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# Novamin versus Sodium Flouride Iontophoresis: The "Salvage Crew" to the Rescue

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## Abstract

*Dentin Hypersensitivity(DH) is a commonly occurring condition in majority of population seeking dental treatment. Hence dentist need to pay a special attention for its treatment. Hence the present study aimed to evaluate and compare the desensitizing potential of novamin containing dentifrice and iontophoresis in the treatment of dentinal hypersensitivity. Forty Subjects with age group between 25-55 years with complaint of hypersensitivity to thermal, mechanical, sour stimulus were included in the study. DH was assessed using verbal rating scale. {VRS scores:0 - No discomfort, 1 - Mild discomfort, 2 - Moderate discomfort, 3 - Severe pain only during application of stimulus and 4 - Severe pain persisting after removal of stimulus}. Subjects who showed score of two or more were included. Subject with dental caries, broken teeth, any chronic systemic disease/cardiac pacemakers were excluded. Subjects were divided into Group1 (n-20) Novamin group, Group 2 (n-20) Iontophoresis group. DH was scored before initiating the treatment modalities, immediately after the treatment, one week and one month post operatively. Scores were subjected to Mann-Whitney and Wilcoxon Signed Ranks test. Iontophoresis was more effective in reducing dentinal hypersensitivity than novamin group at week 1. However the difference in mean score between Iontopheresis and Novamin was not statistically significant at Pre-Op and 1 Month. Both Novamin containing dentifrice and iontophoresis can be considered as effective treatment modality in DH.*

**Keywords:** Novamin, iontophoresis, dentinal hypersensitivity.

## Introduction

Dentin hypersensitivity (DH) is a commonly occurring clinical condition that remains poorly understood with no permanent treatment available, with its prevalence ranging from 1.34–75%[1]. Dentin hypersensitivity is commonly found in patients with chronic periodontal disease as a part of the disease process. Hence prevalence of dentin hypersensitivity is higher in this group of patients, ranging from 72.5–98%[1].

At present most of the treatment modalities for dentinal hypersensitivity is based on the principles of "hydrodynamic hypothesis", proposed by *Brannstorm et al*[2]. Agents used for the treatment will act by one of the following methods. By reducing the ability of the intradental nerve response to fluid shift and By reducing reducing dentinal permeability.

For example, Potassium containing tooth pastes is known to reduce sensitivity by raising the pain threshold of pulpal nerves to stimuli. Other agents such as bioactive glass, sodium fluoride, ammonium fluoride, iontophoresis decrease dentin permeability by occluding patent tubules thus able to reduce sensitivity[3].

NaF (Sodium Flouride) Iontophoresis a method where fluoride is transferred deep into the dentinal tubules under electrical pressure[4]. This causes calcium fluoride precipitation, which decreases fluid movement induced by stimuli, reducing dentin hypersensitivity[5].

Other possible mechanisms of iontophersis include the formation of reparative dentin, dead tracts or paresthesia by altering the sensory mechanism of pain conduction. Iontophoresis probably causes micro-precipitation of calcium fluoride that may block the stimuli that induce pain[6].

Calcium sodium phosphosilicate (Sensodyne repair®) is a bioactive glass that was originally developed as bone-regenerative materials. These materials when exposed to body fluids become active and deposit hydroxycarbonate apatite (HCA), thus when incorporated into a dentifrice, Nova Min particles are deposited onto dentin surfaces and mechanically occlude tubules[7].

The purpose of the present study was to compare the effects of iontophoresis and novamin containing dentifrice in the treatment of dentinal hypersensitivity.

## Material and Methods

Outpatients visiting the Department of Periodontics, D.A.P.M.R.V Dental College, Bangalore, with chief complaint of dentinal hypersensitivity were included in the study. Ethical clearance was obtained from the institution and written consent was obtained from subjects. Subjects of age between 20 and

55years with dentinal hypersensitivity to thermal, mechanical, sweet or sour stimulus, who showed scores of two or more in verbal rating scale were recruited for the study.

Oral examination was carried out on patients to diagnose the hypersensitive teeth using. i. Cold water test: A ice-cold water was poured on the suspected isolated tooth surface drop by drop using disposable syringe. ii. Air blast test: A blast of air was directed on the isolated tooth for one second keeping the nozzle tip of air syringe about 1 - 2 cm away.

Dentinal hypersensitivity was then assessed using verbal rating scale VRS (Verbal Rating Scale) scores: 0 - No discomfort, 1-Mild discomfort, 2 - Moderate discomfort, 3-Severe pain only during application of stimulus, 4-Severe pain persisting after removal of stimulus[8]. Subjects showing a discomfort score of two or more were included in the study. These scores were designated as pre-treatment scores (table-1). Dentinal hypersensitivity was assessed and scored at one week and one month (table 2 and 3)

Subjects with systemic conditions that would contraindicate the use of iontophersis, patients with fractured tooth, dental caries, large restoration, history of periodontal treatment in last six months or patient on desensitizing therapy were excluded.

**Materials:** Novamin containing dentifrice (sensodyne repair®), 2% sodium fluoride gel and Iontophoresis kit (Bluedent™)

**Study Design:** Total of forty patients (22 male and 18 female) were included for the study after considering inclusion and exclusion criteria. Scaling and polishing of the whole mouth was done at day 0 and 7 before initiating desensitizing therapy.

Subjects were divided into two groups. Group A: novamin group, group B: iontophoresis group.

Group A: Subjects were asked to apply novamin containing dentifrice on all the affected teeth surfaces and wait for 2-3 minutes and then brush for 2 minutes, twice daily. (figure-1)

Group B: Iontophoresis was performed using a commercially available instrument (BLUE DENT).™ All the trays were autoclaved before use, appropriate tray was selected for each subject and disposable sponges wetted with distilled water was placed into the tray. 2% Fluoride gel was then applied onto these sponges and placed into mouth such that gel comes in contact with all the affected teeth surfaces. One electrode was fitted to the slot in the tray handle and the second electrode was given to the patient hold to complete the circuit. The current was gradually increased to the selected level (2mA), and this current was applied for 2 minutes per application, (figure-2)

Dentinal hypersensitivity was checked and scores were recorded before initiating the treatment modalities, immediately after the treatment (for iontophoresis), one week and one month post-operative. Iontophoresis was repeated after one week in those patients with persistent dentinal hypersensitivity with verbal score of 2 or more.

**Statistical Analysis:** Intergroupscores were compared using Mann-Whitney test andintra-group comparison at different time intervals was done using Wilcoxon Signed Ranks Test.

## Results and Discussion

Scores were subjected to Mann-Whitney and Wilcoxon Signed Ranks test. (Bothintergroup and intragroup comparison was done). Immediate, one week and one month post-operative scores were compared with the preoperative verbal rating scores.

**Intergroup (Novamin Versus Iontophoresis):** Both iontophoresis and novamin treatment reduced dentinal hypersensitivity effectively. The difference in mean score between iontopheresis and Novamin was found statistically significant at 1 week ($P<0.001$) that is iontophoresiswas more effective than novamin group at week 1 in reducing dentinal hypersensitivity. However the difference in mean score between Iontopheresis and Novamin was not statistically significant at Pre-Op And 1 Month ($P>0.05$) table-4, Graph I.

**Intra Group (Iontophoresis):** Comparison of scores between pre-op and one week, one month post-operativewithin iontopheresis group showed reduction in dentinal hypersensitivity which was found to be statistically significant from Pre-op to Immediate post-op ($P<0.001$), pre-op to 1 week ($P<0.001$) as well as from pre-op to 1 month ($P<0.001$) table-5.

**Intragroup (Novamin):** Comparison of scores between pre-op and one week , one month post-operative within novamin group showed reduction in dentinal hypersensitivity which was found to be statistically significant from pre-op to one week post-op ($P<0.001$) as well as from pre-op to 1 month ($P<0.001$) table-6.

**Discussion:** Dentinal hypersensitivity is a annoying clinical problem which makes the patients avoid hot cold, chilled, acidic or sweet liquid and food[9]. In light of the hydrodynamic theory[10] many of the treatment modalities aim to reduce sensitivity by blocking the dentinal tubules. Desensitizing methods used routinely may range from simplest to the most complex (eg. simple-desensitizing tooth pastes, intermediate-iontophoresis and to complex ones such as tissue graft)[11]. Iontophoresis was first used in the early 1960s to treat dentin hypersensitivity. Low amperage direct electrical current is utilized to introduce ions or ionized drugs into tissues as described by Pivati in 1747[12]. Gangarosa et. al[6] have shown that iontophoresis is effective in the treatment of aphthous ulcer, lichen planus, herpeslabialis, and so on.

Lutin et al reported characteristics of an ideal desensitizing technique/material it should be painless, harmless to the pulp easy to apply, consistently and permanently effective, quick acting and produce no discolouration[12].

Iontophoresis works by several mechanisms such as a) formation of reparative dentin following application of current to dentin, which results in dead tracts paresthesia by altering the sensory mechanism of pain conduction microprecipitation of calcium fluoride that may block the hydrodynamically mediated stimuli that induce pain[6].

Recent clinical evaluation has proved that Novamin was effective at reducing sensitivity[13]. The active ingredient of Novamin is bioactive glass that was originally developed as a bone regenerative material. It was found that bioactive glasses promote the crystallization of new mineral[14].

The present clinical study was conducted to compare the desensitizing potential of novamin (bioactive glass) containing dentifrice and 2% sodium fluoride gel iontophoresis. It was found that both 2% sodium fluoride gel iontophoresis and novamin (bioactive glass) containing dentifrice was effective in reducing dentinal hypersensitivity. Iontophoresis showed statistically significant reduction in the dentinal hypersensitivity compared to novamin group at one week interval; however difference in the reduction of dentinal hypersensitivity by both the groups were not statistically significant at one month post op.

Intragroup comparison at different time intervals showed statistically significant reduction of dentinal hypersensitivity at all-time intervals for both iontophoresis (immediate, one week and one month post-operative) and novamin group (one week and one month post-operative).

Lefkowitzet and Burdilk[15] reported that iontophoresis results in formation of reparative dentin and dead tracks that blocks the stimuli from exposed dentin to the pulp. In the present study we found the best results at one week for iontophoresis and one month for novamin, which denotes that adequate amount of re-parative dentin is formed at one week for iontophoresis and precipitation of calcium fluoride occurred after one month for novamin. Precipitation of $CaF_2$ crystals may have reduced the functional radius of dentinal tubules that occurred in 1 to 4 weeks after novamin application[16].

Our results were similar to the study by Nilam Brahmbhatt[16] who compared sodium fluoride with and without iontophoresis in treatment of dentinal hypersensitivity and found that 2% sodium fluoride with iontophoresis demonstrated an immediate post treatment effect.

## Conclusion

Results of our study indicated that both novamin and iontophoresis were effective in reducing dentinal hypersensitivity. Iontophoresis was more effective in reducing dentinal hypersensitivity than novamin group at week However the difference in mean score between Iontopheresis and Novamin was not statistically significant at Pre-Operative and 1 Month. Present study was a short term study with small sample size. Hence studies incorporating larger sample sizes with long term follow up are essential to further validate our finding.

The difference in mean score between Iontopheresis and Novamin was statistically significant at 1 week ($P<0.01$). However the difference in mean score between oontopheresis and novamin was not statistically significant at pre-op and 1 month ($P>0.05$).

**Table-1**
**Distribution of pre operative scores in Iontopheresis and Novamin**

| Pre-Op | Iontopheresis (N=20) | | Novamin (N=20) | |
|---|---|---|---|---|
| | n | % | n | % |
| No Discomfort | 0 | 0% | 0 | 0% |
| Mild Discomfort | 0 | 0% | 0 | 0% |
| Moderate Discomfort | 3 | 15% | 3 | 15% |
| Severe Pain during application of stimulus | 16 | 80% | 17 | 85% |
| Severe Pain persisting after removal of stimulus | 1 | 5% | 0 | 0% |

**Table-2**
**Distribution of one week post operative scores in Iontopheresis and Novamin**

| 1 Week | Iontopheresis (N=20) | | Novamin (N=20) | |
|---|---|---|---|---|
| | n | % | n | % |
| No Discomfort | 11 | 55% | 4 | 20% |
| Mild Discomfort | 7 | 35% | 8 | 40% |
| Moderate Discomfort | 2 | 10% | 8 | 40% |
| Severe Pain during application of stimulus | 0 | 0% | 0 | 0% |
| Severe Pain persisting after removal of stimulus | 0 | 0% | 0 | 0% |

**Table-3**
**Distribution of one month post operative scores in Iontopheresis and Novamin**

| 1 Month | Iontopheresis (N=20) | | Novamin (N=20) | |
|---|---|---|---|---|
| | n | % | n | % |
| No Discomfort | 16 | 80% | 15 | 75% |
| Mild Discomfort | 3 | 15% | 4 | 20% |
| Moderate Discomfort | 1 | 5% | 1 | 5% |
| Severe Pain during application of stimulus | 0 | 0% | 0 | 0% |
| Severe Pain persisting after removal of stimulus | 0 | 0% | 0 | 0% |

The reduction in mean score was found to be statistically significant from pre-op to Immediately after post-op (P<0.001), Pre-op to 1 week (P<0.001) as well as from pre-op to 1 month (P<0.001).

The reduction in mean score was found to be statistically significant from pre-op to immediately after post-op (p<0.001) as well as from pre-op to 1 month (p<0.001).

**Table-4**
**Comparison between Iontopheresis and Novamin at different time intervals**

| Time Interval | Group | Mean | Std Dev | SE of Mean | Mean Difference | Z | P-Value |
|---|---|---|---|---|---|---|---|
| Pre-Op | Iontopheresis | 2.90 | 0.45 | 0.10 | 0.050 | -0.348 | 0.727 |
| | Novamin | 2.85 | 0.37 | 0.08 | | | |
| 1 Week | Iontopheresis | 0.55 | 0.69 | 0.15 | -0.650 | -2.596 | 0.009* |
| | Novamin | 1.20 | 0.77 | 0.17 | | | |
| 1 Month | Iontopheresis | 0.25 | 0.55 | 0.12 | -0.050 | -0.353 | 0.724 |
| | Novamin | 0.30 | 0.57 | 0.13 | | | |

**Table-5**
**Comparison of scores between pre-op and other time intervals within Iontopheresis group: (Wilcoxon Signed Ranks Test)**

| Time Interval | Mean | Std Dev | SE ofMean | Mean Difference | Z | P-Value |
|---|---|---|---|---|---|---|
| Pre-Op | 2.90 | 0.45 | 0.10 | 2.000 | -3.974 | <0.001* |
| Immediately after Post-Op | 0.90 | 0.79 | 0.18 | | | |
| Pre-Op | 2.90 | 0.45 | 0.10 | 2.350 | -4.005 | <0.001* |
| 1 Week | 0.55 | 0.69 | 0.15 | | | |
| Pre-Op | 2.90 | 0.45 | 0.10 | 2.650 | -4.034 | <0.001* |
| 1 Month | 0.25 | 0.55 | 0.12 | | | |

**Table-6**
**Comparison of scores between pre-op and other time intervals within Novamin group: (Wilcoxon Signed Ranks Test)**

| Time Interval | Mean | Std Dev | SE of Mean | Mean Difference | Z | P-Value |
|---|---|---|---|---|---|---|
| Pre-Op | 2.85 | 0.37 | 0.08 | 1.65 | -3.999 | <0.001* |
| 1 Week | 1.20 | 0.77 | 0.17 | | | |
| Pre-Op | 2.85 | 0.37 | 0.08 | 2.55 | -4.042 | <0.001* |
| 1 Month | 0.30 | 0.57 | 0.13 | | | |

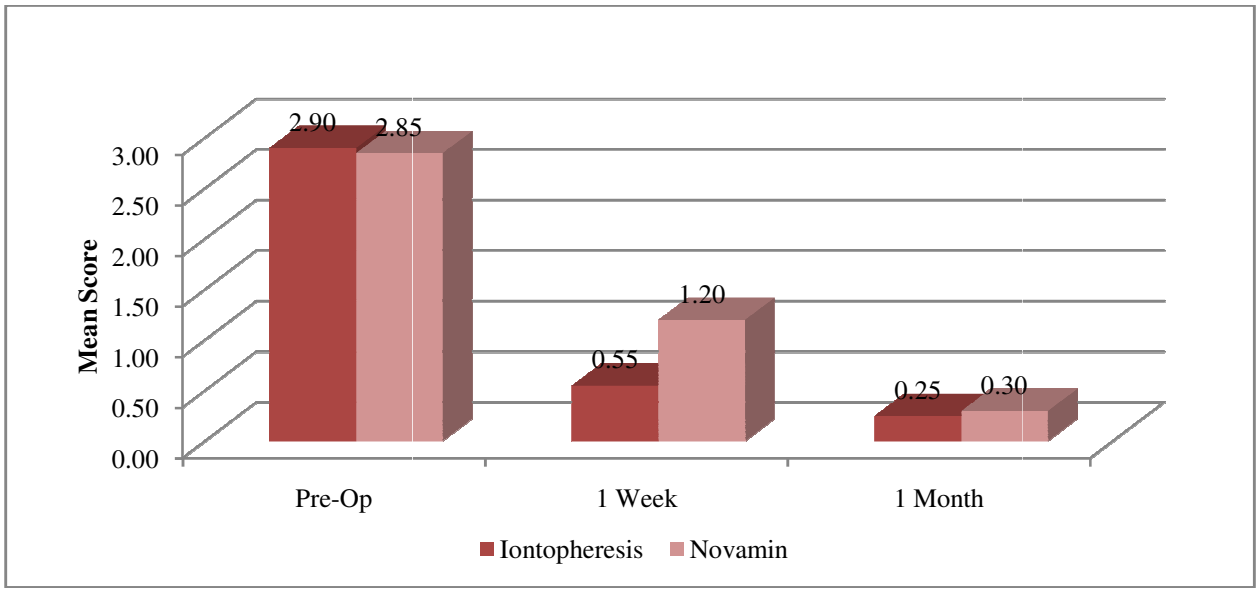


**Figure-1**
**Mean score between the two groups at different time intervals**


**Figure-2**
**Group 1 novamin**


**Figure-3**
**Group 2 iontophoresis**

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