Sanz M, Lussi A, Bartlett D, Bouchard P, Bourgeois D. Prevalence of dentine hypersensitivity and study of associated factors: a European population-based cross-sectional study. J Dent. 2013;41:841–51.
3. Absi EG, Addy M, Adams D. Dentine hypersensitivity. A study of the patency of dentinal tubules in sensitive and non-sensitive cervical dentine. J Clin Periodontol. 1987;14:280–4.
4. Addy M. Dentine hypersensitivity: definition, prevalence, distribution and aetiology. In: Addy M, Embery G, Egar M, Orchardson R, editors. Tooth Wear and sensitivity: clinical advance in restorative dentistry. London: Martin Dunitz; 2000.
5. Schiff T, Dotson M, Cohen S, De Vizio W, McCc J, Volpe A. Efficacy of a dentifrice containing potassium nitrate, soluble pyrophosphate, PVM/MA copolymer, and sodium fluoride on dentinal hypersensitivity: a twelve-week clinical study. J Clin Dent. 1994;5(Spec No):87–92.
6. Leight R, Bowman J, Barlow A. Pain measurement: long term stability of VAS pain intensity ratings assessed by means of a pain scale calibration exercise. J Pain. 2008;9:73.
7. Gibson BJ, Boiko OV, Baker SR, Robinson PG, Barlow APS, Player T, Locker D. The everyday impact of dentine sensitivity: Personal and functional aspects. In: Robinson PG, editors. Dentine Hypersensitivity: Developing a personcentred
approach to oral health. London: Elsevier Inc. 2015. Chp 6.
8. Locker D, Allen F. What do measures of 'oral health-related quality of life' measure? Community Dent Oral Epidemiol. 2007;35:401–11.
9. Jokovi A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G. Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. J Dent Res. 2002;81:459–63.
10. Slade GD. Derivation and validation of a short-form oral health impact profile. Community Dent Oral Epidemiol. 1997;25:284–90.
11. Slade GD, Spencer AJ. Development and evaluation of the Oral health impact profile. Community Dent Health. 1994;11:3–11.
12. Bekes K, John MT, Schaller HG, Hirsch C. Oral health-related quality of life in patients seeking care for dentin hypersensitivity. J Oral Rehabil. 2009;36:45–51.
13. Baker SR, Gibson BJ, Sufi F, Barlow A, Robinson PG. The dentine hypersensitivity experience questionnaire: a longitudinal validation study. J Clin Periodontol. 2014;41:52–9.
14. Boiko OV, Baker SR, Gibson BJ, Locker D, Sufi F, Barlow AP, Robinson PG. Construction and validation of the quality of life measure for dentine hypersensitivity (DHEQ). J Clin Periodontol. 2010;37:973–80.
15. Robinson PG. Dentine hypersensitivity: developing a person-centred approach to oral health. London: Elsevier Inc.; 2015.
16. Basaran S, Celik C. Turkish adaptation of dentine hypersensitivity experience questionnaire (DHEQ). Community Dent Health. 2018;35:47–51.
17. Douglas-De-Oliveira DW, Lages FS, Paiva SM, Cromley JG, Robinson PG, Cota LOM. Cross-cultural adaptation of the Brazilian version of the dentine hypersensitivity experience questionnaire (DHEQ-15). Braz Oral Res. 2018; 32(e37):1–10.
18. He SL, Wang JH. Reliability and validity of the Chinese version of the short form of the dentine hypersensitivity experience questionnaire (DHEQ-15). Qual Life Res. 2015;24:1465–9. Mason et al. BMC Oral Health (2019) 19:226 Page 10 of 11
19. He SL, Wang JH, Wang MH. Development of the Chinese version of the dentine hypersensitivity experience questionnaire. Eur J Oral Sci. 2012;120:218–23.
20. Gracely RH, McGrath F, Dubner R. Ratio scales of sensory and affective verbal pain descriptors. Pain. 1978;5:5–18.
21. Heft MW, Gracely RH, Dubner R, McGrath PA. A validation model for verbal description scaling of human clinical pain. Pain. 1980;9:363–73.
22. Heft MW, Parker SR. An experimental basis for revising the graphic rating scale for pain. Pain. 1984;19:153–61.
23. Heaton LJ, Barlow AP, ColdwelL SE. Development of labeled magnitude scales for the assessment of pain of dentin hypersensitivity. J Orofac Pain.2013;27:72–81.
24. Parkinson C, Hughes N, Jeffery P, Jain R, Kennedy L, Qaqish J, Gallob JT, Mason S. The efficacy of an experimental dentifrice containing 0.454% w/w stannous fluoride in providing relief from the pain of dentin hypersensitivity: An 8-week clinical study. Am J Dent. 2013;26(Spec No A): 25A-31A.
25. Parkinson CR, Jeffery P, Milleman JL, Milleman KR, Mason S. Confirmation of efficacy in providing relief from the pain of dentin hypersensitivity of an anhydrous dentifrice containing 0.454% with or without stannous fluoride in an 8-week randomized clinical trial. Am J Dent. 2015;28:190–6.
26. Lobene RR, Weatherford T, Ross NM, Lamm RA, Menaker L. A modified gingival index for use in clinical trials. Clin Prevent Dent. 1986;8:3–6.
27. Laster L, Laudenbach KW, Stoller NH. An evaluation of clinical tooth mobility measurements. J Periodontol. 1975;46:603–7.
28. Parkinson CR, Hughes N, Hal C, Whelton H, Gallob J, Mason S. Three randomized clinical trials to assess the short-term efficacy of anhydrous 0. 454% w/w stannous fluoride dentifrices for the relief of dentin hypersensitivity. Am J Dent. 2016;29:25–32.
29. Heft MW, Litaker MS, Kopycka-Kedzierawski ST, Meyerowitz C, Chonowski S, Yardic RL, Gordan VV, Mungia R, Gilbert GH, National Dental PBRN Collaborative group. Patient-centered dentinal hypersensitivity treatment outcomes: Results from the National Dental PBRN JDR Clin Trans Res 2018;3:76–82.
30. Mason S, Kingston R, Shneyer L, Harding M. Clinical study to monitor dentinal hypersensitivity with episodic use of a desensitising dentifrice. BDJ Open. 2017;3:17011.

QUESTIONNAIRE

BB1(20) PART 1

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

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

Introduction

Question 1: You see that patient X, even before the procedure has started, is very uncomfortable. You ask the patient if he is comfortable, and he answers with the question: "Is it going to be very sore?" Why will you make a note in the patient record to the effect that the patient is very pain sensitive?

- **A:** A significant proportion of patients in a survey indicated that they would choose to suffer from their dental problems rather than go to an oral health care professional
- **B:** Unrelieved dental pain increases the likelihood of having psychological and physiological consequences
- **C:** The indirect cost of pain due to lost productivity is significant
- **D:** I will not make a note in the patient record

Question 2: Evaluating clinical attachment loss and when scaling in areas with deep pockets, there may be significant pain. Is this statement TRUE?

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

Discussion

Question 3: Your dentist has serious doubts about the value of virtual reality (VR) in the dental setting. You mention that when your son is playing games on his computer, he is so distracted that neither cold nor hunger has any effect on him. This gets the attention of the dentist and asks you to do some research of this topic. Which of the following will you use?

- **A:** Distraction is considered the most common technique applied to alleviate pain during short invasive procedures
- **B:** An individual will focus on the painful stimuli to perceive pain. An individual's perception of pain is decreased when their attention is distracted from the painful stimuli
- **C:** The interactive aspects of VR compete for patients' attention, therefore minimising their ability to process incoming pain signals
- **D:** VR is effective in distracting patients for up to 45 minutes

Question 4: You become very interested in the VR topic and continue your research the following day. You find studies, inter alia, by *Das et al,* and *Furman et al* in which the findings include all the following, except for ……?

- **A:** Participants reported a reduction of the amount of time spent thinking about pain when using the VR
- **B:** Participants described the "dental experience" as unpleasant as before using VR
- **C:** There was no reduction in tooth and gum discomfort
- **D:** Nausea was associated with the use of VR

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

Question 5: You employ a new dental assistant. After her first week, she inquires why all patients are not educated in terms of the proven advantages of flossing and interdental brushing for preventing gingivitis and plaque buildup. What would you answer her?

- **A:** The evidence to support her statement is mixed, with studies done at population level showing limited benefit
- **B:** That her statement is correct, but only if one flosses after every meal and before going to bed
- **C:** A recent systematic review and meta-analysis have shown that antiplaque chemical formulations can provide significant improvement in gingival, bleeding and plaque indices
- **D:** All the above

Question 6: Is it TRUE that 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

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

Question 7: With reference to studies on the use of sodium bicarbonate toothpastes, which of the following statements are TRUE?

- **A:** Toothpastes with high levels of sodium bicarbonate (>50%) have been shown to reduce gingival inflammation, but not oral malodour
- **B:** Previous studies have typically been of 3 – 6 weeks duration
- **C:** The maximum strength of sodium bicarbonate used in these studies was 65%
- **D:** The aim of this study was to determine the effects of brushing for 6 weeks with 67% sodium bicarbonate toothpaste on gingival health

Discussion

Question 8: This and previous studies demonstrated which of the following?

- **A:** The improvements in the current study were observed as early as 3 weeks
- **B:** Previous studies did not demonstrate a dose relationship with higher concentrations associated with a greater efficacy than lower concentrations
- **C:** In a single-brushing study, a 65% sodium bicarbonate toothpaste resulted in a 13% mean greater plaque removal than a 20% sodium bicarbonate toothpaste
- **D:** Both a 67% and a 62% bicarbonate toothpaste resulted in a statistically significant greater plaque removal than a 0% sodium bicarbonate toothpaste

Dry brushing: Does it improve plaque removal

Introduction

Question 9: Your dentist, after seeing a patient that will have to have several teeth removed due to gingivitis, remarks that she wonders if toothpaste is really such a good idea and if "dry brushing" is not more effective? Which of the following are TRUE with regard to this way of brushing?

- **A:** Dry brushing involves brushing without dentifrice and a toothbrush wet with water
- **B:** Its purpose is to avoid the smooth perception of tooth surfaces being the results of reduced surface tension, as provided by surfactants of a dentifrice
- **C:** A recent systematic review demonstrated that brushing with a dentifrice does not improve the efficacy of mechanical plaque removal
- **D:** It increases people's ability to feel the bacterial biofilm, as well as to feel the difference in dental plaque on the tooth surfaces before and after brushing

Discussion

Question 10: The next day you ask your dentist if the practice is thinking of recommending dry brushing. She answers that she did some research the previous evening and found a study done on this topic. Which of the following was included in the research she found?

- **A:** The overall reduction in plaques scores was at least 57% following a 2-minute brushing exercise with a prewetted toothbrush
- **B:** For dry brushing the same exercise resulted in an overall reduction in plaque scores of 85%
- **C:** Dry toothbrushing contributed significantly to toothbrush efficacy
- **D:** Prewetting a toothbrush neither improved nor reduced plaque removal efficacy

End

400 Theuns van Niekerk Street
Wierda Park
0157
PO Box 71
Wierda Park
0149

FOCUS ON HEALTH

http://foh-cpd.co.za
Whatsapp: 074 230 3874
Tel: 012 653-0133 /2373
Mon-Fri: 07:30-16:30

PERSONAL INFORMATION

(If your personal details have not changed, only complete the sections marked with an asterisk *)

HPCSA No		***FOH Number**	
***Initials &Surname**		***Cell Number**	needed for confirmation sms
Employer		**Email address**	
***Time spent on activity**	**_____Hour _____Min**		

ANSWER SHEET

BB1 (20) PART 1

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					

SEND ANSWER SHEET TO:

FAX: 086 614 4200 / 012 653 2073 *OR* **WHATSAPP:** 074 230 3874 *OR* **EMAIL:** SAFOCUS@IAFRICA.COM

YOU WILL RECEIVE A CONFIRMATION OF RECEIPT SMS WITHIN 12-24 HOURS, IF NOT RECEIVED PLEASE SEND AGAIN

This activity is accredited for **TWO (2) CLINICAL** CEU's

Please rate the article:

POOR 1		**FAIR 2**		**AVERAGE 3**		**GOOD 4**		**EXCELLENT 5**	

I hereby declare that the completion of this document is my own effort without any assistance.

Signed: ***Date:***

For office use		
MARK: /10 = _____% (70% PASS RATE)	FAILED (R50 to resubmit)	PASSED (IAR will be sent)
MODERATED BY:	CAPTURED:	DATE: