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Comparative evaluation of efficacy of commercially available calcium sodium phosphosilicate and potassium nitrate containing toothpaste in reducing dentinal hypersensitivity

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***Abstract*---**Aim: Dental hypersensitivity is commonly complained by the subjects in the dental office or hospitals. Our chief aim was to compare two commercially available toothpastes containing Calcium sodium phosphosilicate and 5% potassium nitrate for the treatment of dentinal hypersensitivity. Materials and methods: Sixty subjects with the chief complaint of dentinal hypersensitivity were selected and randomly divided into two groups. Assesment of hypersensitivity was done using visual analog scale (VAS) scores by applying water and air

stimuli at baseline, 3 weeks after usage of the respective provided toothpaste, and 3 weeks after discontinuation i.e., 6 months of the respective toothpaste. Results: Both the groups showed reduction in hypersensitivity scores at 3 weeks and 6 weeks for air and water stimulus. The group provided with toothpaste containing potassium nitrate, however, showed significantly better reduction in hypersensitivity compared to the group provided with toothpaste containing calcium sodium phosphosilicate.

***Keywords*---**dentinal hypersensitivity, toothpaste, potassium nitrate. Calcium sodium phosphosilicate.

Introduction

Many individuals are affected by the oral pain condition due to dentinal hypersensitivity arising due to the response of various stimuli. [1] In recent days dentinal hypersensitivity is likely to become a more frequent dental complaint in clinics and hospitals. Several etiological factors are associated with dentinal hypersensitivity in which recession of gingiva is the most common, followed by attrition; erosions. Dentinal hypersensitivity can also be caused by many other factors such as chipped off or fractured teeth, cracked cusps, carious lesions, and faulty restorations. [2]However, the reported prevalence of dentine hypersensitivity varies from 3 to 57%. Dentinal hypersensitivity can present from early to old age, with most sufferers aged between 20 to 40 years. [3] Pain caused by dentinal hypersensitivity can be explained by the widely accepted "hydrodynamic theory" proposed by Brannstrom and Astrom (1964). Histologically, widened dentinal tubules are seen under the transmission electron microscope (TEM). [4] To overcome dental hypersensitivity, different treatment options are available. The treatment options are the application of various chemicals such as stannous fluoride, sodium fluoride, varnishes, potassium oxalates, potassium nitrates, desensitizing agents, periodontal soft tissue grafting and LASERS. [5] Two main approaches applied in the treatment and prevention of dentinal hypersensitivity are tubular occlusion and blockage of nerve activity. In the tubular occlusion approach, the affected tooth/ teeth are treated with a physical or chemical agent that forms a layer over the surface, which mechanically occludes the exposed dentinal tubules, thereby preventing pulpal fluid flow thereby leading to a reduction in dentinal hypersensitivity. [6]

Several agents and approaches have been investigated, such as potassium nitrate, strontium Chloride, resin adhesives, fluoride and laser therapy etc. 5% Calcium sodium phosphosilicate (Nova Min Technology, Alachua, Fla.) was introduced into the dental market as a desensitizer. It consists of Calcium sodium phosphosilicate and has been reported to be effective in relieving dentine hypersensitivity when added to a dentifrice". [7] As per literature, it has been suggested that 5% Calcium sodium phosphosilicate effectively reduces dentinal hypersensitivity and may have an effect even after discontinuation due to its tubular occluding property. Thus the present study was done with an aim of examining the efficacy of new toothpaste containing Calcium sodium phosphosilicate for treating dentinal hypersensitivity and comparing effectiveness

with 5% Potassium nitrate, which is considered the gold standard in treating dentinal hypersensitivity.

Material and Methods

The study population comprised 60 subjects, 35males and 25females, reporting to the Department of Periodontology with the chief complaint of teeth hypersensitivity. Before the start of the study, the protocol was approved by the Institutional Review. After a brief case history and clinical examination, dental hypersensitivity was recorded using a visual analog scale (VAS) using air stimulus [8] and cold water stimulus.[9,10] VAS is the most accepted method for measuring pain, comprising of a scale from 0 - 10 cm in length. Subjects were asked to place a mark on the VAS scale (0 -10 cm line), indicating the intensity of dentin hypersensitivity when an external stimulus was applied. [11] On the assessment of the subject's relevant data based on systemic history, Two groups (30 individuals in each group) were made. Group I subjects was given dentifrice containing 5% Calcium sodium phosphosilicate and Group II subjects were given dentifrice containing 5% Potassium nitrate. Subjects were recalled after three weeks of usage of respected dentifrices. VAS scores were recorded. Subjects were then asked to discontinue their respective dentifrice and recalled after three weeks, i.e. six weeks from baseline. VAS scores were again recorded.

Inclusion criteria

1. Systemically healthy subjects.
2. Subjects with a history of dentinal hypersensitivity caused by gingival recession or cervical abrasion.
3. Subjects with VAS score of 4 or more in at least two teeth.
4. Subjects with age 20 to 60 years.

Exclusion criteria

1. Teeth with caries, defective restorations, and subjects with orthodontic appliances or bridge work.
2. Subjects allergic to the ingredients used in the study,
3. Subjects who exhibited any gross pathology, eating disorders, chronic diseases, or any disease requiring repeated or regular analgesia, anti-inflammatory drugs, or antihistamines.

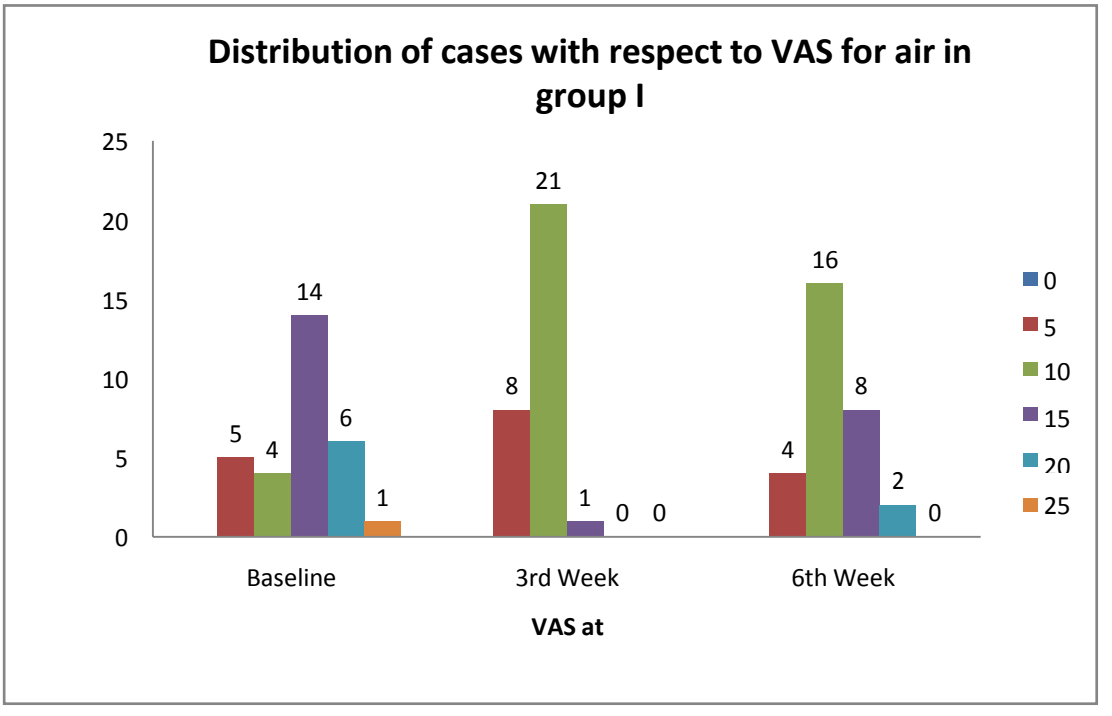
Results and Discussion

Nonparametric tests were carried out. Intra-group analysis by Wilcoxon signed-rank test and Inter-group analysis was done by Mann–Whitney U test by SPSS version 20 ($P< 0.05$ significant). Results are summarized in Table 1 to Table 6, Graph 1 and 2.

Table1: Comparison of Median VAS at baseline and 3rd week, baseline and 6th week with air stimulus in Group I (5% Calcium sodium phosphosilicate) and Group II (5% Potassium Nitrate)

Group I	Median VAS
Baseline	6
3rd week	1
6th week	2

Group II	Median VAS
Baseline	6
3rd week	2
6th week	5

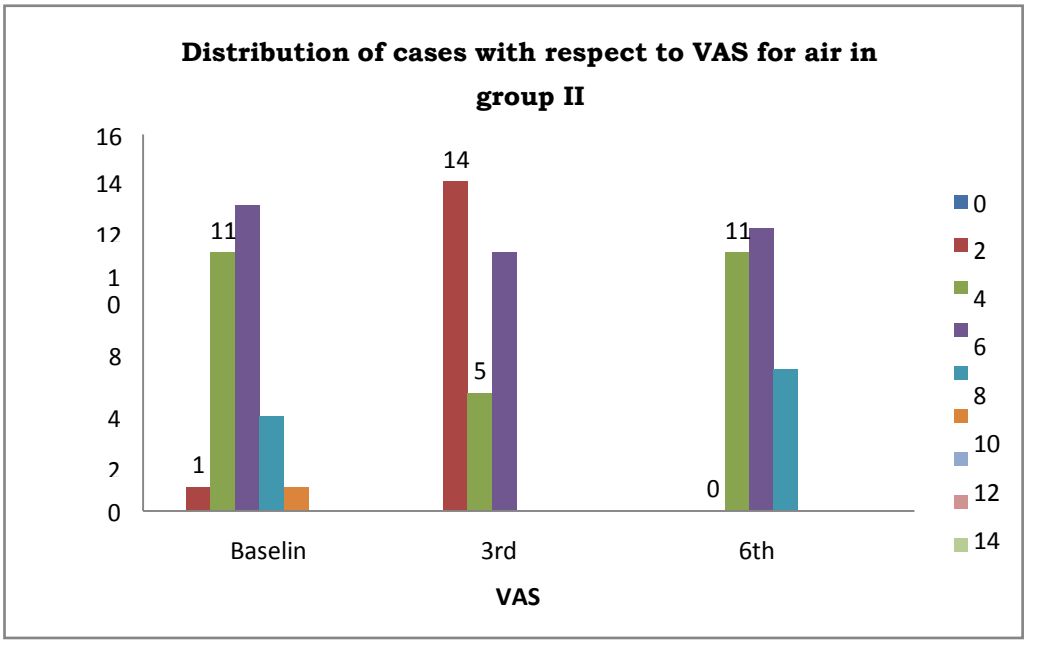


Graph 1: Comparison of VAS at baseline and 3rd week, baseline and 6th weekwith air stimulus in Group I (5% Calcium sodium phosphosilicate)

Table 2: Comparison of Median VAS at baseline and 3rd week, baseline and 6th week with water stimulus in Group I (5% Calcium sodium phosphosilicate) and Group II (5% Potassium Nitrate).

Group I	**Median VAS**
Baseline	7
3rd week	1
6th week	3

Group II	**Median VAS**
Baseline	6
3rd week	3
6th week	5



Graph 2: Comparison of VAS at baseline and 3rd week, baseline and 6th week with air stimulus in Group II (5% Calcium sodium phosphosilicate)

There was an increase in VAS score of dentinal hypersensitivity in both the groups after discontinuation of the dentifrices. However, it was significantly less in Group I (5% Calcium sodium phosphosilicate) when compared to Group II (5% Potassium nitrate). No untoward reactions were seen with either of the dentifrices on subjective and objective evaluation. From the observations, it can be concluded that although both the groups showed a reduction in dentinal hypersensitivity, a more significant reduction was found with 5% Calcium sodium ph osphosilicate than with 5% Potassium nitrate after three weeks of usage, even after six weeks, i.e. three weeks of discontinuation of the dentifrice results in 5% Calcium sodium phosphosilicate were better than 5% Potassium nitrate. A total of 60 subjects 'With the complaint of dentinal hypersensitivity were included in this study. Dentinal hypersensitivity was scored using the Visual Analog Scale (VAS) scale on-air stimulus and cold water stimulus. There was a statistically significant reduction of dentine hypersensitivity between baseline and third week, baseline and 6th week on water stimulus in group II (5% Potassium nitrate). Dentinal hypersensitivity reduction in Group I (5% Calcium sodium phospho-silicate) was statistically significant when compared to Group II (5% Potassium nitrate) at 3 weeks, i.e. after 3 weeks of usage of respective dentifrices on both air and water stimulus.

Table 3
Comparison of Median VAS at baseline with air stimulus in Group I (5% Calcium sodium phosphosilicate) and Group II (5% Potassium Nitrate)

	Median grade	p-value
Group I	6	0.649
Group II	6	

Table 4
Comparison of Median VAS at 3rd and 6th week with air stimulus in Group I (5% Calcium sodium phosphosilicate) and Group II (5% Potassium Nitrate).

	Median grade at 3rd week	Median grade at 6th week	p- value
Group I	1	2	0.001
Group II	2	5	

Table 5
Comparison of Median VAS at baseline with water stimulus in Group I (5% Calcium sodium phosphosilicate) and Group II (5% Potassium Nitrate).

	Median grade	p-value
Group I	7	0.957
Group II	7	

Table 6
Comparison of Median VAS at 3rd and 6th week with water stimulus in Group I (5% Calcium sodium phosphosilicate) and Group II (5% Potassium Nitrate).

	Median grade at 3rd week	Median grade at 6th week	p- value
Group I	1	3	0.001
Group II	3	5	

Dentinal hypersensitivity reduction in Group I (5% Calcium sodium phosphosilicate) was statistically significant when compared to Group II (5% Potassium nitrate) at six weeks, i.e. after 3 weeks of discontinuation of respective dentifrices. To elucidate further the efficacy of Calcium sodium phosphosilicate on: dentinal hypersensitivity, further studies with a larger sample size and longer duration of usage of 5% Calcium sodium phosphosilicate are needed as an increase in hypersensitivity was seen after discontinuation of the dentifrice. There is also the scope of including in vitro assessment of the action of Calcium sodium phosphosilicate on dentinal tubules, which can then be correlated to in vivo results. Hence, it can be concluded that under the conditions of this study, the 5% Calcium sodium phosphosilicate group showed a considerable reduction in dentinal hypersensitivity symptoms. Satyapal et al [12] Pradeep *et al* [13] and Salien

et al 14 in their study reported that dentifrice containing 5% NovaMin have rapid and longer relief from dentinal hypersensitivity in four weeks compared to a dentifrice containing 5% potassium nitrate. This might be due to the tubule occluding property of Novamin.5% Calcium sodium phosphosilicate also showed prolonged effects compared to 5% Potassium nitrate even after discontinuation. Results was similar to the study done by Acharya *et al* [15] This can be attributed to its dentinal tubular occlusion property, as suggested by the literature. As Calcium sodium phosphosilicate showed a greater reduction in dentinal hypersensitivity compared to 5% Potassium nitrate and also tends to maintain it even after discontinuation, it may provide a new direction for the treatment of dentinal hypersensitivity.

Conclusion

Dentinal hypersensitivity has long been a dilemma for both dentists and patients, as this is one of the most common ailments encountered in dentistry. It is a common painful condition of the teeth, which is likely to increase in prevalence for several reasons, in particular, life expectancy, retention of teeth and changing lifestyles, notably diet. From the above observations, it can be concluded that although both the groups showed a reduction in dentinal hypersensitivity, a greater reduction was found with 5% Calcium sodium phosphosilicate when compared with 5% Potassium nitrate after 3 weeks of usage, even after 6 weeks i.e. three weeks of discontinuation of the dentifrice.

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