

A comparative evaluation of 0.33% Sodium Fluoride (Iontophoresis) and Novamin Paste as a dentine desensitizer: A comparative study

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Abstract:

Background: Dentine hypersensitivity is characterized by short, sharp pain arising from exposed dentine in response to stimuli typically thermal, evaporative, tactile, osmotic or chemical which cannot be ascribed to any other form of dental defect or pathology. The management of this condition requires a good understanding of the complexity of the problem, as well as the variety of treatments available.

Aim: To evaluate and to compare the efficacy of two different desensitizing agents in dentin hypersensitivity using Acidulated NaF gel (0.33%NaF) and NovaMin paste.

Materials and Methods: A total of 400 teeth from 70 patients included in this study were randomly divided in to two groups: group 1, who received 0.33% sodium fluoride-iontophoresis (NaF); group 2, who received NovaMin paste. The teeth were evaluated immediately after treatment and at 15days, 1 month and 3 months. The affected tooth was retreated with the same agent in case of failure at the 15 days interval.

Results: It was found that group 1 was more effective than group 2 at 3-months interval. Group 1 had a lower mean score of verbal rating scale than group 2, which indicated greater improvement of NaF over NovaMin paste at 1 month and 3 month intervals (although statistically not-significant to all the stimuli). When the results of the three groups were compared, there were no significant differences in any of three stimuli. The mean discomfort score was also greater at 3 months than at last time intervals in both groups.

Conclusion: The desensitizing agents NaF iontophoresis and NovaMin paste were equally effective in causing immediate relief in dentinal hypersensitivity, but 0.33% NaF iontophoresis was comparatively better and NovaMin paste for long term relief. More teeth with a baseline higher sensitivity score required a repeated dose.

Key words: Iontophoresis, dentin hypersensitivity, novamin

I. Introduction:

Dentinal hypersensitivity is a common clinical dental condition which may cause patients more distress due to exposure of dentin. Because of discomfort, it is difficult for patient to maintain proper oral hygiene and perform plaque control measures. The failure to perform satisfactory plaque control has well-established consequences on gingival, periodontal and oral health. So a cycle of hypersensitive teeth leading to reduce plaque control, more gingival and periodontal disease may be established. ^[1] A wide variety of treatment options are available for the management of dentinal hypersensitivity. These treatment options involve the application of chemicals such as stannous fluoride, sodium fluoride, calcium hydroxide, copal varnishes, potassium oxalates, potassium nitrates, dentin bonding agents and fluoride treatment with or without iontophoresis. Home applied agents like mouthwashes and dentifrices are effective. The effects of home-applied agents are manifested after a period of time and also require patient compliance. ^[2] Studies have shown that topical application of NaF is effective. ^[3] Iontophoresis with NaF in which the fluoride ions are transferred under electrical pressure deep into dentinal tubules, has been utilized. ^[4,5] Studies have shown the sealing of dentinal tubules with a bonding agent or resin in case of dentine hypersensitivity to produce a long lasting blockage of dentine hypersensitivity. ^[6,7] Studies have shown that NovaMin powder with NovaMin containing toothpaste showed significant hypersensitivity reduction. ^[9]

The aim of the present study was to evaluate and to compare the efficacy of two different desensitizing agents in dentinal hypersensitivity using Acidulated NaF gel (0.33% NaF) Iontophoresis and NovaMin paste in reducing the dentinal hypersensitivity.

II. Materials And Methods

Study sample: The present study was a randomized, controlled and double masked clinical trial. The study were conducted from October 2014 to March 2015 and the population was selected randomly from patients attending the outpatient section of the Department. All participants received a detailed explanation regarding the study procedure, and written informed consent was obtained from the patients.

Inclusion criteria were:

1. Good physical and overall health.
2. A willingness to participate in the study for 3 months.
3. History of tooth hypersensitivity to thermal, sweet, mechanical or sour stimuli on at least one tooth.

Exclusion criteria were:

1. Patients having defective restoration, cracked tooth syndrome, faulty restoration, deep periodontal pockets and chipped tooth

2. Patients having orthodontic and prosthodontic appliances.
3. Pregnant or lactating women.
4. Patients on a cardiac pacemaker.
5. Patient already undergoing treatment for tooth hypersensitivity.

The patients were evaluated using different stimulus.

1. **Tactile test.** A sharp dental explorer was passed over affected tooth, perpendicular to the long axis of the tooth. The score was noted using the discomfort scale.
2. **Air blast test.** A blast of air from a 3-way dental syringe was directed on affected area of tooth for 1 second from a distance of 10mm. Adjacent teeth were protected with cotton rolls.
3. **Cold water test.** A pre-cooled 1cc disposable syringe filled with freshly melted ice-cool water. After isolating the particular tooth, 0.2 ml of the water slowly expelled from the syringe onto the tooth surface.

For all stimuli tests, patients responses were recorded on the following verbal rating scale (VRS).^[10] The patients with a VRS score of 2 or more were further included in the study.

0 = no significant discomfort, or awareness of stimulus.

1 = discomfort, but no severe pain.

2 = severe pain during application of stimulus.

3 = severe pain during and after application of stimulus.

In this study, total 400 teeth from 70 patients were randomly divided into three groups: **Group 1:-** Treated with 0.33% sodium fluoride solution applied with iontophoresis; **Group 2:-** Treated with novamin paste. Throughout the study, all three stimuli test were applied in same order, with a minimum 5-minute gap between the applications of stimuli. After the test performed, teeth with rated score 2 or more for any of the two tests were selected for the study. All patients underwent ultrasonic scaling and polishing before study. They were instructed not to use any other desensitizing agents.

Procedure: Group 1. The teeth to be treated were isolated with cotton roll and dried thoroughly. Using an electrode iontophoresis, 0.33% sodium fluoride was applied according to manufacture specification. A fresh solution of sodium fluoride was taken onto cotton or sponge contained within the oral electrode tip for each tooth involved. Cotton soaked in normal saline was wrapped around other electrode which was held between fingers of the patient left hand. The unit was switched on and current knob was slowly turned clockwise until ammeter read 2.5mA. This current was applied each tooth for 2 minutes, for a dosage of 1mA per minute [Figure 1 and 2].^[11, 12, 13] **Group 2.** The teeth to be treated were isolated with cotton rolls, cleaned and dried with cotton. Novamin paste was applied with small cotton pledget to the tooth surface, left for two minutes and then rinsed off.^[9] The teeth were evaluated at baseline, immediately after treatment at 0 days, at 15days, at 1 and 3 months using the three stimuli tests. In case of failure at the 15 days interval, the affected tooth was retreated with same solution as before and evaluated again.

Statistical analysis: The statistical analysis was performed using one way ANOVA test. Data entry was done in MS Excel sheet. Analysis was carried out with SPSS 19TH Version. Results were expressed in terms of mean and standard deviation. Comparison between two groups was assessed by using unpaired t test. Comparison of mean score at different time interval was assessed by one way ANOVA test. P value <0.05 was considered as statistically significant and P value <0.001 was considered as statistically highly significant.

III. Results:

Table 1 shows statistically significant result of Group 1 when assessed at day 0, day 15, day 30 and day 90. The mean values of verbal rating scale were 1.12 (± 0.64 SD), 0.79 (± 0.54 SD), 0.82 (± 0.58 SD) and 0.79 (± 0.54 SD) at 0 day, 15th day, 30th day and 90th day respectively.

Table 2 shows statistically significant result of Group 3 when assessed at day 0, day 15, day 30 and day 90. The mean values of verbal rating scale were 1.5 (± 0.66 SD), 0.94 (± 0.66 SD), 0.94 (± 0.94 SD) and 0.94 (± 0.94 SD) at 0 day, 15th day, 30th day and 90th day respectively.

Table 3 shows statistically significant results when different groups were compared. **Table 4,5,6 and graph 1** depicts that when the mean discomfort score were compared, group 1 had a lower mean score of verbal rating scale than group 2, which indicated greater improvement of NaF over NovaMin paste at 1 month and 3 month intervals (although statistically not-significant to all the stimuli). When the results of the three groups were compared, there were no significant differences in any of three stimuli. Similar number of teeth in both group required treatment. The mean discomfort score was also greater at 3 months than at last time intervals in both groups. It suggested that the recurrence of hypersensitivity with comparatively greater recurrence in group 2. When mean discomfort baseline scores in both group for teeth requiring and not requiring retreatment were compared, the results were highly significant for all three stimuli test.

IV. Discussion

There is no doubt that patients self report regarding discomfort or sensitivity arises from various stimuli, but the highly subjective nature of the condition makes it extremely difficult to evaluate dentine hypersensitivity.^[24] In our study clinical investigations have shown that treatment with concentrated fluoride solutions, especially with iontophoresis, is highly efficient in reducing tooth hypersensitivity, this is in accordance to the study conducted by Eshleman et al^[15] and Lefkowitz et al^[16] who suggested that the formation of reparative dentine resulted in dead tract within the primary dentin. It has also been theorized that an iontophoresis current may produce paresthesia by altering the sensory mechanism of pain conduction.^[17]

The mechanism of action of fluoride iontophoresis have been hypothesized as follow:

1. After application of electric current to dentine, formation of reparative dentine occurs.^[18]
2. The iontophoresis electric current by altering the sensory mechanism of pain conduction produce paresthesia.^[18]
3. Fluoride iontophoresis may be increased the flow of fluoride ions in the dentinal tubules. Fluoride ions may act to block hydrodynamically mediated pain inducing stimuli.^[4]

In this study desensitizing agent showed significant result at the baseline, 15th day, 30th day and 90th day as it contain glutaraldehyde which is a biologic fixative that may denature the proteins in the dentinal fluid, thereby occluding dentinal tubules. These findings are supported by Dondidal Orologio et al study.^[20] Dondidal Orologio et al. reported that single dose of desensitizer in treatment of hypersensitive lesions significantly reduced dentin sensitivity throughout 6-month observation time.^[20] Kern et al.^[21] reported significant reduction in sensitivity to both tactile and air blast stimuli immediately after application.

This study showed significantly reduction in sensitivity when effect of NovaMin paste was assessed at the baseline, 15th day, 30th day and 90th day. This is due to the penetration of NovaMin into dentinal tubules, which resulted in the occlusion of tubules. In aqueous solution environment, the sodium ions in calcium sodium phosphosilicate particles immediately begin to exchange with hydrogen cations. The precipitation of calcium and phosphate from the saliva to form a calcium phosphate layer on tooth surface. The combination of the residual calcium sodium phosphosilicate particles and hydroxycarbonate apatite layer results in physical occlusion of dentinal tubules, which relieve dentin hypersensitivity.^[23] Tai BJ in their study demonstrated that NovaMin containing dentifrice significantly improves oral health as measured by a reduction in gingival bleeding and reduction in supragingival plaque.^[24]

Singal et al.^[14] reported similar results as the current study, wherein the NaF iontophoresis had a comparatively more effect than NovaMin paste. Carlo et al reported that patients with initial severe sensitivity required repeat dose of NaF iontophoresis.^[14] Olusile et al.^[25] reported immediate relief to NaF iontophoresis. The technique of fluoride iontophoresis can be considered safe for delivering therapeutic amounts of sodium fluoride solution into dentin. No problems were found with placement of electrode, and the equipment is adaptable for all teeth. The results of the present study suggest that this method of decreasing sensitivity may have clinical significance.

V. Conclusion

Dentinal hypersensitivity is a relatively common and significant dental problem which can be successfully managed by a very wide variety of procedures, agents and formulations applied locally, either in office or at home. The desensitizing agents NaF iontophoresis and NovaMin paste were equally effective in causing immediate relief in dentinal hypersensitivity, but 0.33% NaF iontophoresis was comparatively better than NovaMin paste for long term relief. More teeth with a baseline higher sensitivity score required a repeated dose.

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Table 1: Comparison the response of sodium fluoride iontophoresis at Day 0,15, 30 & 90

Day	N	Mean	Std. Deviation	F	df	p	Inference
Day 0 After Treatment	34	1.12	.64	2.553	3	0.048 (<0.05)	Significant
Day 15 After Treatment	34	.79	.54				
Day 30	34	.82	.58				
Day 90	34	.79	.54				

Table 2: Comparison of the response of novamin paste at Day 0,15,30 & 90:

Day	N	Mean	Std. Deviation	F	df	p	Inference
Day 0 After Treatment	34	1.5	0.66	5.297	3	0.002 (<0.05)	Significant
Day 15 After Treatment	34	0.94	0.69				
Day 30	34	0.94	0.94				
Day 90	34	0.94	0.94				

Table 3: Comparison between groups at Day 0

	N	Mean	SD	F	df	P	Inference
Sodium Fluoride	35	1.12	0.64	3.222	2	0.044 (<0.05)	Significant
Novamin paste	35	1.5	0.66				

Table 4: Comparison between groups at Day 15

	N	Mean	SD	t	Df	P	Inference
Sodium Fluoride	35	0.79	0.54	1.121	2	0.33 (>0.05)	Not significant
Novamin paste	35	0.94	0.69				

Table 5: Comparison between groups at Day 30

	N	Mean	SD	T	Df	P	Inference
Sodium Fluoride	35	0.82	0.58	0.635	2	0.532 (>0.05)	Not significant
Novamin paste	35	0.94	0.94				

Table 6: Comparison between groups at Day 90

	N	Mean	SD	T	df	P	Inference
Sodium Fluoride	35	0.79	0.54	0.745	2	0.478 (>0.05)	Not significant
Novamin paste	35	0.94	0.94				

Graph 1: Overall Comparison of the response (after treatment) of dentin hypersensitivity patients to two types of desensitizing agents

