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"COMPARATIVE EVALUATION OF DENTIN TUBULAR OCCLUSION WITH BIOACTIVE GLASS CONTAINING DENTRIFICE AND GLUMA DESENSITIZER– A SEM STUDY"

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Conflicts of Interest: Nil

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Abstract:

Aim: To evaluate the dentinal tubule occluding ability of two commercially available dentifrices (Gluma desensitizer and Bioactive glass) by using Scanning Electron Microscopy (SEM).

Methodology: The present study was an experimental study done upon 60 freshly extracted sound human premolars and then sectioning of the tooth was done which was further followed by ultra-sonication with distilled water. The specimens were randomly divided (20each) into 3 groups: **Group 1** (distilled water only), **Group 2** (Gluma Desensitizer), and **Group 3** (Bioactive glass). After application of materials scanning electron microscope (SEM) examination was done. Student's T-test was used to evaluate the effectiveness among the materials used for dentinal hypersensitivity.

Results: The present SEM study revealed that Bioactive glass was found to be more effective in occluding the dentinal tubules completely as compared to Gluma desensitizer. But Gluma Desensitizer partially occlude the dentinal tubules as compared to distilled water, which have no tendency to occlude the tubules partially.

Conclusion: It was concluded from the present study that Novamin completely occluded the dentinal tubules as compared to Gluma desensitizer and Distilled water.

Keywords: Novamin, Gluma desensitizer, dentinal hypersensitivity, SEM

Introduction

Tooth sensitivity is a very common clinical presentation which can cause considerable concern for patients. This condition is frequently encountered by dentists, endodontists, periodontists, hygienists and dental therapists. Tooth hypersensitivity generally involves the facial surfaces of teeth near the cervical aspect and is very common in premolars and canines region[1]

Dentine hypersensitivity (DH) has been defined as a short, sharp pain arising from exposed dentine response to stimuli typically thermal, evaporative, tactile, osmotic or chemical and which cannot be ascribed to any other form of dental defect or disease''. [2] The aetiology of DH is multi-factorial. Interactions between several factors including stimuli as well as predisposing factors may play an important role in initiating this condition.

Cold and air stimulation are known to be the commonest stimuli while dietary acid also have a significant potential in evoking DH. Gingival recession and abrasion, as well as erosion and attrition are also considered as important ones. Dentin hypersensitivity is a frequently encountered problem in dentistry and a very troublesome clinical complaint found in many adult populations.[3]

STUDY DESIGN

The present experimental SEM study was conducted in the Department of Periodontology and Implantology, D.J. College of Dental College and Research, Modinagar (U.P.) in collaboration with the Indian Institute of Technology, Delhi.

METHODOLOGY

Freshly extracted sound 60 premolars from human beings were collected from the Department of Oral and maxillofacial surgery, D.J. College of Dental Sciences and Research, Modinagar and stored in 10%

formalin. The selection was done on the basis of inclusion and exclusion criteria which were as follows:

Inclusion criteria

Extracted for orthodontic reasons/Non Carious Tooth

Exclusion criteria

Teeth with history of scaling root planning or oral prophylaxis in the previous six months.

PREPARATION OF THE DENTIN SPECIMEN

Sectioning was done after extraction of the tooth. The specimens were ultrasonicated in distilled water for 30 secs, then the samples were treated with 6% citric acid for 2 mins to remove the smear layer and after that the samples were rinsed in distilled water. Ultrasonic Scaling was done for all the premolars teeth which were collected as sample and after that all the teeth were thoroughly cleaned with normal saline and stored in 10% formalin at room temperature for no longer than two months. The teeth were sectioned mesio-distally using a double-sided diamond disc. One bloc were obtained from each flat cervical dentine surface measuring 5x5x3mm (L x B x H) by transverse.

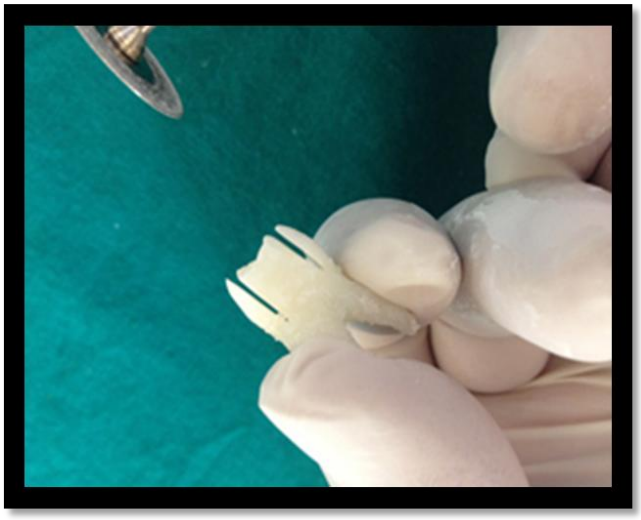


Figure 1:

MESIO-DISTAL LONGITUDINAL SECTION

Samples were ultrasonicated in an ultrasonic cleaner with distilled water for 2 mins for the removal of smear layer and to expose the dentinal tubules which further simulate hypersensitivity in dentin. Subsequently the sections were copiously rinsed with distilled water for a period of 30 seconds and stored in 10% Formalin at room temperature. After that groups were made.

Figure 2:

ULTRASONIC CLEANER

The specimens were randomly divided (20each) into 3 groups:

Group 1 Specimens were brushed with distilled water only.

Group 2 Specimens were brushed with Gluma Desensitizer.

Group 3 Specimens were brushed with Novamin.

The agents for group I and II was applied using an applicator brush for a period of 30-40 secs.

The agents for group III was applied using an applicator brush for a period of 2 mins.

After application of materials, the specimens were washed with distilled water and then dried and then scanning electron microscope (SEM) examination was done.

The Scanning Electron Microscopic analysis was done at Indian Institute of Technology, Delhi. Treated specimens were mounted on aluminium stubs. After that the specimens were examined under scanning electron microscope at magnification of 2000X and representative photomicrograph of each specimen were randomly taken and analysed to assess the percentage (%) of tubular occlusion. The percentage of occluded tubules was calculated by using the following equation

$$\%OCT = \frac{\text{Number of occluded tubules}}{\text{Total number of tubules}} \times 100$$

Figure 3: SCANNING ELECTRON MICROSCOPE (JEOL 7610F)

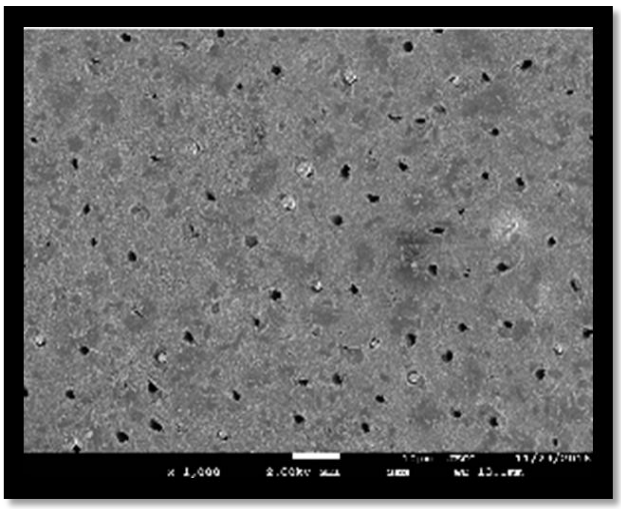


Figure 4: BRUSHED WITH DISTILLED WATER ONLY

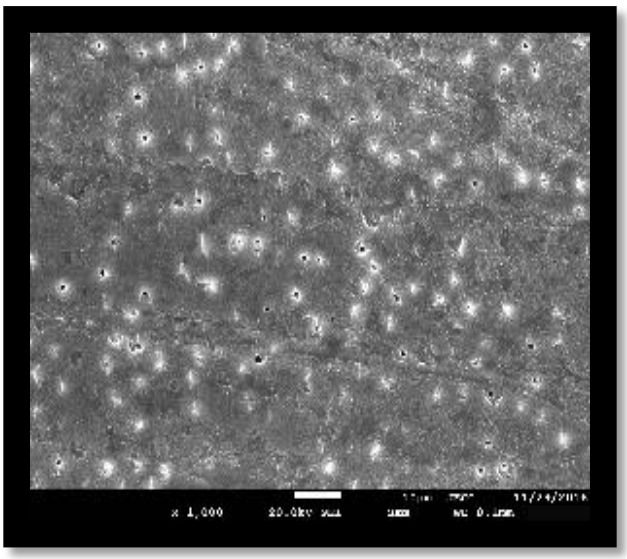


Figure 5: GLUMA DESENSITIZER

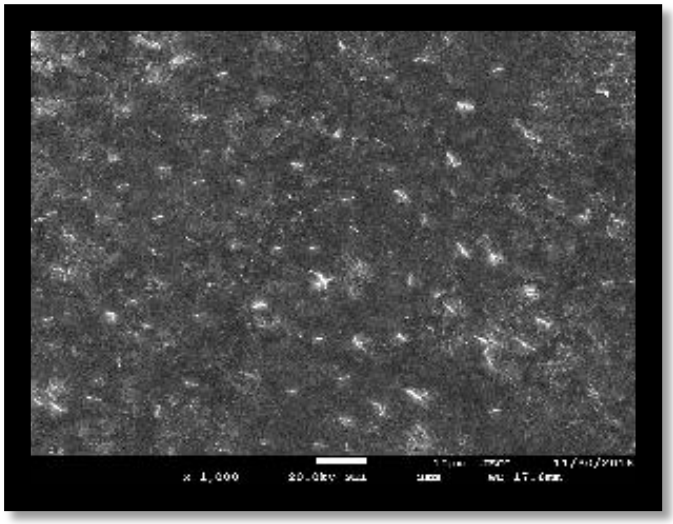


Figure 6: Brushed with Bioactive glass

RESULTS

Table 1: Comparison between mean percentage of completely occluded dentinal tubules to total no. of dentinal tubules among Group1 , Group2 .

Variable	Mean ± SD	t-value	p-value	Significance
Distilled Water	25.9 ± 9.42	- 22.889	0.000	**S**
Gluma Desensitizer	87.1 ± 8.36			

(p ≤ 0.05 – Significant, CI = 95 %)

Table showed the comparison between mean percentage of completely occluded dentinal tubules to total no. of dentinal tubules among Group1, Group2. A statistically significant comparison was seen between distilled water and Gluma desensitizer where Gluma desensitizer occluded maximum dentinal tubules as compared to distilled water.

Table 2: Comparison between mean percentage of completely occluded dentinal tubules to total no. of dentinal tubules among Group1, Group3

Variable	Mean ± SD	t-value	p-value	Significance
Distilled Water	25.9 ± 9.42	- 26.144	0.000	**S**
Novamin	92.5 ± 3.33			

(p ≤ 0.05 – Significant, CI = 95 %)

Table revealed the comparison between mean percentage of completely occluded dentinal tubules to total no. of dentinal tubules among Group1 , Group3. A statistically significant comparison was seen between distilled water and Novamin and

Novamin occluded maximum dentinal tubules as compared to distilled water.

Table 3: Comparison between mean percentage of completely occluded dentinal tubules to total no. of dentinal tubules among Group2, Group3

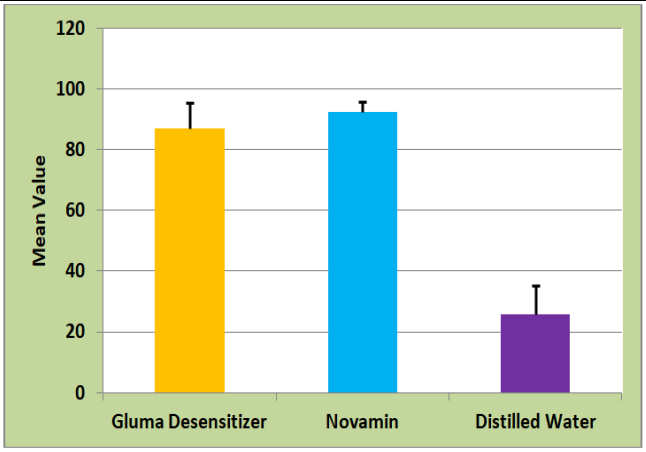
Variable	Mean ± SD	t-value	p-value	Significance
Gluma Desensitizer	87.1 ± 8.36	-2.785	0.012	**S**
Novamin	92.5 ± 3.33			

(p ≤ 0.05 – Significant, CI = 95 %)

Table showed the comparison between mean percentage of completely occluded dentinal tubules to total no. of dentinal tubules among Group2, Group3. A statistically significant comparison was seen between Gluma desensitizer and Novamin where Gluma desensitizer occluded maximum dentinal tubules as compared to distilled water.

Table 4: Comparison between mean percentage of completely occluded dentinal tubules to total no. of dentinal tubules among Group 1, Group 2 and Group3

Variable	Mean ± SD
Distilled Water	25.9 ± 9.42
Gluma Desensitizer	87.1 ± 8.36
Novamin	92.5 ± 3.33



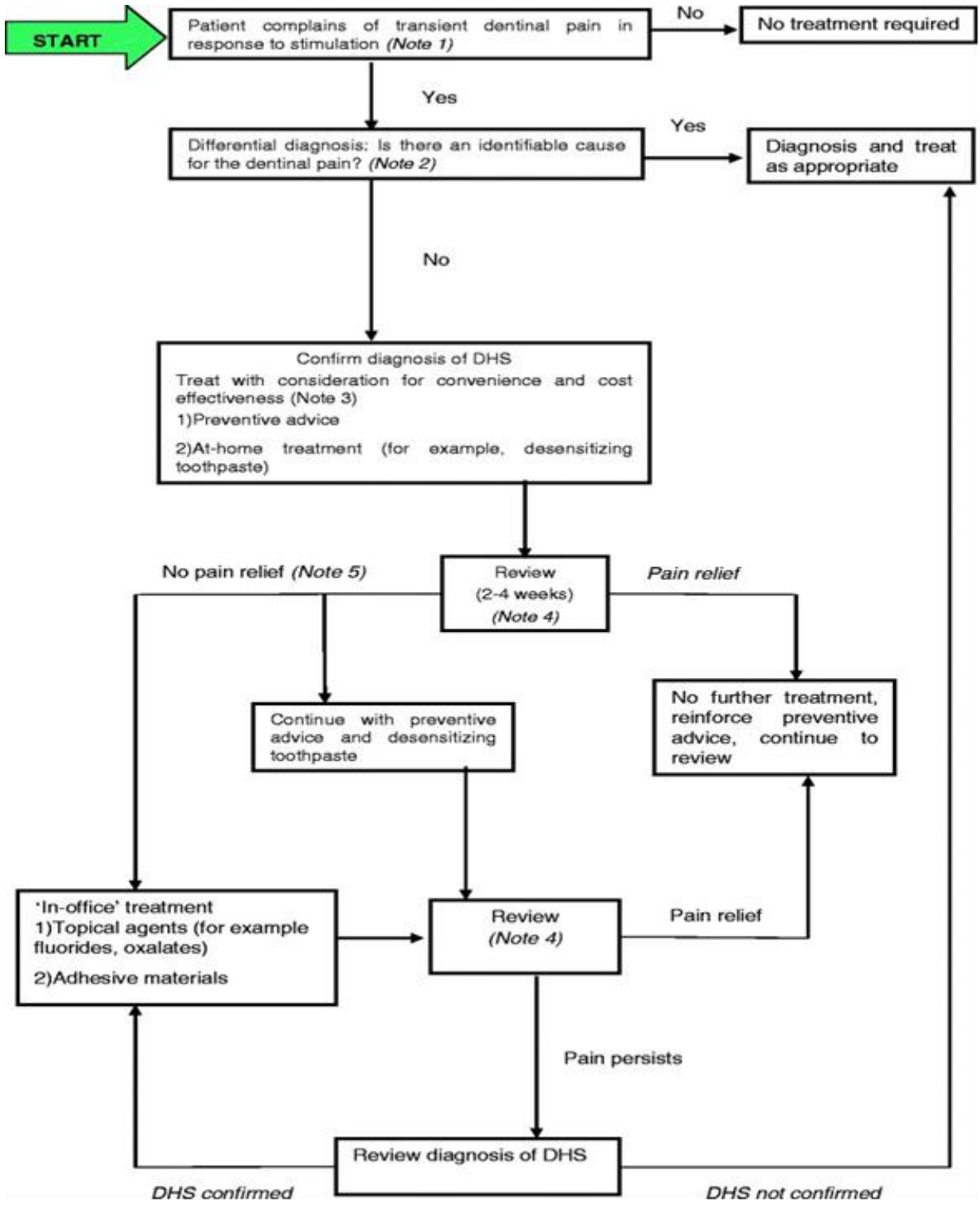
DISCUSSION

Dentine hypersensitivity (DH) is a painful response of the tooth to different stimuli such as brushing, low pH beverages, occlusal overload, dental caries and thermal changes.[5] The desired goal for treatment of dentin hypersensitivity is attainment of immediate as well as lasting relief from discomfort. This is achieved by application of a desensitizing agent used alone or as an adjunct to another dental procedure. Till date no such treatment has been discovered and there is no '**gold standard**' by which one can assess the efficacy of the agent used[6].

The effectiveness of dentin desensitizing agents is directly related to their capacity of promoting the sealing of the dentin canaliculi. Conventional therapies for the treatment of Dentinal hypersensitivity comprehend the topical use of desensitizing agents, either professionally or at home such as nerve desensitizers (Hydroxyethyl methacrylate), protein precipitators (glutraldehyde, silver nitrate, zinc chloride, strontium chloride, dentinal tubule pluggers (sodium fluoride, stannous fluoride, strontium chloride, potassium oxalate, calcium phosphate, calcium carbonate, bioactive glasses) dentin adhesive sealers (fluoride varnishes, oxalic acid and resin, glass ionomer cements, composites, dentin bonding agents) and recently lasers .

An in vitro study reported by Joshi S et al (2013) compared Gluma desensitizer with Novamin, Novamin showed more completely occluded tubules (0.545 ± 0.051) while Gluma desensitizer showed more partially occluded tubules (0.532 ± 0.075). The differences among all the groups were statistically significant (p ≤ 0.05).

Another study done by Gupta et al (2013) also showed that bioactive glass was found to produce more completely occluded tubules while Gluma desensitizer caused more partial occlusion on initial application.



CONCLUSION

The present SEM study results revealed that:

- Novamin was found to produce more completely occluded tubules while Gluma desensitizer caused more partial occlusion on initial application.
- There was a statistically significant difference between the two groups when the ratio of complete and partial occlusion was calculated against the total number of tubules.
- Novamin application could be more effective in providing relief from dentinal hypersensitivity when compared to Gluma desensitizer.

However further long term clinical and SEM studies are required to establish the role of these agents in reducing dentin hypersensitivity.

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