

EFFICIENCY OF TWO DESENSITIZING AGENTS FOR THE RELIEF OF DENTIN HYPERSENSITIVITY IN CHRONIC PERIODONTITIS PATIENTS. A RANDOMIZED CLINICAL TRIAL

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ABSTRACT

Periodontal therapy is one of the etiological factors of dentine hypersensitivity (DH). This study aimed to evaluate the efficacy of two in-office desensitizing agents 8 % Arginine-CaCO₃ and 1.23 NaF varnish on reducing DH that affects patients with chronic periodontitis after routine periodontal treatment.

Study design: Forty chronic periodontitis patients with history of dentine hypersensitivity after periodontal therapy were included in this study, and randomly divided into two groups: group-1, who received 8%Arginine-CaCO₃ and group-2, who received 1.23%NaF varnish. The clinical indices were recorded at first visit. Dentine hypersensitivity was evaluated by using tactile, air-blast, and thermal stimuli. The subject's response was recorded at baseline, one month and 3 month after the application.

Results and conclusions: The results were statistically analyzed, and it was found that 8% Arginine-CaCO₃ treatment was more effective than 1.23% NaF-varnish at time intervals. Sensitivity score differences between the groups were statistically significant at one and three months. The 8% Arginine-CaCO₃ group exhibited statistically significant reduction in dentine hypersensitivity on three stimuli at baseline to one and three months. It was concluded that 8% Arginine-CaCO₃ is more effective than 1.23% NaF varnish in reduction of patients' pain in chronic periodontitis patients.

KEY WORDS: Chronic periodontitis, desensitizing agent, dentine hypersensitivity

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INTRODUCTION

Dentine hypersensitivity (DH) is a relatively common dental condition which may have a profound effect on the quality of life of those who suffer with the problem. ⁽¹⁾ Individuals who may be at risk for dentin hypersensitivity such as: Overenthusiastic brushers, Periodontal treated patients, Bulimics, People with xerostomia, High-acid food/drink consumers, Older people exhibiting gingival recession, Chewing smokeless or snuff tobacco. ⁽²⁾ Moreover, dental professionals may contribute to dentine exposure and dentine hypersensitivity by instrumentation.

The main presenting symptom is pain generally in response to several stimuli (tactile, osmotic and thermal), subjectively manifested through the patients' complaints or during the examination by the professional using these stimuli. The mechanism of tooth sensitivity can be explained by the widely accepted "hydrodynamic theory" developed by Brannstrom. ⁽³⁾ According to this theory, open tubules of exposed dentine allow the movement of intratubular fluid towards the pulp or in the opposite direction, depending on the nature of the stimulus, causing distortions in the mechanoreceptors, which leads to stimulation of the sensory nerve in the subodontoblastic plexus.

Among periodontal patients, the prevalence of root sensitivity has been reported to be up to 90%. Also, it is very common that patients often report increased hypersensitivity following scaling and root planing ^(4,5). Pain, arising from exposed root surface, is the most common complaint mentioned by the patients following periodontal treatment. The thermal (air jet) and mechanical (dragging the probe over the exposed dentin) stimuli are considered effective in measuring the intensity of the hypersensitivity ^(6,7).

Hypersensitivity related to periodontal disease and after treatment, in particular supragingival and subgingival instrumentation, tends to an increase

in intensity after treatment, and even when initially absent, arises due to the removal of dentin and cementum with the calculus. The hypersensitivity may gradually subside or persist, even becoming more intense, and may be immediate, lasting from 5 to 60 days after the treatment procedures ^(8,9). Thus, a prophylaxis paste with an immediate desensitizing effect used for stain removal and polishing after scaling and root planing procedures would be beneficial for the patient.

In the treatment of dentine hypersensitivity, variety of methods and materials are applicable to both home and office use with a varying degree of success ⁽¹⁰⁻¹²⁾. The agents used at home include desensitizing dentifrices or mouthwashes with sodium fluoride (NaF), stannous fluoride, potassium nitrate, formaldehyde, strontium chloride, etc. The agents used at office include fluoride compounds, calcium compounds, cavity varnishes, restorative resins, etc.

The aim of study:

The primary aim of the present study was to compare the efficacy of two desensitizing agents 8% Arginine- CaCO_3 and 1.23%NaF varnish in the treatment of dentinal hypersensitivity (DH) in chronic periodontitis patients. The secondary purpose was to assess the duration of sensitivity relief up to 3 months.

MATERIAL & METHODS

Study overview

This clinical study was a, double-blind, randomized design. The study was conducted after the approval of the Institutional Review Board (IRB) at BAU with code number 2015H-016-D-R-0050. Before intervention, patients were briefed about the study and informed consent was obtained from all participants after a thorough explanation of the safety and potential efficacy of desensitizing agents, and the probability of receiving 8% Arginine- CaCO_3 varnish or 1.23% NaF- varnish.

Study objects

Forty patients having mild to moderate chronic periodontitis were selected according to the criteria of AAP (Armitage, 1999) ⁽²⁰⁾ from the Department of Periodontology, faculty of dentistry –BAU. Their age (range 30-55 years) with a history of DH at least two teeth were selected.

Inclusion criteria were at least two vital teeth with hypersensitivity on facial surfaces to thermal, mechanical, tactile stimuli. Individuals were systemically healthy and non-smokers. They had DH following periodontal therapy and did not use other hypersensitivity methods. Subjects were not treated periodontally and didn't use antibiotics within the last 6 months.

Exclusion criteria for teeth; 1- with caries; 2- with crowned and prosthetic restoration; 3- with any other painful pathology; 4- restored less than three months; 5- with any restorations into the test area.

Qualified patients were enrolled study from January to July 2015.

Study randomization and treatment procedures

The design of this study was double-blinded. Patients were randomly allocated to each group using an online random group generator (<https://www.randomizer.org/>) by single examiner who applied the desensitizing agents and blinded to all measurements. The 1.23% NaF- varnish and 8% Arginine- CaCO_3 desensitizer had the same appearance. No one, including the other examiner, operator collecting clinical measurements, and the patients aware of the type of desensitizing agent to which the patients was assigned

The scaling and root planing procedure was carried out using standard hand instruments. As the last step of this prophylaxis procedure, the assigned prophylaxis paste was applied for one minute as described in the manufacture instructions for use (Figures, 1-3).



Fig. (1) The *desensitizing agents 8 % Arginine- CaCO_3* used in this study



Fig. (2) Topical application of desensitizing agent



Fig. (3) Light curing of the desensitizing agent.

All subjects were given instructions to use soft bristled toothbrush twice daily (morning and evening) for 2 timed minutes before the baseline examination and during the trial.

Tactile hypersensitivity

Tactile hypersensitivity was assessed by scratching on the dentinal surface with a sharp-tipped probe and performed by one examiner. The probe tip was placed perpendicular to the evaluable tooth surfaces, just apical to the cemento enamel junction and drawn slowly across the surface in a distal to mesial direction to ensure application of the stimulus across all patent tubules.

Cold water (thermal stimulus)

10 µl of ice-cold water applied to the exposed dentin surface while neighboring teeth were isolated during testing using cotton rolls. Sensitivity was measured using VAS score. A period of at least 5 minutes was allowed between the two stimuli on each tooth.

Air blast hypersensitivity

The test teeth were isolated from the adjacent teeth by the placement of red boxing wax. Air was delivered from a standard dental unit air syringe at maximal pressure (45 psi) and at an environmental temperature of 19–24°C. The air current was applied for 1 s at a distance of 1 cm and perpendicular to the buccal surface of the tooth. The subjects scored pain intensity by placing a mark on a 10 cm-long line on a Visual Analogue Scale (VAS) that was labeled from (0 = no pain to 10 = extreme, unbearable pain). Patients were instructed to point to the VAS.^[9,10] Patients were informed before testing about the different score levels. Each group was evaluated at baseline; 1, and 3 months post application

Statistical methods

Within treatment comparisons of the baseline versus the follow-up values were performed using

paired t-tests. Comparisons between treatment groups at post-baseline time-points were performed using analyses of covariance (ANCOVA), in which the baseline scores were employed as a co-variable. All comparative statistical tests were two-sided, and employed a level of significance of 0.05.

RESULTS

Throughout the study, there were no adverse effects on the soft or hard tissues of the oral cavity, which were observed by the examiner or reported by the subjects when questioned. The canines and premolars were the most affected tooth in both groups of this study, followed by the lateral and central incisors, while molars were the least affected.

Throughout the study, plaque accumulation was minimal and gingival health was excellent in most of the subjects. There were no statistically significant differences on clinical parameters between groups at first visit ($p>0.05$)

Mean VAS scores for tactile, air and thermal stimulus of 1.23% NaF varnish group and 8% Arginine-CaCO₃ group at baseline, 1 and 3 months are shown in (Table 1). The VAS scores for three stimuli of all two groups were not statistically different from each other at baseline ($p>0.05$).

The 8% Arginine-CaCO₃ group was found to be better in reducing VAS score for air-blast stimuli tactile stimuli and thermal stimuli compared to the 1.23% NaF-gel group. The changes of air-blast stimuli and thermal stimuli were highly significant in the Arginine group at 1 month than NaF varnish group ($p<0.001$). The 8% Arginine-CaCO₃ group was more effective for tactile stimuli than NaF-varnish group at 1 month, however the differences between groups was not statistically significant ($p>0.05$). (Table 2)

The 8% Arginine-CaCO₃ group: The differences of VAS score for air-blast stimuli, tactile stimuli and thermal stimuli were significant at baseline to 1 month ($p<0.05$). There was greater reduction in

sensitivity score for thermal stimuli at 1 month, following air-blast and tactile stimuli respectively. The VAS score was statistically significant at time interval during experiment for three stimuli.

The 1.23% NaF group: The changes in VAS score of air-blast stimuli, tactile stimuli and thermal stimuli at 1 month were decreased to compare with baseline, decreasing was not statistically significant ($p>0.05$). At 3 month, the VAS scores for air-blast, tactile and thermal stimuli were lower than baseline. These differences were statistically significant.

TABLE (1) The mean VAS scores of each treatment group at baseline (VAS 1), 1month (VAS 2) and 3 months (VAS 3) after application of materials

Group	VAS 1 mean $\pm$ SD	VAS 2 mean $\pm$ SD	VAS 3 mean $\pm$ SD
Argine	40.72 $\pm$ 5.76	27.33 $\pm$ 2.60	25.27 $\pm$ 5.74*
NaF	39.63 $\pm$ 2.91	33.30 $\pm$ 3.01	31.08 $\pm$ 3.55*

SD – standard deviation; VAS – visual analogue scale.

** – a statistically significant difference at p value <0.05.*

DISCUSSION

In the present study we investigated the effect of 8% Arginine-CaCO₃ for the treatment of dentine sensitivity compared to NaF. According to results in our study, Arginine-CaCO₃ was better than NaF in decreasing of dentine hypersensitivity in chronic periodontitis patients in agreement with some researchers^(9,12,14).

Gingival recession, resulting from abrasive tooth brushing or periodontal disease, is the primary route for which the underlying dentin becomes exposed⁽⁶⁾ and dietary acids as well as extensive root debridement are the major reasons for loss of cementum. These findings are consistent with reports in the literature demonstrating that periodontal disease and treatment lead to a high prevalence of dentin hypersensitivity and/or teeth with hypersensitive roots.

Dentin sensitivity may differ according to different stimuli, and it is recommended that at least two hydrodynamic stimuli be used in the clinical trial. The chemical, mechanical and thermal stimuli to exposed dentin surfaces cause patients to feel pain in teeth⁽⁹⁾. Despite only air blast test was applied in many studies, the use of tactile and cold stimulus is also recommended, because, some patients may not

TABLE (2) Sensitivity Scores to Three Stimuli for Both Treatment Group at All Time Points.

	Air Blast			Tactile			Thermal		
	Baseline	1 month	3 months	Baseline	1 month	3 months	Baseline	1 month	3 months
8% Arginine-CaCO	5.80 $\pm$ 0.9 a,b	4.40 $\pm$ 0.7	3.54 $\pm$ 0.71*	5.79 $\pm$ 0.6	4.72 $\pm$ 0.8	3.84 $\pm$ 0.8	5.86 $\pm$ 0.74b	4.64 $\pm$ 0.7	3.24 $\pm$ 0.6*
1.23% NaF	5.86 $\pm$ 0.7	5.60 $\pm$ 0.5	4.25 $\pm$ 0.8*	5.75 $\pm$ 0.7	5.74 $\pm$ 0.6	4.34 $\pm$ 0.7	5.76 $\pm$ 0.7	5.7 $\pm$ 0.6	4.3 $\pm$ 0.9*

a Data are expressed as mean and standard deviation.

b Differences within group according to stimulus were statistically significant ($p<0.05$).

**Statistically significant at p value <0.05.*

experience sensitivity when only air blast stimuli is used ⁽³⁾. Therefore in our study, all three methods were performed, and the 5-minute gap was allowed between two stimuli to minimize interactions.

We used the VAS in this study to evaluate hypersensitivity of the patients as the scale is simple to administer and it has been used to evaluate dentin hypersensitivity, previously. Several investigators have been demonstrated the validity and reliability of the VAS for both experimental and clinical pain. The VAS also appears to be more sensitive in discriminating between various treatments and changes in pain intensity. ⁽²¹⁾

Previous clinical studies have shown that the evaluation period of desensitizing agents must be a minimum of 4 or better 8 weeks ^(1,4,9,10). In this study, patients evaluated for three month as, it has been reported that arginine-containing agent blocks the dentin tubules immediately after the application and maintains this effect for one month.

By analyzing the relationship of hypersensitivity to age, it appears that in all age groups this pathosis may be present, as observed in young patients who had gingival recession ⁽¹¹⁾. According to other researchers ^(16,18), the greatest incidence occurs in those aged 20-39 years. Regarding gender, females had more hypersensitivity ⁽¹⁵⁾, while other researchers ⁽¹⁷⁾ reported a higher percentage in males. The results of this study agree with the authors cited above, whose samples revealed the presence of hypersensitivity in all patients, regardless of gender and age, although it was more prevalent in certain types of hypersensitivity and when periodontal disease was recorded.

The in-office desensitizing agent containing 8% arginine and calcium carbonate provides a statistically significant reduction in dentin hypersensitivity instantly after a single professional application of the product and this reduction is maintained for 12 weeks without further application of arginine. Arginine is an amino acid found

naturally in saliva. The combination of arginine and calcium carbonate mimics saliva's ability to occlude and seal open dentinal tubules, the result is a plug which renders that tooth surface resistant to acid and thermal attacks thereby reducing fluid movement. The combination of arginine, bicarbonate, a pH buffer and calcium carbonate was introduced by Kleinberg ⁽¹⁸⁾, in 2002 and first used in commercial products in 2009 as novel breakthrough at that time. ⁽¹⁵⁻¹⁸⁾

The lack of long-term follow up also means that the longevity of symptom relief could not be judged. This is disappointing as patients want a long-term predictable treatment for this condition. The importance of long term follow up was highlighted in a review paper by the Canadian Advisory board suggesting that although initial management may lead to relief of symptoms, recurrence can occur. For these patients their social and medical history usually remains unchanged therefore reinforcement of advice in relation to removal of predisposing factors and long-term use of desensitising agents is usually necessary although the long term outcome of such a treatment regime is unknown.

CONCLUSION

Our study showed that periodontal treatment was one of the etiological factors of DH. The results of present study showed that application of both agents was observed to reduce sensitivity and maintained for three months. We found statistically significant differences between the desensitizing efficacy of 8% Arginine-CaCO₃ and that of the 1.23% NaF varnish. The 8% Arginine-CaCO₃ might be an effective agent in the prevention of dentinal hypersensitivity caused by scaling and root planning procedures. There are needed more long-term studies with a larger sample size to determine the efficacy of desensitizing agents in treatment of dentin hypersensitivity in chronic periodontitis patients.

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