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Desensitizing Agents on Tubule Occlusion Using Various Acidic Beverages Under Scanning Electron Microscope

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Abstract

Aim

The present study aims to evaluate and compare the effects of desensitizing agents on tubule occlusion under various acidic conditions by using Scanning Electron Microscope (SEM).

Materials and method

60 dentin discs of each 1mm thickness were prepared and divided randomly in to three groups, Group I, II and III. Group IA and IB were the control groups brushed with Colgate sensitive plus(CSP) and Tooth in (TM) desensitizing agents respectively for 1 min on each side and washed. Group IIA and IIB after treatment with their respective toothpastes were immersed in carbonated drink for 2 mins.

Statistical analysis

The percentage of tubule occlusion was compared by Kruskal Wallis ANOVA. Pair wise comparison based on the percentage of tubule occlusion was done by Mann-Whitney U test.

Results

Among both the desensitizing agents in presence of acidic beverages significant difference was seen in tubule occlusion with CSP showing more occluded tubules than TM.

Conclusion

The application of the two desensitizing agents resulted in effective dentinal tubule occlusion. However pro arginine technology based desensitizing agent (CSP)

represented excellent tubule occlusion effect after subjecting to acidic beverages while TM has shown least tubule occlusion when subjected to both the acidic challenge.

Keywords

Acidic condition; Dentinal hypersensitivity; Scanning electron microscope; Tubule occlusion

Introduction

Dentin hypersensitivity (DH) is epitomized by brief, sharp well localized pain in response to thermal, evaporative, tactile, osmotic or chemical stimuli that cannot be ascribed to any other form of dental defect or pathology.[1] DH should be differentiated from other diseases such as dental caries, cracked tooth and periodontal diseases. The pain should be differentiated from the pain of pulpal origin which is dull, aching and more prolonged.

Materials and methods

Extracted human premolar and molar teeth that underwent surgical extraction were collected after informed consent was obtained from the patient.The teeth were cleansed thoroughly and stored in normal saline (Vishal, Bangalore, India) to be used within a period of a month. The teeth that were carious, restored, abraded, attrited, eroded, fractured or with any developmental anomaly were excluded from the study.

In Group IA, IIA and IIIA the discs were brushed with Colgate sensitive plus (CSP) (Colgate-Palmolive Ltd, India) for 1 minute on both the sides and washed. Group IA (n=10) which served as a control group was directly stored in artificial saliva after brushing with the desensitizing agent. pH was assessed by using pH meter before subjecting the groups to acidic challenge.

Statistical analysis

The statistical analysis was performed with the use of SPSS 17.0 software for windows. The median and mean rank percentage of tubule occlusion was compared among the three groups i.e. Group I (A, B), Group II (A, B) and Group III (A, B) by using Kruskal Wallis ANOVA. Pair wise comparison between the six groups based on the percentage of tubule occlusion was done by Mann-Whitney U test. The outcome measure obtained was on an ordinal scale hence non parametric tests were applied.

Results

The tubule occlusion results are expressed as percentage of maximum tubule occlusion considered to be 100% and grading was done to express the percentage of tubule occlusion in each specimen. Table 2 shows the data of percentage of tubule occlusion produced in three different groups. The least tubule occlusion were observed when the samples were subjected to wine where Group IIIA (pre-treated with CSP) showed more tubule occlusion with a mean rank of 12.50% when compared to Group IIIB (pre-treated with TM)that showed the lowest mean rank of 8.50%.Pairwise comparison showed a significant difference of p=0.029 between Group IIIA and Group IIIB.

Scanning electron microscope evaluation

All the tested specimens showed morphological changes to the dentin surfaces. SEM evaluation showed complete tubule occlusion (75%-100%) in control groups IA and IB [Figure 1A and 1B]. Acidic challenge reduced the amount of deposits in the tubule occlusion and increased the diameter.

Discussion

Dentin hypersensitivity is based on the most widely accepted principle of hydrodynamic theory. Clinical symptomatology of dentinal hypersensitivity is reduced by the substances that occlude the open dentinal tubules and decrease the dentinal fluid conductivity. [14]

This study aims to evaluate the effect of two desensitizing agents on tubule occlusion when subjected to acidic challenge. Dentin discs of thickness 1mm were prepared from coronal dentin as the density of these tubules is more

than the radicular dentin.

Another remineralizing agent (Toothmin) that works on anticay mechanism was used. Its demineralising effect is due to the availability of calcium and phosphate that reduces the solubility of enamel in acidic condition due to common ion effect as well as is a fluoride compliment. It is soluble in water thereby provides high concentration of calcium and phosphate that binds to the tooth structure and causes remineralisation.[21] Though its action on open dentinal tubules is not thoroughly known it can be assumed that the calcium sucrose phosphate mixture forms a bond with the dentinal tubule and causes its occlusion.

The dentin specimens treated with both the desensitizing agents used in the present study exhibited resistance to acidic challenge. However SEM observation showed that acidic beverages tested were able to remove particulate and coating layer from tubule orifices.

Conclusion

Application of these two desensitizing agents resulted in formation of microcrystals in the dentinal tubules which resulted in better tubule occlusion. Colgate sensitive plus has shown more resistance to acid challenge compared to toothmin desensitizing agent. However colgate sensitive plus represents better approach to dentinal tubule occlusion when subjected to acidic challenge. Further functional invivo studies are required to assess the effect of these agents on vital teeth. A large scale multicentered randomized control clinical trial are required to evaluate the clinical effectiveness of these treatment modalities.

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