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Comparision of Commercially available Desensitizing Toothpastes in the Management of Dentin Hypersensitivity- A Randomized Controlled Clinical Trial

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Abstract:

Backround: Dentin Hypersensitivity is a sharp painful response that occurs when exposed dentin tubules are subjected to various stimuli. Studies have shown that toothpastes containing Bio-active glass and Arginine showed better control over tooth sensitivity. Therefore, this study aimed to evaluate and compare the efficacy of two commercially available toothpastes incorporating Arginine and Bio Active glass in the treatment of Dentin Hypersensitivity.

Methods: A total of 20 patients with minimum of two hypersensitive teeth with air blast stimulus score of two on Schiff cold air sensitivity scale were recruited. Patients were instructed to brush twice daily with the assigned toothpastes for a period of four weeks. Dentin Hypersensitivity examination was carried out using tactile stimulation, air-blast stimulation and visual analogue scale at baseline and after four weeks by patients and dentist. Data descriptive statistics frequency analysis, percentage analysis was used for categorical variables and the mean & S.D were used for continuous variables. Wilcoxon signed rank test was used to find the significant difference between the bivariate samples and Kruskal Walli's test followed by Mann-Whitney U test was used for multivariate analysis.

Results: When comparing Bioactive glass and Arginine group of toothpastes, both showed better reduction in dentin hypersensitivity in Schiff scores, VAS Scores of Air-blast, Tactile sensitivity both by patient and dentist without any statistical significance between groups.

Conclusion: Toothpastes containing Arginine and Bioactive glass are effective and almost comparable in reducing the dentinal hypersensitivity.

Key Words: Arginine, Bio-active glass, Toothpaste

INTRODUCTION:

Dentin Hypersensitivity is a painful response that occurs when exposed dentin tubules are subjected to various stimuli. This can be broadly managed by either the blocking of the open dentinal tubules or by nerve desensitization. A primary strategy in the management for non-carious dentinal exposure is the use of desensitizing toothpastes. Multiple over-the- counter dentifrices, are available that claim superiority to other products that creates a challenge to the dentist, to prescribe the most appropriate agent for the patient.

Studies have shown that toothpastes containing Arginine and Bioactive glass have appeared to provide optimal relief in dentin hypersensitivity. [1] Shah et al (2017) suggested that at physiological pH, 8% Arginine and Calcium Carbonate interacts and bind to the negatively charged dentine surface, to form a calcium rich layer on the dentin surface. Further, Arginine triggers occlusion of the dentin tubules, that remain intact even after exposure to acids - preventing transmission of pain-producing stimuli.[2]

Calcium Sodium Phosphosilicate, the active ingredient of Novamin products, reacts when exposed to aqueous media and provides calcium and phosphate ions that form a hydroxy-carbonate apatite (HCA) with time. This layer results in the physical occlusion of dentinal tubules which relieves hypersensitivity (Wefel 2009).[3]

This study aimed to evaluate and compare the efficacy of two commercially available toothpastes incorporating Arginine and Bio Active glass in the treatment of Dentin Hypersensitivity.

MATERIALS AND METHODS:

The study was single blind (investigator) randomized controlled clinical design. The study duration was four weeks, in which sensitivity scores were measured at baseline and at four weeks. The research protocol was approved by the Institutional Review Board. The duration of the study was from December 2016 to March 2017.

Inclusion and exclusion criteria:

Patients with age group of 18-70 years, with minimum of two hypersensitive teeth with a minimum air blast stimulus score of two on Schiff cold air sensitivity scale. The exclusion criteria include Patients under analgesic, anti-inflammatory, anti-depressive treatment regimens, patients subjected to periodontal surgery within past three months, Patients with deep pockets (PPD>5mm), Patients with carious tooth, cracked or fractured tooth, Teeth with pulpal involvement or non-vital teeth, Patient who is already

under desensitizing therapy, Teeth with congenital enamel/dentin defects, Patients who are allergic to any of the contents of the toothpaste.

Patients who fulfilled the above criteria are included in the study. Sample size was calculated based on previous studies with 95% confidence levels, α value of 0.05 and 80% power and the final sample size was found to be ten in each in group. The recruited patients were randomly assigned by coin toss method into two groups with ten patients in each group.

Group 1: Toothpaste incorporating Arginine (Colgate Sensitive Pro-Relief Toothpaste)

Group 2: Toothpaste incorporating Bioactive Glass (Sensodyne Rapid Relief Toothpaste)

For the recruited patients, the clinical parameters evaluated were Full mouth Plaque Score (SILLNESS &LOE-1974), Schiff scores, Tactile -sensitivity Examination, Air blast - sensitivity Examination (SCHIFF SCALE)[4], Visual Analogue Scale (VAS) at baseline. Scaling has been done to all recruited patients. Patients were instructed to brush twice daily with the assigned toothpastes for a period of four weeks. Air blast and controlled tactile stimulation by a sharp probe were conducted on the sensitive teeth after four weeks. They were recorded as Visual analogue scores both by the patient as well as the clinician. Schiff scores were also analyzed after four weeks.

Statistical analysis:

The collected data were analysed with IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics frequency analysis, percentage analysis was used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in Paired groups (Baseline & 4th Week) the Wilcoxon signed rank test was used. For the multivariate analysis the Kruskal Walli's test followed by Mann-Whitney U test was used. In all the above statistical tools the probability value .05 is considered as significant level.

RESULTS:

A total of 20 subjects completed the entire study from baseline to four weeks. In our study, statistically significant reduction of VAS scores of Air-blast and Tactile sensitivity and Schiff Scores were observed from baseline to four weeks.

Table 1 explains the comparison of Schiff scores with air blast evaluated by the dentist at baseline and after four weeks of treatment between the study groups. Statistical significant improvement was seen from baseline to four weeks in both groups

Table 2 explains the intragroup comparison of Visual analogue score of air-blast and tactile sensitivity scores of groups I and II by both patient and dentist at baseline and after four weeks of treatment. Significant improvement is seen for all the parameters tested at the four week of treatment in both the groups

Table 3 explains the intergroup comparison of P-values of Visual analogue score of air-blast scores and tactile sensitivity scores by both patient and dentist in all the three groups after four weeks of treatment. There is no statistically significant difference between two test groups I &II.

Table 1 : Comparison of Schiff Scores between two groups with Mean ± Standard Deviation

	BASELINE (Mean ± SD)	**4 WEEKS (Mean ± SD)**	**P-VALUE**
GROUP I	2.4 ± 0.51	1.5 ± 0.85	0.014
GROUP II	2.6 ± 0.51	1 ± 0.66	0.004

*SD – Standard Deviation

Table 2 : Comparison of visual analogue score of Air blast and tactile sensitivity scores by patient and clinician in GROUP I and II

GROUP	**VARIABLES**	**PATIENT**		**PVALUE**	**DENTIST**		**PVALUE**
		BASELINE (Mean±SD)	4WEEKS (Mean±SD)		BASELINE (Mean±SD)	4WEEKS (Mean±SD)	
GROUP I	VAS-AAB	5.5 ±1.3	2.7±1.05	0.005	5.2±1.2	2.4±0.9	0.005
	VAS-ATS	5.4±1.2	2.3±1.33	0.005	5.2±1.3	2.1±1.19	0.005
GROUP II	VAS-AAB	6.2± 1.03	2.4± 0.84	0.005	5.5 ± 0.97	2.3± 0.82	0.004
	VAS-ATS	5.9 ± 0.8	2.4 ± 0.84	0.005	5.6 ± 0.8	2.3 ± 0.82	0.004

*VAS-AAB – Visual Analogue Score-Air-Blast, VAS-ATS – Visual Analogue Score-Tactile Sensitivity, SD-Standard Deviation, GROUP I- Toothpaste containing Arginine, GROUP II- Toothpaste containing Bio-active glass.

Table 3: Intergroup comparison of p-values of Group I and II

	VAS AAB	**VAS ATS**	**VAS AAB**	**VAS ATS**
GROUP I & II	0.436	0.579	0.739	0.529

*VAS-AAB – Visual analogue score-Air-Blast, VAS-ATS – Visual analogue score-Tactile sensitivity

DISCUSSION:

Dentin hypersensitivity is one of the most common painful tooth problem that affects the quality of patient's life. Toothpastes have been widely used in the treatment of dentin hypersensitivity because of their low cost and ease of use for home application. The mechanism of action of a desensitizing toothpaste is either nerve depolarization or the obliteration of dentin tubules by the precipitation of insoluble deposits on the dentin surface. Although, both approaches are effective at reducing or eliminating the hypersensitivity, the duration of relief is highly variable. Hence, the need for materials which reduce dentin hypersensitivity by chemically reacting with the tooth surface has led to the development of newer technologies such as those employing novamin and pro-argin technologies.

Novamin is described as calcium sodium phospho-silicate, which reacts when exposed to the body fluids, and deposits hydroxycarbonate apatite, a mineral that is chemically similar to the mineral in enamel and dentin. [5] On the other hand, Arginine provides naturally protective oral health benefits. When the Ph is at the physiological limit, arginine and calcium carbonate act together and binds to the negatively charged dentin surface to form a calcium rich layer on the dentin surface and in the dentin tubules to plug and seal them. [1] Pradeep et al., in their study compared the efficacy of commercially available desensitizing toothpastes containing Novamin and Pro-Argin in reducing dentin Hypersensitivity. It was concluded that Desensitizing toothpaste containing Novamin showed better reduction of sensitivity when compared to dentifrice containing Pro-argin technology. It has been shown that the innovative bioactive glass-containing toothpaste occludes dentinal tubules and resists acid challenge. Moreover, it has demonstrated a strong antimicrobial behaviour in vitro, which reduces symptoms of dentin hypersensitivity by preventing bacteria to induce pulpal response.[6] Penmetsa et al. did a study to compare the efficacy of commercially available desensitizing toothpastes containing Novamin and Pro-Argin in reducing dentin hypersensitivity.[1] Desensitizing toothpaste containing Novamin showed better reduction of sensitivity when compared to dentifrice containing Pro-argin technology. Docimo et al conducted a study to evaluate the dentin hypersensitivity reduction efficacy of three commercially available toothpastes: 1) Colgate Sensitive Pro-Relief Toothpaste Arginine technology); 2) Sensodyne Rapid Relief Toothpaste (Novamin technology); and (3) Crest Cavity Protection Toothpaste. It was concluded that Toothpaste with arginine technology which was used twice daily, significantly reduces dentin hypersensitivity, and is more effective in reducing dentin hypersensitivity than toothpaste with Novamin technology and control at the period of eight weeks.[7] It is difficult to draw conclusion from the previous studies regarding the efficient Desensitizing toothpaste as because the results are varied. This may be attributed to the sample size, time period of usage of tooth paste and may be the different method of evaluation of dentin hypersensitivity. So, in our study we compared two desensitizing toothpastes - one comprising of Bioactive glass and the other containing Arginine.

The dentinal hypersensitivity scores were measured by recording Schiff's air-blast scores, Visual Analogue Scale for Air blast and Tactile sensitivity by Dentist as well as patient at baseline to four weeks after treatment. The results depicted that both toothpastes showed statistically significant improvement from baseline to four weeks in case of assessment of Schiff's score of air-blast. When we assessed the intra-group comparison in respect with patient assessment, VAS of both air-blast and tactile sensitivity scores showed better response in Bioactive glass containing toothpastes. In accordance with dentist assessment, VAS of both air-blast and tactile sensitivity scores were significant in both the groups. But, inter-group comparison of dentinal hypersensitivity parameters does not show statistical significance.

CONCLUSION:

Within the limitations of the present study, the toothpastes containing Arginine and Bioactive glass are effective and almost comparable in reducing the dentinal hypersensitivity both the treatment groups showed reduction of sensitivity from baseline to four weeks.

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