International Journal of Medical and Health Research
ISSN: 2454-9142
www.medicalsciencejournal.com
Volume 4; Issue 8; August 2018; Page No. 65-70

Influence of skin cold sensation threshold in the occurrence of dental sensitivity

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Abstract
Objective: This study verified the prevalence of dental sensitivity in patients submitted to a thirty-fifth oxide based mostly product (Whiteness H.P. Maxx thirty-fifth – FGM), skin cold sensation threshold (SCST) and its influence on dental sensitivity. Material and Methods: Sixty volunteers were divided into four teams (n=15), in keeping with SCST (low: GI and GIII, and high: GII and IV) and bleaching treatment (hydrogen peroxide: GI and GII, and placebo: GIII and GIV). SCST was firm within the inner forearm for six totally different times employing a neurosensory instrument, the government agency II (Medoc Advanced Medical Systems, Ramat Yishai, Northern District, Israel). Dental sensitivity measurements were performed ten totally different times employing a thermal input associated with an intraoral device connected to government agency II, positioned within the buccal surface of the higher right central tooth. Spontaneous dental sensitivity was conjointly determined victimization the Visual Analogue Scale (VAS). information was submitted to the Student's t-test and Pearson's Correlation check (α=0.05). SCST remained identical throughout bleaching treatment. Results: Distinct responses of dental sensitivity were found in patients with low and high SCST throughout the primary and third bleaching session (p≤0.05). The teeth submitted to the bleaching treatment became additional sensitive to cold than those treated with placebo. Moreover, information obtained with a government agency and VAS bestowed moderate correlation. Conclusions: Bleaching treatment accrued dental sensitivity and skin cold sensation threshold would possibly represent a determinant consider this prevalence since low and high SCST patients had totally different responses to the thermal input within the teeth.

Keywords: clinical trial, dental bleaching, sensation, quantitative analysis

Introduction

Tooth bleaching is one amongst the foremost in style esthetic procedures requested by patients and a conservative approach with economical results [7]. The in-office technique victimization extremely focused oxide product has become a wonderful difference for each professional and patients [11]. Despite a change of colour effectiveness, recent studies showed that patients submitted to dental bleaching reportable totally different intensities of dental sensitivity [11, 15, 19, 24, 26]. This symptom may be a concern for dentists and patients as a limitation for treatment evolution and satisfaction .

It has been established that the mechanisms of the whitener action ar supported the presence of reactive styles of atomic number 8, that are extraordinarily unstable and promote oxidisation of pigments embedded in dental tissues, giving them a lighter look [24].

On the opposite hand, upon penetrating the dental tissues to oxidize the pigmenting agents, the reactive styles of atomic number 8 diffuse quickly within the dental tissues reaching the chemosensitive particle channel (TRPA1), activating the intradental nerve and inflicting discomfort [14, 15].

Postbleaching sensitivity has additionally been associated with the morphological changes that presumptively alter porosity, leading to temporary sensitivity when the bleaching procedure [6, 23].

Some clinical trials regarding dental sensitivity showed that pain is totally different among people and it's sometimes stronger at the ultimate section of treatment [3, 4]. This variation is also related to the feeling threshold of every patient, that is classed as low once cold sensation is definitely detected and high within the opposite state of affairs [22]. Some studies associated with pain and even dental anxiety, state that these variations in pain and sensitivity threshold gift a challenge to the identification and subsequent treatment of patients, since the judgment of sensitivity makes the response to many treatments terribly peculiar, on the far side the dental scope [21, 29].

Visual Analogue Scales (VAS) are unremarkably utilized in clinical trials to see spontaneous dental sensitivity prevalence throughout bleaching treatments [11] while not proof of being the foremost applicable methodology. Nowadays, the pain trade developed some new devices that modify computerised neurosensory analysis, known as Quantitative Sensory Testing (QST) [13, 17, 25]. office II (Medoc Advanced Medical Systems, Ramat Yishai, Northern District, Israel) represents this contemporary technology for the study of pain and is effectively wont to judge and quantify the neurosensory response relating to major and minor nervous fibres unremarkably found in teeth, victimization thermal, mechanical, or electrical stimuli [13, 15, 18, 25].

Thus, check for cold and warm sensation may be conducted victimization correct devices that transfer temperature changes to many body structures underneath preset speed [13, 25].
In addition, a coincidental study for tactile sensation threshold and dental sensitivity older throughout the change of colour would offer clinical safety levels to stop and treat this uncomfortable aspect result [29], like the utilization of various bleaching agents and individual protocol of treatment attending to management dental sensitivity .
In this manner, the aim of this study was to gauge the correlation between the dental sensitivity information obtained victimization QST and VAS and to verify the influence of skin cold sensation threshold in dental sensitivity victimization the neurosensory analysis to quantify thermal sensitivity throughout dental bleaching .
The null hypothesis assumed that

- There is no distinction in the skin cold sensation threshold throughout bleaching with thirty fifth oxide products ;
- Skin cold sensation threshold of every patient doesn't influence dental sensitivity throughout bleaching ;
- There's no distinction in dental sensitivity at totally different periods throughout bleaching with thirty fifth oxide products ;
- There's no correlation between dental sensitivity obtained victimization QST and VAS.

Material and methods

Experimental design

After approval by the analysis committee (00278/2011), sixty male patients were chosen. To standardize our study sample, it had been established that solely medicine college man students of the night amount would be allowed to volunteer, aged from eighteen to twenty-five years. The patients were fastidiously evaluated and submitted to anamnesis and applicable clinical and picture taking exams to observe dental medicine conditions, misplaced restorations, decayed teeth, or dentine exposure before allocation. The initial colour of teeth wasn't thought of as inclusion/exclusion criteria since there's no scientific proof that it'd influence sensitivity results. Moreover, the efficaciousness of dental bleaching wasn't the purpose of our study .
This placebo-controlled, double-blinded, and factorial test with equal randomisation enclosed the factors: (1) bleaching treatment in a pair of levels (35% peroxide and placebo); (2) skin cold sensation threshold in a pair of levels (low and high); and (3) ten analysis periods (Baseline: twenty four hours before treatment; at once before treatment; at once once the first treatment session; twenty four hours once the first treatment session; at once once the 2d treatment session; twenty four hours once the 2d treatment session; at once once the third treatment session; twenty-four hours once the third treatment session; and seven and thirty days once the treatment) .
It is noteworthy that patients were conjointly tutored to not use analgesic or medicament medications and desensitising toothpaste throughout thirty days once the bleaching treatment to avoid information misinterpretation.
A two-week wash-out amount was thought of. throughout this point, the study population failed to use desensitising merchandise or oral medicines, and their home-care program was standardized, with the use of identical dentifrice and toothbrushes. Patients WHO weren't familiarised with the assessment techniques and trial procedures were excluded.

Quantitative Sensory Testing (QST) – skin cold sensation threshold

Skin cold sensation threshold (SCST) was foremost measured to divide the patients consistent with low and high skin cold sensation threshold. Afterwards, they were assigned by lottery into two study teams (n=15), experimental or placebo treatment, by a scientist UN agency, didn't-participate within the clinical section of the experiment .
The first measuring of skin cold sensation threshold was performed mistreatment the neurosensory analyser, authority II (Medoc Advanced Medical Systems, Ramat Yishai, Northern District, Israel) in a very silent setting with a continuing temperature of 26°C. The sessions were conducted from eight a.m. to 10 a.m .
The authority II was designed mistreatment the "Limits" operate, and also the check of cold sensation thresholds (CST) was used for this purpose. 3 descending temperature tests were performed within the inner forearm, in numerous areas, in order that there was no sensitization of the thermoreceptors and, consequently, a false positive response. The check began at 32°C (comfort temperature), and also the thermode cooling speed was 1°C per second. Once the patient perception of temperature alteration, the patient paused the stimulation, and also the measuring was perennial double, thirty seconds once the previous one .
The values obtained throughout the primary check were discarded, and also the mean of the subsequent tests was used because of the temperature for cold sensation threshold testing in the skin .
The mean temperature was thought-about the skin cold sensation threshold and wont to classify patients in low or high skin cold sensation threshold.

Quantitative Sensory Testing (QST) dental cold sensation threshold

For standardization of tooth analysis, a 100% ethene polymer and vinyl acetate receptacle were fictitious for every patient. The receptacle had a circular perforation with a diameter the same as the active tip of the intraoral thermode. The perforation was created within the centre of the tooth buccal surface .
Quantitative Sensory Testing (QST) for cold sensation thresholds was conducted exploitation of thermal stimuli associated with an intraoral device of half dozen millimeter diameter connected to the TSA II. it had been forever positioned within the same space, among the circular perforation of the receptacle, within the flattest region of the buccal surface of the higher right central tooth. the proper was used rather than the left one only for convenience .
Before measuring, the tooth was lined with a thermal paste containing silver chemical compound (IPT – Implastec Eletroquímica Ltd., Votorantim, São Paulo, Brazil) to optimize thermal physical phenomenon. The tests were performed within the same conditions antecedently rumoured .
The patients might stop cooling of the intraoral the mode at any time exploitation the device in their hands. The check

began at 36°C, and therefore the thermode cooling speed was zero.5°C per second, leading to slow temperature variation that allowed transference of the thermal stimulant to the dentine-pulp complicated. The TSA II was designed exploitation the "Limits" operate, and therefore the check of cold sensation thresholds (CST) was used for this purpose. within the technique of "Limits", stimuli increase in intensity until a sensation is perceived, at that moment the stimulant is halted by the topic himself. The thermode temperature right away returns to adaptation temperature, in preparation for the following stimulant. 3dropping temperature tests were performed. when the patient perception of temperature alteration, the patient paused the stimulant, and therefore the measuring was recurrent double, thirty seconds when the previous one. Celsius degrees values obtained throughout the primary check were discarded, and therefore the mean of the subsequent tests was used because of the temperature for cold sensation threshold testing in the tooth .

Dental cold sensitivity measuring was performed for each study teams in the present analysis periods.

Visual Analogue Scale (VAS) – spontaneous sensitivity

Spontaneous sensitivity was evaluated employing a pain from before and once the bleaching procedure. AN intensity scale starting from zero to ten five was established. additionally, the form contained info concerning the sort of pain experienced, and also the amount and oral region during which it occurred. This form is widely utilized in the scientific literature for dental research12. it's conjointly used for dental and facial pain studies [3, 11].

Treatments performed

Once the patients were classified per skin cold sensation threshold (low cold sensation threshold were those UN agencies detected thermal sensation up to 30°C, and high cold sensation threshold, those UN agencies detected thermal sensation below 30°C), the in-office bleaching technique employing a thirty-fifth peroxide achromatic colour HP Maxx thirty-fifth (FGM Produtos Odontológicos – Ltd., Joinville, Santa Catarina, Brazil) was performed in within the higher right central tooth of the patients in teams I and II while not physical activation. the merchandise is commercially offered as a two-bottle system (one bottle contains the peroxide and also the alternative contains the thickener), and also the substances are mixed in a veryperoxide/thickener quantitative relation of 3:1 drops. once the tip of the experiment, the remaining teeth were conjointly submitted to the change of colour treatment.

After tooth prevention and soft tissue isolation employing a light-weight cured rosin animal tissue barrier high Dam (FGM Produtos Odontológicos Ltd., Joinville, Santa Catarina, Brazil), the bleach was inserted into a graduated syringe, and 0.06 millilitre of the bleaching product was applied on the buccal surface of the tooth for quarter-hour. once the primary application, the teeth were clean and dried with gauze, and also the procedure was perennial doubly, totalizing forty-five minutes of contact between the bleaching product and enamel in every session. once seven and fourteen days, an equivalent procedure was performed. though the colour wasn't the topic of our study, to investigate dental sensitivity occurred

Throughout the change of colour treatment, it absolutely was necessary to perform 3 sessions, the traditional length in a very real dental workplace .

In teams, III and IV, a placebo agent, a dead ringer for the first bleach presentation, purchased from an equivalent manufacturer, was applied to the dental surface an equivalent manner as rumoured for the bleach. The authority and also the operator was an equivalent person, thus, patients and also the operator wasn't helping of the cluster to that they belonged.

Statistical analysis

Temperature variations (delta) were wont to perform the applied math analysis. They were obtained by subtracting the initial temperatures/baseline from those found within the alternating periods of study .

Data were submitted to Student's t-test at a five-hitter level of significance and additionally to Pearson's Correlation take a look at (α=0.05) to work out whether or not there was the correlation between the dental sensitivity obtained exploitation VAS and QST. Pacifico 5.1 statistics code was used.

Results

The analysis of skin cold sensation threshold throughout dental bleaching showed no applied math distinction between the periods ($p>0.05$), revealing no alteration in skin cold sensation threshold in spite of the initial classification as low or high threshold.

The influence of skin cold sensation threshold on dental cold sensation was evaluated through comparison of activity (delta) for cold sensation within the jaw central tooth of experimental teams with low and high threshold. Statistically vital variations were ascertained at P 02, P 03, P 06, P 07, and P 08 ($p\leq0.05$)

As for the values of dental cold sensation, the bleached teams (GI and II) were statistically totally different from the initial values ($p\leq0.05$). In teams treated with placebo (G III and IV), cold sens ation remained an equivalent throughout the study ($p>0.05$), apart from P 02 in cluster III ($p\leq0.05$) and P 03 in cluster IV.

We additionally ascertained that temperature variations for cold sensation within the bleached cluster were statistically totally different compared to placebo all told periods ($p\leq0.05$), in spite of skin, cold sensation threshold Data disclosed stronger dental sensitivity throughout bleaching with thirty-fifth oxide compared to placebo.

Analysis using VAS additionally showed totally different spontaneous dental sensitivity intensities within the different periods of study for bleached teams (GI and II). Generally, I showed a lot of incidence of spontaneous dental sensitivity than GII. Patients with low SCST given a higher incidence of moderate and intense magnitudes of spontaneous dental sensitivity throughout the bleaching treatment than patients with high SCST, UN agency has given lighter magnitudes of spontaneous dental sensitivity throughout the treatment.

The application of Pearson's correlation test between dental sensitivity values determined using VAS and QST showed a moderate correlation for patients with low (ρ=0.30; R2= 0.0921) and high SCST (ρ=0.59; R2= 0.3525)

Discussion

The Quantitative Sensory Testing (QST) employed in this study to live dental cold sensation throughout the change of colour has been employed in many fields for pain analysis [13, 17, 25, 26]. Among all devices applied to this system, the neurosensory instrument (TSA II) provides duplicatable and reliable tests principally once conducted by one operator and associated with the patient's collaboration [13, 15].

This analysis permits the analysis of thick and skinny myelinated and unmyelinated fibres [25], that is noteworthy in medicine since differing types of fibre penetrate the top opening [18].

The method "Limits" accessible within the device package was used as a result of it's duplicatable and well tolerated by patients [30]. per the manufacturer (Medoc Advanced Medical Systems, Ramat Yishai, Northern District, Israel), throughout the check, a response time object is constructed in to the present activity thanks to the time lapse between the instant a sufficient energy has been administered to the stimulation website to eventually induce a sensation, until the information reaches the brain, is processed, and a message is conducted to the signal hand to press the switch. These patients have total management of the stimuli and should stop it whenever required. "Limits" is that the most generally used technique, requiring the shortest check procedure, and is capable of sensitivity threshold activity. This characteristic is vital since a long analysis causes stress and knowledge quality.

This way, since the influence of continual testing within the same tooth, ought to be additionally thought-about, Associate in Nursing interval between measurements should be established to avoid windup. Thus, the 30-second interval was waited between the measurements to change a cushty temperature. The slow natural action was conducted to achieve the dentine-pulp advanced since pain in human teeth will evoke pain sensations of various qualities counting on the kind and intensity of the stimuli used and myelinated deep fibres appear to be accountable to the sensitivity of dentin [18].

Based on these results, the primary null hypothesis wasn't rejected since the change of colour failed to amendment skin cold sensation threshold. The skin threshold changes throughout specific things, like general malady and ageing [20, 21]. Thus, sample standardization relating to health condition, gender, and age ought to be established since those factors could influence the results: sex variations area unit found in metabolism, responsiveness to hormones and pharmacological agents, condition to pathologic changes and longevity and therefore the sensitivity of mammals to hormones, food factors, and medicines varies with age [20, 21]. Everything in our study was established to standardize the study sample and avoid knowledge quality **.**

On the opposite hand, it plays a vital role in dental sensitivity since those people with high and low skin cold sensation thresholds showed completely different behaviour at the initial section of treatment (during the first and third sessions). In those cases, the skin threshold influenced clinical tooth response, representing completely different tolerance levels against thermal stimuli on the tooth. Thus, the second null hypothesis was rejected**.**

The third null hypothesis was additionally rejected since the temperature for dental cold sensation was completely different throughout treatment. Previous studies evaluating dental sensitivity through self-reports and questionnaires [1, 12] with Analogue Visual Scale area unit in accordance with our results [3, 11]. However, the dental cold sensation threshold remained dateless within the teams treated with placebo (III and IV), that justifies its use within the study. The alterations in those teams were determined at P 02 (low threshold) and P 03 (high threshold) and should be associated to worry and placebo response joined to physiological mechanisms. proof suggests that the expectations of a patient will markedly have an effect on the end result of treatment since the issue causes the brain to reply by emotional correct endogenous neurotransmissions [8, 16].

It is noteworthy that dental cold sensation remained dateless thirty days when finishing the treatment. it's been incontestable that bleaching agents cause histomorphological alterations in enamel [2, 28] and our results advised that a number of those modifications persisted over time. The merchandise hydrogen ion concentration and its action on enamel proteins could have accrued the diffusion channels and tissue permeableness, influencing the response to thermal stimulant [2, 27]. Additionally, penetration of peroxide into dental pulp could promote the activation of particle channel TRPA1, gift in a number of the intradental nerves, inflicting structural injury and inflammation with a lot of inflammatory cells and interruption of odontoblasts layers as a result of reversible pulpitis [10, 15, 27]. This event has been additionally involved in the mediation of dental pain evoked by cold [15].

In this study, patients with low and high SCST United Nations agency underwent bleaching treatment bestowed dental sensitivity throughout all treatment periods in numerous intensities. These knowledge corroborate with the literature that reports that a large proportion of the patients tough this symptom throughout and when dental bleaching [3, 15].

Moreover, the moderate-to-intense level was rumoured a lot of times in cluster I, with low SCST. This info permits North American country to state that patients with low SCST area unit a lot of vulnerable to dental sensitivity incidence throughout the bleaching treatment. Moreover, the moderate correlation found between spontaneous (VAS) and evoked (QST) sensitivity allowed a North American country to reject the fourth hypothesis of this study and additionally certified the accuracy of the information obtained in our study. In scientific literature, there aren't any papers reportage on the correlation between the intensity of dental sensitivity obtained with the Visual Analogue Scale and exploitation Quantitative Sensory Testing. alternative strategies exploitation cooling agents area unit accustomed to checking cold sensation, however, they were performed in a very constant temperature (-50°C) [9]. However, they're not capable to quantify the thermal response. In these cases, a standard or healthy pulp present with the absence of symptomatology, manufacturing a small transient painful response to the cold stimulant **.**

In general, the neurosensory analysis with authority II in tooth is helpful for medicine as information regarding bleaching facet effects has relevancy for development of safe and cozy protocols, since taking into thought the sound judgement of pain [21], the employment of personalised therapies, like completely different peroxide concentrations or range of applications and dental change of color sessions, might stop or

perhaps avoid dental sensitivity, an element extremely accountable for discouraging patients to bear change of color treatment.

Otherwise, more investigations area unit necessary to enhance this technique of measurement of cold sensation in the tooth, that may be an exhausting and anelastic structure.

Conclusion

Based on these results and despite all the higher than mentioned limitations of the strategy, skin cold sensation threshold failed to amendment throughout bleaching treatment exploitation thirty fifth oxide. Skin cold sensation threshold would possibly represent a determinant think about the prevalence of dental sensitivity. The temperature for dental cold sensation failed to stay an equivalent throughout bleaching treatment and therefore the information obtained with iatrogenic (QST) and spontaneous sensitivity (VAS) conferred moderate correlation.

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