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Comparison of Clinical Efficacy of Three Commercially available Desensitizing Mouthwashes in the Treatment of Dentinal Hypersensitivity

Abstract

Background: Dentine hypersensitivity is an abnormal response of the exposed vital dentine to thermal, chemical, or tactile stimuli. A considerable number of agents are effective in the treatment of dentin hypersensitivity. Aim of this study is to compare the clinical efficacy of three commercially available desensitizing mouthwashes in the treatment of dentinal hypersensitivity. **Methods:** A total of 45 subjects (aged 20 to 60 years) with dentin hypersensitivity were included in the study. After sensitivity scores for controlled cold air blast from a dental unit syringe and tactile stimuli with dental explorer at baseline were recorded, subjects were divided into three groups of mouthwashes: Colgate Plax Sensitive mouthwash, SHY-OR mouthwash, Hiora K mouthwash. The sensitivity scores were measured again at 4- and 6-week follow-ups. **Results:** After using the desensitizing agent, it was found that all VAS scores from the post treatment periods were significantly lower in all three groups in response to both air stimuli and tactile stimulation. Statistical Analysis was performed using SPSS v16.0 software. Analysis of Variance (ANOVA) was used to test statistical significant difference in change in VAS score from baseline to 4th week and 6th week between three groups. **Conclusion:** The result shows that there is no statistically significant difference in change in VAS score from baseline to 6th week between three groups for cold air blast and tactile sensation. However, long-term studies to facilitate better understanding of the performance of these desensitizing agents can be advocated in the future.

Monali R. Sonawane[1], Mona U. Shah[2], Yogesh S. Doshi[3], Monika Bajaj[4], Raghavendra NM[5], Arush U. Shah[6]

[1]Post Graduate Student, Department of Periodontics, PDU Dental College, Solapur, Maharashtra, India
[2] Professor & Head, Department of Periodontics, PDU Dental College, Solapur, Maharashtra, India
[3]Reader, Department of Periodontics, PDU Dental College, Solapur, Maharashtra, India
[4]Senior Lecturer, Department of Periodontics, PDU Dental College, Solapur, Maharashtra, India
[5]Senior Lecturer, Department of Periodontics, PDU Dental College, Solapur, Maharashtra, India
[6]Senior Lecturer, Department of Oral and Maxillofacial Surgery, PDU Dental College, Solapur, Maharashtra, India

Key Words

Hypersensitivity; potassium nitrate; visual analog pain scale, mouthwashes

INTRODUCTION

Dentinal hypersensitivity (DH) is a relatively common problem in periodontal practice. DH is characterized by short sharp pain arising from exposed dentin in response to stimuli typically thermal, evaporative, tactile, osmotic or chemical - that cannot be ascribed to any other dental defect or disease.[1] Dentinal hypersensitivity may occur spontaneously when the root becomes exposed to oral environment as a result of gingival recession or it may occur after scaling and root planing & periodontal surgical procedures. It is manifested as pain induced by cold or hot temperature by citrus fruits or sweets, or by contact with a toothbrush or a dental instrument due to exposed dentin. Dentinal Hypersensitivity is a painful clinical condition with an incidence ranging from 4 to 74%.[2-4] While it can affect the patient of any age, most affected patients are in the age group of 20-50 years, with a peak between 30 and 40 years of age.[5] Regarding the type of teeth involved, canines and premolars of both the arches are the most affected teeth. Buccal aspect of cervical area is the commonly affected site.[6] Several theories have been proposed to

Table 1: Comparison of VAS score between three groups for Evaluation of response to cold air blast and tactile stimulation

Evaluation of response to cold air blast	**Group 1 : Colgate Plax Sensitive Mouthwash**	**Group 2 : Shy-OR Mouthwash**	**Group 3 : Hiora K Mouthwash**	**F-value**	**P-value**
Baseline	7.47 ± 1.19	7.73 ± 1.22	7.6 ± 1.18	0.18	P=0.83
4th week	2.93 ± 1.39	3.6 ± 1.29	3.13 ± 0.99	1.15	P=0.33
6th week	0.8 ± 0.77	1.2 ± 0.9	0.93 ± 0.96	0.77	P=0.46
Evaluation of response to tactile stimulation	Group 1 : Colgate Plax Sensitive Mouthwash	Group 2 : Shy-OR Mouthwash	Group 3 : Hiora K Mouthwash	F-value	P-value
Baseline	6.6 ± 1.12	7.2 ± 1.37	6.8 ± 1.37	0.83	P=0.44
4th week	2.33 ± 1.05	2.87 ± 1.46	2.4 ± 0.98	0.91	P=0.41
6th week	0.67 ± 0.89	1.33 ± 1.05	1.07 ± 1.03	1.70	P=0.19

Table 2: Comparison of VAS score for Evaluation of response to cold air blast over period of time

Group	Baseline	4th week	6th week	F-value	P-value
Group 1 : Colgate Plax Sensitive Mouthwash	7.47 ± 1.19	2.93 ± 1.39	0.8 ± 0.77	200.62	P<0.0001
Group 2 : Shy-OR Mouthwash	7.73 ± 1.22	3.6 ± 1.29	1.2 ± 0.9	211.49	P<0.0001
Group 3 : Hiora K Mouthwash	7.6 ± 1.18	3.13 ± 0.99	0.93 ± 0.96	244.50	P<0.0001

Table 3: Multiple comparisons using Bonferroni method for Evaluation of response to cold air blast

Group	(I) Group	(J) Group	Mean difference (I-J)	p-value	Remarks
Group 1 : Colgate Plax Sensitive Mouthwash	Baseline	4th week	4.53	P<0.001	Significant
		6th week	6.67	P<0.001	Significant
	4th week	6th week	2.13	P<0.001	Significant
Group 2 : Shy-OR Mouthwash	Baseline	4th week	4.13	P<0.001	Significant
		6th week	6.53	P<0.001	Significant
	4th week	6th week	2.40	P<0.001	Significant
Group 3 : Hiora K Mouthwash	Baseline	4th week	4.47	P<0.001	Significant
		6th week	6.67	P<0.001	Significant
	4th week	6th week	2.20	P<0.001	Significant

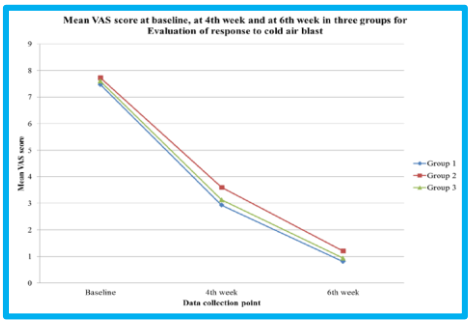
explain the mechanism involved in dentinal hypersensitivity.[7] The transducer theory, the modulation theory, the "gate" control and vibration theory, and the hydrodynamic theory.[8,9] Of these theories, the hydrodynamic theory is currently believed most responsible for the transmission of dentinal sensation. According to the hydrodynamic theory, as put forth by Brannstrom and Astrom,[10] a dentinalgia results from a stimulus causing minute changes in the fluid movement within the dentinal tubules. This may subsequently deform the odontoblast or its process and hence cause an elicitation of pain via the intimately associated "mechano- receptor-like" nerve endings. Treatment of dentin hypersensitivity is challenging for both the patient and the dentist for two reasons. It is difficult to measure patient's pain and it is difficult for the patient to change the habits that initially caused the problem. The objective of treatment with desensitizing agent is either to make it less responsive to stimulation, desensitize the nerve, or plug the dentinal tubules preventing fluid flow. According to Grossman (1935), the ideal desensitizing agent should be non-irritating to the pulp, be relatively painless, be easily applied, act quickly, be permanently effective and not discolor tooth structure.[11] Overall, patient responses are very subjective and thus treatment results are largely dependent upon the individual's pain threshold.[12,13] A numbers of agents have been investigated for the treatment of hypersensitive teeth, with varying degrees of effectiveness. They include formaldehyde, sodium fluoride, sodium monofluorophosphate, dibasic sodium citrate, sodium silico-fluoride, silver nitrate, calcium hydroxide, and strontium chloride including recent advances like fluoride iontophoresis and lasers. Some of these compounds have been incorporated into dentifrices for daily use of action.[14,15] There has been evidence in the literature which shows that both the formulations i.e., toothpaste and mouthwash have therapeutic potential to alleviate dentinal hypersensitivity. But the studies which compare the effectiveness of a mouthwash are rare. So, the aim of the present study is to compare the clinical efficacy of three commercially available

Table 4: Comparison of VAS score for Evaluation of response to tactile stimulation over period of time

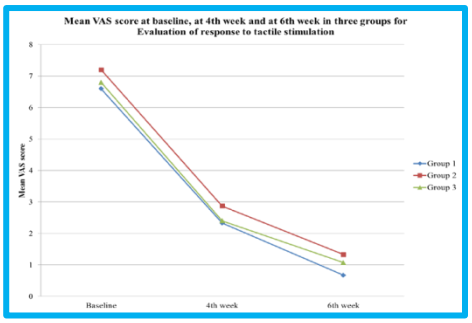
Group	Baseline	4th week	6th week	F-value	P-value
Group 1 : Colgate Plax Sensitive Mouthwash	6.6 ± 1.12	2.33 ± 1.05	0.67 ± 0.89	165.72	P<0.0001
Group 2 : Shy-OR Mouthwash	7.2 ± 1.37	2.87 ± 1.46	1.33 ± 1.05	191.86	P<0.0001
Group 3 : Hiora K Mouthwash	6.8 ± 1.37	2.4 ± 0.98	1.07 ± 1.03	142.01	P<0.0001

Table 5: Multiple comparisons using Bonferroni method for Evaluation of response to tactile stimulation

Group	(II)Group	(J) Group	Mean difference (I-J)	p-value	Remarks
Group 1 : Colgate Plax Sensitive Mouthwash	Baseline	4th week	4.27	P<0.001	Significant
		6th week	5.93	P<0.001	Significant
	4th week	6th week	1.67	P<0.001	Significant
Group 2 : Shy-OR Mouthwash	Baseline	4th week	4.33	P<0.001	Significant
		6th week	5.87	P<0.001	Significant
	4th week	6th week	1.53	P<0.001	Significant
Group 3 : Hiora K Mouthwash	Baseline	4th week	4.40	P<0.001	Significant
		6th week	5.73	P<0.001	Significant
	4th week	6th week	1.33	P<0.01	Significant



Graph 1



Graph 2

desensitizing mouthwashes in reducing dentin hypersensitivity after four and six weeks of twice daily use.

MATERIALS AND METHODS

After Institutional ethical committee approval of the protocol and the letter of informed consent, a total of 45 Patients (34 males and 11 females) in the age group 20 to 60 years participated in the study. To be eligible for participation in the study, each subject had to have a minimum of two teeth with dentin hypersensitivity among incisors, canines, and premolars, with cervical erosion/abrasion or gingival recession, as determined by a tactile hypersensitivity stimulus and visual analogue scale score of ≥ 4. Patients were excluded from the study with poor periodontal condition, systemic debilitating disease, history of treatment for dentin hypersensitivity, caries or restoration in the area of hypersensitivity, allergy to the agents used in the study, and patients with orthodontic appliance, crowns and bridges in the area of sensitivity. The clinical trial was conducted in Department of Periodontics, PDU Dental College and hospital, Solapur. Subjects were randomly divided into three groups.

Group I – Patients who used Colgate Plax Sensitive Mouthwash (Colgate®) containing Potassium citrate, Cetylpyridinium Chloride. (n=15).

Group II- Patients who used HiOra K Mouthwash (Himalaya® herbal healthcare) containing Suryakshara 50.0mg (Potassium nitrate) (n=15).

Group III- Patients who used Shy-OR Mouthwash (Group pharmaceuticals limited) containing Potassium Nitrate (3%) and Sodium Monofluorophosphate (0.2%) (n=15).

Patient's response was assessed using cold air blast and tactile stimuli evaluation to record visual analogue scale[16] (VAS) score for each patient at baseline and after fourth and sixth week. The VAS is a 10-cm line with the anchor words "no pain" (0 cm) and "intolerable pain (10 cm)" at the opposite ends. Each participant was asked to place a vertical mark on the VAS to indicate the intensity of his or her level of sensitivity after receiving stimuli. Patient's response to cold air blast from a dental unit syringe (at 20º±3ºC at 40 to 65 psi) was assessed for 1-second duration at a distance of 0.5 cm away from the affected teeth. Tactile stimuli evaluation was performed with dental explorer (17/23) on the exposed dentin, in a mesio-distal

direction passed lightly across the affected area, perpendicular to long axis of the tooth. After recording both sensitivity scores at baseline, subjects were given mouthwash randomly and divided into three groups.

RESULTS

Each group had 15 subjects. Group I had 3 females and 12 males with mean age of 31.47 ± 5.26. Group II included 4 females and 11 males with mean age of 30.73 ± 4.99. Group III had 5 females and 11 males with mean age of 30.53 ± 6.14. Data analysis was done by using software SPSS v16.0. Comparison between three groups was done by using ANOVA test followed by post hoc Tukey-Kramer Multiple Comparisons Test for normally data and Kruskal-Wallis Test followed by post hoc Dunn's Multiple Comparisons Test for non-normally data. Repeated measures of ANOVA test was used for all three groups at three point data collection followed by Bonferroni multiple comparisons was made to calculate the mean difference in VAS score at different time points. A p-value less than 0.05 were considered as significant. Table 1 represents the mean VAS scores for the three treatment groups after receiving cold air blast and tactile stimuli at baseline, at week 4 and week 6. The mean VAS score at baseline in group I was 7.47 ± 1.19 and 6.6 ± 1.12 in response to air and tactile stimuli respectively. In Group II, the mean VAS score was 7.73 ± 1.22 and 7.2 ± 1.37 in response to air and tactile stimuli respectively. In Group III, the mean VAS score was 7.6 ± 1.18 and 6.8 ± 1.37 in response to air and tactile stimuli respectively. In group I VAS score decreased from 7.47 ± 1.19 to 0.8 ± 0.77 in response to air stimuli and 6.6 ± 1.12 to 0.67 ± 0.89 in response to tactile stimuli respectively. In group II VAS score decreased from 7.73 ± 1.22 to 1.2 ± 0.9 in response to air stimuli and 7.2 ± 1.37 to 1.33 ± 1.05 in response to tactile stimuli respectively. In group III VAS score decreased from 7.6 ± 1.18 to 0.93 ± 0.96 in response to air stimuli and 6.8 ± 1.37 to 1.07 ± 1.03 in response to tactile stimuli respectively at the end of 6 weeks. Results showed that there is statistically significant difference in decrease in VAS scores from baseline to 4th week and 6th week for all the three treatment groups as depicted in table 2 to 5. After using the mouthwashes, we found that all VAS scores were significantly lower in all the three groups in response to both air and tactile stimuli as shown in Graphs 1 and 2. Intragroup comparison shows that all the three mouthwashes demonstrated statistically significant reduction in VAS scores from baseline to 4th and 6th weeks.

DISCUSSION

The three mouthwashes included in the study were Colgate Plax Sensitive Mouthwash containing potassium citrate, Hiora - K mouthwash containing Suryakshara 50.0mg (Potassium nitrate) and Shy-OR Mouthwash containing 3% potassium Nitrate as a key ingredient. This clinical study provided an investigative comparison of the efficacy of three commercially available mouthwashes with respect to dentin hypersensitivity reduction after 4 and 6 weeks of at-home, two times per day usage over six-week period. Evaluation of response was assessed by means of a psychometric response scale i. e. the visual analogue scale (VAS). Its validity and reliability has been demonstrated for measuring both experimental & and clinical pain[16]. The results of our clinical study showed that there is significant decrease in VAS scores as compared to baseline, at 4 weeks as well as at 6 weeks in all three treatment groups with air stimuli and tactile stimulation. However intergroup comparison did not show any statistically significant difference in VAS score from baseline to 6th week for cold air blast and tactile sensation. In our study potassium citrate is the key ingredient in group I. Potassium ions are reported to work by blocking the synapse between nerve cells, reducing nerve excitation, and the associated pain.[17,18] The results showed that there is significant decrease in VAS scores as compared to baseline, at 4 weeks and at 6 weeks which correlate with the findings of the study done by Sowinski J, *et al*. They reported that 5.3% potassium citrate is clinically effective in treating dentin hypersensitivity.[19] Similar results were reported in a study on clinical efficacy of toothpaste containing potassium citrate which was effective in reducing dentin hypersensitivity with oral hygiene instruction.[20] Group II is Hiora - K mouthwash containing Suryakshara 50.0 mg/gram of powder. *Suryakshara* is potassium nitrate, which is available in the form of colourless crystals or a white, crystalline powder. Suryakshara helps in re-mineralization of enamel and acts as a desensitizer by blocking the transmission of pain from the tooth surface to the tooth nerve.[21] In group III we used 3% (w/v) potassium nitrate (Shy-OR mouthwash). Potassium Nitrate (KNO_3) is widely used in the field of medicine and dentistry. It has been in use in dentistry, as a desensitizing agent, since more than last 3 decades.[22] The mechanism of action of

potassium ions are thought to diffuse along dentinal tubules and decrease the excitability of intradental nerves by altering their membrane potential thus reducing dentinal hypersensitivity.[23,24] A number of studies have reported the efficacy of potassium nitrate for managing dentinal hypersensitivity[25,26] both in the form of a toothpaste and mouthwash. In group II and III, both the concentrations of Potassium nitrate were equally effective in reducing dentinal hypersensitivity. These results are in agreement with Hodash *et al*., who reported that potassium nitrate is a "superior desensitizer" at concentrations of 1 to 15%.[27] Also Tarbet *et al*., in a controlled study found that 5% potassium nitrate-paste was able to desensitize the dentin effectively at 1 week and up to 4 weeks compared to the control (paste without potassium nitrate) in 92% of the subjects.[28] All the above mentioned studies used toothpaste as a medium for delivery of active ingredient to alleviate hypersensitivity. However there are very few published studies which reported the effectiveness of mouthwash for dentinal hypersensitivity. The results of the clinical study done by Sunita Sharma *et al*., showed that both desensitizing toothpaste and mouthwash are equally effective in reducing sensitivity within 4 weeks evaluation period, despite the different application procedure, there were no statistically significant differences between the groups.[29] In 2001 Pereira R, Chava VK concluded that 3% potassium nitrate/ 0.2% sodium fluoride mouthwash appears to have therapeutic potential to alleviate dentinal hypersensitivity.[30] Mouthwashes have been used in the treatment of dentin hypersensitivity because of their low cost and ease of use for home application. So, it is one of the effective at home treatment modality.

CONCLUSION

Thus, the results of our study suggest that all the three mouthwashes i.e., Colgate Plax Sensitive Mouthwash, HiOra K Mouthwash and Shy-OR Mouthwash are equally effective in reducing dentinal hypersensitivity. Even though in group I potassium citrate and in group II and III potassium nitrate was used as active ingredient none proved to be better than other agent. In addition this study depicts that herbal mouthwashes are equally potent to non-herbal mouthwashes. However, long-term studies to facilitate better understanding of the performance of these desensitizing agents are advocated in the future.

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