

Comparative Analysis of Three Commercially Available Desensitising Agents on Dentinal Hypersensitivity: An in Vivo Study

Dr Siddhi Yadav, Dr Soumya Ojha

Bhopal, India

Abstract: ***Aim:** The aim of this study is to evaluate the efficacy of three dentinal hypersensitivity agents in reduction of dentin hypersensitivity among patients. **Materials and Methodology:** 15 patients, were evaluated among which at least 4 teeth had dentin hypersensitivity, was randomly allocated into 4 treatment groups: Group I – Colgate pro relief, Group II – GC tooth mousse, Group III – novamin (shy-nm), Group IV – distal water as a placebo control. A Verbal Rating Scale (VRS) was used to record the degree of hypersensitivity, based on patient's response to tactile and air blast stimuli. The baseline scores were obtained. Each intervention group received applications of their respective agents consecutively on 1st, 7th and 21st days. After each application, the scores were recorded. **Results:** All three group showed significant reductions in dentin hypersensitivity. **Conclusion:** GC tooth mousse was found to be significantly better in reducing the dentinal hypersensitivity as compared to Colgate pro relief, novamin (shy-nm) and distal water.*

Keywords: Dentin hypersensitivity, Colgate pro relief, GC tooth mousse, Split mouth, VRS

1. Introduction

Dentine sensitivity (DS) or dentinal hypersensitivity (DH) is one of the most commonly encountered clinical problems. It is clinically described as an exaggerated response to application of a stimulus to exposed dentine, regardless of its location.^[1,2] The terms DS or DH have been used interchangeably to describe the same clinical condition. True hypersensitivity can develop due to pulpal inflammation and can present the clinical features of irreversible pulpitis, i.e., severe and persistent pain, as compared with typical short sharp pain of DH.^[3] Majority of literature reviews dealing with this clinical condition have suggested the use of term DS and consider that the sharp pain is actually the normal pulpal response to the exposed dentine.^[4,5] But it is well known that all exposed dentine are not sensitive and the term DH has been used over the decades by the clinicians.^[6,7] Therefore, both the terminologies can be used to describe the clinical condition. The condition has been defined by an international workshop on DH as follows:^[8] "Dentine hypersensitivity is characterized by short, sharp pain arising from exposed dentine in response to stimuli, typically thermal, evaporative, tactile, osmotic or chemical and which cannot be ascribed to any other dental defect or pathology". Some authors have substituted the word "dentine" and added the site, such as cervical or root, resulting in various other terminologies (e.g., cervical sensitivity/hypersensitivity) to describe the same clinical condition.^[9]

Now a day's many methods have been used for the clinical treatment of hypersensitive dentine. In-office methods provide an advantage over home use of desensitizing agents as they do not require multiple applications, patient compliance is not required and higher concentration of desensitizing agent can be used that provides better relief from sensitivity.

- Colgate pro relief contains arginine and calcium carbonate which repairs tooth enamel. Arginine activates bacteria

that neutralize acids and the calcium along with saliva restores the enamel.¹⁰

- Gc tooth mousse is a commercial preparation containing cpp-acp combination localizes in plaque in the form of nano clusters and causes remineralisation of enamel at a much faster rate than seen with acp alone.
- Novamin is the trade name for a calcium sodium phosphosilicate bioactive glass that has been developed for use of oral health care. Its particles bind to tooth surface and when the particles come in contact with saliva & water it reacts with water to release calcium and phosphate ions. These ions are protected by glass particles so that they can be delivered to specific locations. Sodium ions in particles exchange with hydrogen cations which allows the calcium and phosphate ions to be released. A calcium phosphate layer then forms and crystallize as hydroxyapatite, a form of hard and strong mineral in teeth. The physical occlusion of dentinal tubules results from both the hydroxylapatite layer and residual novamin particles.

Subjects and Methods

A randomized, split mouth trial was conducted among patients coming to Department of Conservative & Endodontics, Peoples Dental Academy, who fulfilled the following criteria.

Selection criteria:

Patient Inclusion Criteria for those fulfilling the preliminary screening:

- 1) Patients aged 18-40 years, coming to Department of Conservative & Endodontics, Peoples Dental Academy.
- 2) Patients having at least 4 caries free cervical lesions with dentin hypersensitivity.
- 3) The loss of dentin should be less than 2 mm deep as per TWI code "2"
- 4) Patients with adequate oral hygiene and only those who are willing to participate in the study.

Patient Exclusion Criteria:

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- 1) Patient with history of any systemic illness and/or psychological diseases and previous hospitalization.
- 2) Teeth having dental caries, cracks or fractures in the cervical areas of the teeth.
- 3) Teeth with TWI code 0, 1 and 4¹¹
- 4) Teeth with any extensive or unsatisfactory restorations, prosthesis or orthodontic appliances involving the cervical areas.
- 5) Patients with history of drug addictions.

Withdrawal criteria:

Failure to complete follow-up after undergoing initial treatment and giving consent.

Method of Collection of Data:

A dental chart for each patient was used to record cervical abrasion using Tooth Wear Index (Smith and Knight, 1984). Tooth Wear Index (TWI) was assessed on visual examination. It evaluates all the tooth surface (i.e. cervical, buccal/labial), lingual, occlusal or incisal). In the present study only the cervical surfaces was evaluated for abrasion and was coded according to criteria for TWI. This modification was done to focus on the objectives of the study.

Patient scoring TWI code '3' (less than 2 mm deep defect in the cervical area) and having at least 4 cervical lesions with dental hypersensitivity (DH) was eligible to participate in the study.

Participants were informed about the purpose and design of the investigation and sign an appropriate informed consent form. The research protocol was approved by the Ethics Committee of People's Dental Academy, Bhopal.

Sample consists of patients having at least 4 teeth with DH who have fulfilled selection criteria. The prospective investigation was randomized, split mouth, and placebo controlled. The experimental period was determined of 3 weeks.

The teeth of participants with DH were randomly assigned to one of the three equally sized groups according to the desensitizing treatment under study:

1. Group I – Colgate pro relief
2. Group II – GC tooth mousse
3. Group III – Novamin (Shy-nm)
4. Group IV – Distal water as a placebo control

2. Methodology

The desensitizing agents was applied by one experienced operator other than the examiner as follows:

- 1) Removal of debris and calculus, if any, around the affected teeth using hand scalers followed by isolation with cotton rolls.
- 2) The tooth surface was dried with air from the dental unit for 15 sec.
- 3) After a 15 sec. desensitizing agents was applied directly on dentinal hypersensitive site as recommended by the manufacturer.

- 4) Care was taken to ensure that none of the product touched other zones of the oral mucosa.
- 5) Excess removal by using cotton pellets.

The patient was instructed not to rinse, eat or drink for 30 minutes after the treatment and avoid using any other professionally or self applied desensitizing agent in the course of the investigation.

Each tooth received two stimuli:

- a) Clinical probing (tactile stimulus)
- b) Air blast (thermal evaporating stimulus)

The probe stimulus was applied under slight manual pressure in the mesio-distal direction on the cervical area of the tooth. The test was repeated 3 times before recording the score.

Air blast was applied with air syringe for 1-2 seconds at the distance of 1 cm of the tooth surface to avoid desiccating the surface while the adjacent teeth protected by operator finger (Ide et al. 1998).

The degree of hypersensitivity reported by the participants with each stimuli was determined according to the Verbal rating scale – VRS from 1-100 in which:

- 1-20=no discomfort (0)
- 21-40=minimum discomfort (1)
- 41-60=mild discomfort (2)
- 61-80=moderate discomfort (3)
- 81-100=intense discomfort (4)

The values was collected before the intervention (baseline values) 5min. After each application, in weekly interval for three weeks on days 1st, 7th and 21st.

Statistical Analysis:

All the data were entered into a personal computer in a Microsoft Excel sheet. Descriptive statistical analysis was performed by using SPSS. Software version 19. All the data obtained by comparing the four groups was presented in term of mean and standard deviation. Analysis of variance (ANOVA) was used to analyse the difference among group means. Whereas repeated measures of ANOVA was used to analyse the difference at different time interval in each group.

3. Results

A total of 15 patients, who presented hypersensitive teeth, were evaluated in the study. All the participants followed and completed the trial and so the patient compliance rate was 100%.

[Table/Fig-1] shows comparison of mean sensitivity VAS score among four group and reduction in severity of dentinal hypersensitivity for each group at different time intervals for thermal stimulus. There was no significant difference at base line and after 30sec application but there was highly significant difference at 7th and 21st day of application in all the three groups except group 4(distal water).

[Table/Fig-1]: Comparison of mean sensitivity VAS scores among four group at thermal stimulus.

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Group	Base line Mean ±SD	After 30sec Mean ±SD	After 7days Mean ±SD	After 21days Mean ±SD	Repeated measure of ANOVA	P-value
1(N=15)	66.80 ± 8.96	66.33±8.88	60.20±6.59	42.47±8.88	78.23	0.001
2(N=15)	66.87±8.78	60.40±10.37	44.93±6.91	17.53±6.74	218.50	0.001
3(N=15)	66.53±9.71	63.60±9.67	56.87±7.49	31.60±8.87	97.67	0.001
4(N=15)	66.73±9.14	66.67±9.33	66.67±9.33	67.67±8.17	2.86	0.112
ANOVA F value	0.004	1.384	21.257	99.693		
P value	1.000	0.257	0.001	0.001		

[Table/Fig-2] shows comparison of mean sensitivity VAS score among four group and reduction in severity of dentinal hypersensitivity for each group at different time intervals for tactile stimulus. There was no significant difference at base

line and after 30sec application but there was highly significant difference at 7th and 21st day of application in all the three groups except group 4(distal water).

[Table/Fig-1] Comparison of mean sensitivity VAS scores among four group at tactile stimulus.

[Table/Fig-1]: Comparison of mean sensitivity VAS score among four group at tactile stimulus						
Group	Base line Mean ±SD	After 30sec Mean ±SD	After 7days Mean ±SD	After 21days Mean ±SD	Repeated measure of ANOVA	P-value
1(N=15)	67.07±8.26	64.80±9.34	58.73±10.03	42.47±11.97	74.26	0.001
2(N=15)	67.07±8.26	59.47±11.25	45.00±5.73	19.73±4.68	164.14	0.001
3(N=15)	67.07±8.26	63.87±9.02	56.47±8.03	35.67±7.60	127.06	0.001
4(N=15)	67.07±8.26	67.80±8.26	67.07±8.26	67.80±8.53	3.65	0.077
ANOVA F value	0.000	1.67	18.64	81.10		
P value	1.000	0.183	0.001	0.001		

Gc mouse showed highest reduction in the severity of dentin hypersensitivity after 7th and 21st day of application both in thermal and tactile stimulus.

4. Discussion

The present study was a pioneering randomized, controlled clinical trial that evaluated the clinical effect of GC tooth mouse, Novamin and Colgate pro relief in reducing dentin hypersensitivity.

A split mouth study design was adopted which had advantages of same pain perception, oral hygiene habits, dietary habits and psychosomatic factors. It is generally recommended that more than one stimulus should be used in clinical studies which are done on dentinal hypersensitivity. This study utilized air blast and probing stimulation for the evaluation of dentin hypersensitivity. These two methods were reported to be accurate for the investigation of hypersensitivity levels according to Snowinski et al.¹² In the current study, the effectiveness of the agents was evaluated by using VRS which has been widely used in human clinical and physiological research to assess subjective states¹³.

S Madhvan et al, compared the clinical efficiency of CPP-ACP F, sodium fluoride, propolis, and distilled water that was used as placebo in treating dentinal hypersensitivity and concluded that Multiple therapeutic modalities have been developed to treat dentinal hypersensitivity including products that impede nerve conduction of pain stimulus, products that mechanically occlude dentinal tubules, and calcium containing products designed to create plugs in the tubules utilizing a demineralization mechanism.¹⁴ in this study all three desensitising agent showed reduction in the dentine hypersensitivity.

BM Shivaprasad et al, evaluated the efficacy of calcium sodium phosphosilicate bioactive glass (NovaMin) as a chair side desensitizing agent and concluded that chair side application of calcium phosphosilicate bioactive glass can be a therapeutic adjunct to provide immediate relief for the patient with dentinal hypersensitivity.⁽¹⁵⁾ In the present study Gc mousse showed better results then novamine at chair side application.

Tung et al., postulated that the materials CPP-ACP and Propolis precipitate and obstruct the dentinal tubules and that they decrease dentinal permeability by 85% or more¹⁶. In this study, agents i.e. GC tooth mousse, Shy nm and Colgate pro relief, effectively reduced the dentinal hypersensitivity

G.C. tooth mousse contains casein phosphopeptide (CPP) and amorphous calcium phosphate (ACP). CPP stabilizes ACP and forms nano complexes with ACP at the tooth surface, thereby providing a reservoir of calcium and phosphate ions which favors mineralization¹⁷

In our study, G.C. tooth mousse was found to be the most effective among the test groups (p<0.01).

The initial observation of this medicine revealed that its action was most effective in the first days of application. Perhaps, in order to increase its desensitizing effect, it has been recommended that, this application should be repeated at intervals which were shorter than 7 days¹⁷. The sterile water, which was used as a negative control in our study showed the least (35.4%) reduction in dentin hypersensitivity. This slight reduction in dentin hypersensitivity may be attributed to placebo effect and participation bias. This study was peculiar in being one of the few where a true placebo, water, was applied to the test teeth. Dentin hypersensitivity studies are subject based.

Therefore, several factors can influence the measurement of pain. To date, none of the methods which have been used to assess the measurements have been found to be completely successful. However, it may be suggested that the aim of dentin hypersensitivity studies is to relieve patients' discomfort. Hence, long-term studies and repeated applications of desensitizing agents are necessary. To date, no standard procedures have been developed to test products which have been designed for treatment of this condition; hence, comparison of products between trials is fraught with difficulties. In addition, well-designed control groups and working with more subjects may be of great help in obtaining more reliable results.

5. Conclusion

Within the parameters of this study, the following conclusions can be drawn:

- 1) GC tooth mousse was the most effective among all three treatment agents, followed by shy nm and Colgate pro relief.
- 2) GC tooth mousse showed a rapid reduction in dentin hypersensitivity, and also the highest patient satisfaction, without any side effects.

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