Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 10, Issue, 08, pp.72512-72514, August, 2018

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

COMPARATIVE EVALUATION OF THE EFFECTIVENESS OF FOUR COMMERCIAL DESENSITISING TOOTHPASTES IN DENTINE TUBULE OCCLUSION USING SCANNING ELECTRON MICROSCOPY

***[1]Dr. Mridusmita Mukherjee and [2]Dr. Krishna Das**

[1]MDS Consultant Endodontist, Guwahati, Assam, India
[2]MDS Consultant Periodontist, Kokrajhar, Assam, India

ARTICLE INFO

Article History:
Received 29th May, 2018
Received in revised form
10th June, 2018
Accepted 27th July, 2018
Published online 30th August, 2018

Key words:
Desensitivity, occlusion ,
Toothpaste, dentine etc.

ABSTRACT

Aim: This study aimed to evaluate the effectiveness of four commercial desensitizing toothpastes in dentine tubule occlusion using the scanning electron microscopic analysis.
Materials and Methods: The samples were divided into five groups having ten teeth each (n = 10); the groups were divided accordingly, Each of the five groups (A-E) were treated as follows Group A- Sensodyne Rapid (Strontium acetate), Group B – Sensodyne Repair (Stannous fluoride), Group C – BioRepair (Zinc-carbonate hydroxyapatite), Group D – Colgate Total Sensitive (New silica), Group E- saline (control).Each tooth was then split longitudinally and was prepared for examination by scanning electron microscope under ×1000.
Statistical Analysis: The scores were compared statistically within the groups using Mann Whitney test with a level of significance set at $P<0.01$.
Results: Zn-CHA based toothpaste exhibited significant occlusion of dentinal tubules when compared to other groups
Conclusion: The maximum desensitising efficacy was shown by Bio Repair (Zinc-carbonate hydroxyapatite) followed by Colgate Total Sensitive (New silica) toothpaste.

Citation: Dr. Mridusmita Mukherjee and Dr. Krishna Das, 2018. "Comparative evaluation of the effectiveness of four commercial desensitising toothpastes in dentine tubule occlusion using scanning electron microscopy", *International Journal of Current Research*, 10, (08), 72512-72514.

INTRODUCTION

Gingival recession results in exposed dentine, which is the primary cause of dentine hypersensitivity and is a nuisance to many patients. "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"(Holland *et al.,* 1997). It is a painful clinical condition with an incidence ranging from 4 to 74%. Three major mechanisms of dentinal sensitivity have been proposed in the literature:

- Direct innervation "theory"
- Odontoblast receptor
- Fluid movement/hydrodynamic theory

According to direct innervation theory, nerve endings penetrate dentine and extend to the dentino-enamel junction (Irvin, 1998).

Corresponding author:* **Dr. Mridusmita Mukherjee,
MDS Consultant Endodontist Guwahati, Assam, India.
DOI: https://doi.org/10.24941/ijcr.29533.08.2018

Direct mechanical stimulation of these nerves will initiate an action potential. However, there are many shortcomings of this theory. Odontoblast receptor theory states that odontoblasts acts as receptors by themselves and relay the signal to a nerve terminal which responds to painful stimuli (Rapp *et al.,* 1968). The third theory was proposed by Brannstrom (1964) who proposed that dentinal pain is due to hydrodynamic mechanism, i.e., fluid force. It has been noted that stimuli which tend to move the fluid away from the pulp–dentine complex produce more pain (Brännstrom and strom, 1964). Out of all hypothesis, hydrodynamic theory has been accepted and has been clinically relevant.

MATERIALS AND METHODS

Fifty dentine discs from extracted human upper permanent incisors were randomly divided into five groups (n = 10): Group A- Sensodyne Rapid (Strontium acetate) Group B – Sensodyne Repair (Stannous fluoride), Group C – BioRepair (Zinc-carbonate hydroxyapatite), Group D – Colgate Total Sensitive (New silica), Group E- saline (control).

The discs were etched with 37.5% phosphoric acid and treated with the test agents. All treated discs from each group were then exposed to 6% citric acid challenge. The extent of tubule occlusion was assessed using scanning electron microscopy (SEM) at a magnification of 1000X. Scoring was done based on the following scale: (1) occluded (100% of tubules occluded); (2) mostly occluded (50–<100% of tubules occluded); (3) partially occluded (25–<50% of tubules occluded); (4) mostly unoccluded (<25% of tubules occluded); (5) unoccluded (0%, no tubule occlusion). The mean score of tubule occlusion by the three blinded reviewers was taken and used for analysis.

SEM investigation

All specimens were dehydrated in graded acetone, dried and sputter-coated with gold palladium and examined under the SEM (JEOL JSM-6360, Japan) at 20 kV acceleration voltage. In addition, energy dispersive X-ray spectroscopy (EDS, EDAX Ametec; Mahwah, NJ, USA) was used to observe the penetration of the toothpaste into the dentine tubules. Statistical analysis was done using Microsoft excel and IBM SPSS Version 20 software.

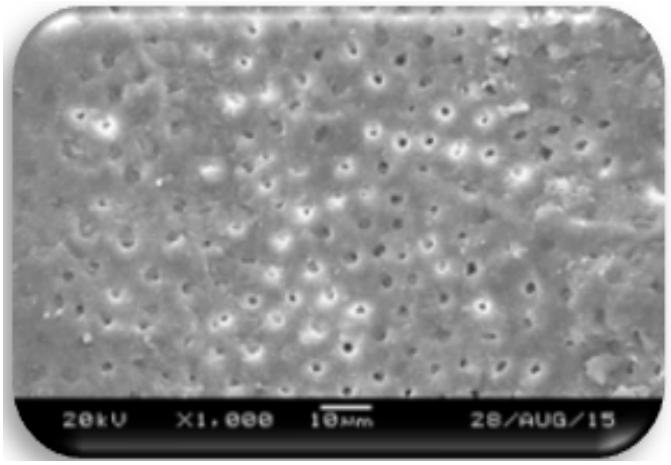

Fig 1. gr A

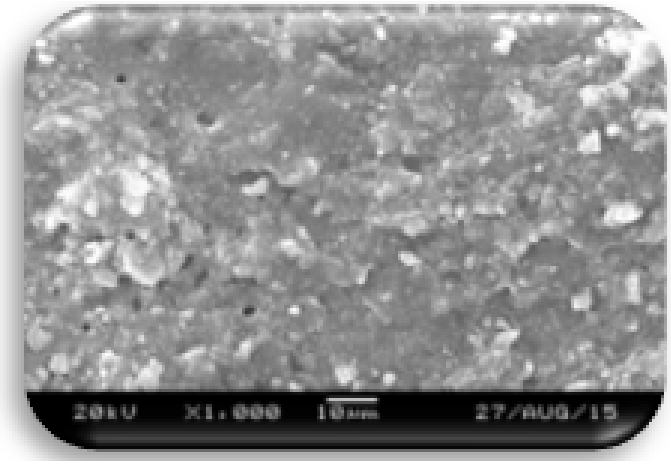

Fig 2. gr B

RESULTS

All the four desensitising agents were able to achieve dentinal tubule occlusion. Group A showed 60% occlusion of the tubules, Group B showed 75 % tubule occlusion, 95% blockage was found in Group C and 88% in group D respectively.

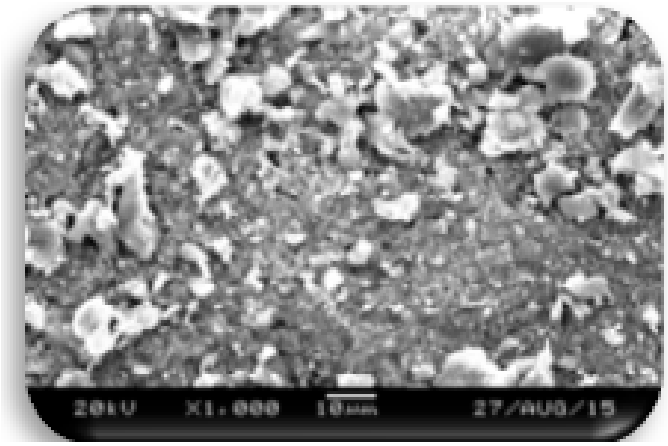

Fig. 3. gr C

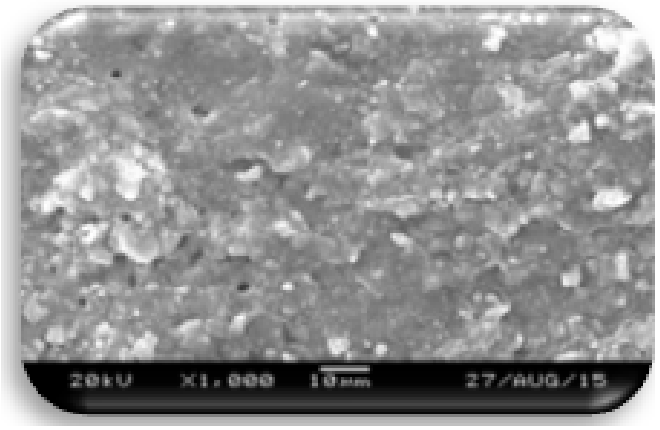

Fig. 4. gr D

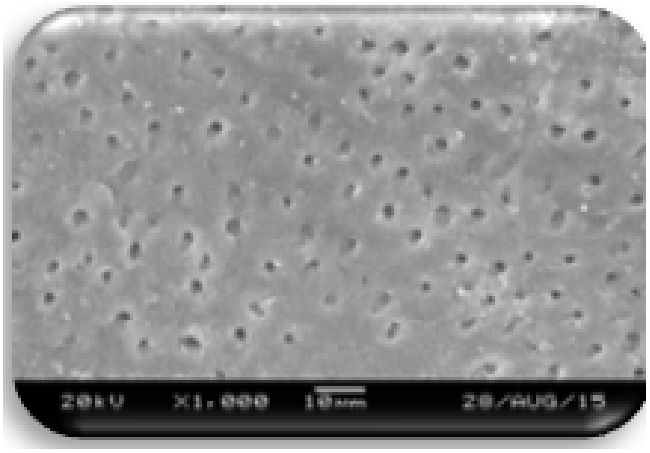

Fig 5. gr E

On comparison of the desensitising toothpastes, it was observed that there was a statistically significant difference among the four desensitising toothpastes (F=8.362, p=0.005).There was a statistical significant difference between Group C and D (p-value< 0.005). Furthermore, as the mean difference between Group C and D was 0.83, Group C was more efficacious as compared to Group D. There was no statistical significant difference between Group A and B (p=0.235). Similarly, there was no statistical significant difference between Group C and D as (p=0.154) however in Group E i.e., control group there was no occlusion of the dentinal tubules.

DISCUSSION

Saliva naturally occludes patent dentinal tubules by transporting calcium and phosphate ions into the tubules to induce tubule plugging and by forming a surface protective layer of salivary glycoprotein with calcium and phosphate (Pashley, 1985). However, this process of natural tubule occlusion is very slow and the tubule plugging is easily removed by dietary acid and physical insult, thus rendering it neither effective nor reliable in providing lasting relief of DH. Dentine tubule occlusion is achieved in two different ways, either by the deposition of an occluding layer on top of the dentine or by introduction of occluding material into dentine tubules causing intratubular mineralisation. Desensitising pastes are the easy and economical option to relieve dentinal hypersensitivity, and majority of them contain potassium salts to numb the pain of hypersensitivity (Kuroiwa *et al.,* 1994).

In this study, in gr 1,the effect of strontium salts is thought to be attributable to their ability to absorb into the connective tissue of dentine and to form strontium apatite, which may occlude the dentine tubules (Suge *et al.,* 1995; Morris *et al.,* 1999; Lan *et al.,* 1999 an). In gr 2, Stannous fluoride works by occluding dentinal tubules, inhibiting fluid movement in the tubules, and thus decreasing nerve stimulation. An 8-week randomized study by Schiff *et al* showed a clinically and statistically significant decrease in hypersensitivity with twice-daily use of a stabilized 0.454% SnF_2 dentifrice (Schiff *et al.,* 2005). On the other hand, Zn-CHA based toothpaste repairs or remineralises dentine surface by means of the deposition of a biomimetic CHA coating (Rimondini et al, 2007; Roveri *et al.,* 2009a). In group D i.e; bioglass,the basic component is silica, which acts as a nucleation site for precipitation of calcium and phosphate. It is thought to promote infiltration and remineralization of dentinal tubules.SEM analysis has shown that bioglass application forms an apatite layer, which occludes the dentinal tubules (Shivaprasad *et al.,* 2014).

Conclusion

DH is a common occurrence and is often one of the main reasons why patients seek dental treatment. The discomfort of DH experienced by the patients is highly subjective and can vary substantially between individuals. For some patients, the discomfort is perceived as a low grade pain, of slight concern, but for others the discomfort may present as a disturbing, severe pain which can affect their quality of life. To avert stimulation of the hypersensitive areas, patients tend to avoid certain food and drinks in their diet and avoid cleaning their teeth. Inability to maintain adequate plaque control may lead to increased risk of caries development and periodontal problems. Therefore, effective and long-lasting treatment is of great interest to both patients and dental professionals. In this regard, desensitising pastes can be extremely beneficial and useful.

REFERENCES

Brännstrom, M. and Astrom, A. 1964. A Study on the mechanism of pain elicited from the dentin. *J Dent Res.,* 43:619–25.

Holland, GR., Narhi, MN., Addy, M., Gangarosa, L. and Orchardson, R. 1997. Guidelines for the design and conduct of clinical trials on dentine hypersensitivity. *J Clin Periodontol.,* 24:808–13.

Irvine, JH. 1988. Root surface sensitivity: A review of aetiology and management. *J N Z Soc Periodontol.,* 66:15–8.

Kuroiwa, M., Kodaka, T., Kuroiwa, M. and Abe, M. 1994. Dentin hypersensitivity. Occlusion of dentinal tubules by brushing with and without an abrasive dentifrice. *J Periodontol., 65*:291–6. [PubMed].

Lan, WH., Liu, HC. and Lin, CP. 1999. The combined occluding effect of sodium fluoride varnish and Nd: YAG laser irradiation on human dentinal tubules. *J Endod.,* 25:424–6.

Morris, MF., Davis, RD. and Richardson, BW. 1999. Clinical efficacy of two dentin desensitizing agents. *Am J Dent.,* 12:72–6.

Pashley, DH. 1985. Dentin-predentin complex and its permeability: Physiologic overview. *J Dent Res.,* 64:613–20. [PubMed]

Rapp, R., Avery, JK. and Strachan, DS. 1968. Possible role of the acetylcholinesterase in neural conduction within the dental pulp. In: Finn SB, editor. Biology of the dental pulp organ. Vol. 31. Birmingham: University of Alabama Press; pp. 309–31.

Rimondini, L., Palazzo, B., Iafisco, M., Canegallo, L., Demarosi, F., Merlo, M., et al. 2007. The remineralizing effect of carbonate-hydroxyapatite nanocrystals on dentine. *Mater.Sci. Forum.,* 539–543, 602–605 10.4028/ www. scientific.net/MSF.539-543.602.

Roveri, N., Battistella, E., Bianchi, C. L., Foltran, I., Foresti, E., Iafasco, M., *et al*. 2009a. Surface enamel remineralization: biomimetic apatite nanocrystals and fluoride ions different effects. *J. Nanomater*., 2009.

Roveri, N., Battistella, E., Foltran, I., Foresti, E., Iafasco, M., Lelli, M., et al. 2008. Synthetic biomimetic carbonate-hydroxyapatite nanocrystals for enamel remineralization. *Adv. Mater. Res*., 47–50, 821–824.

Schiff, T., Saletta, L., Baker, RA., Winston, JL. and He, T. 2005. Desensitizing effect of a stabilized stannous fluoride/sodium hexametaphosphate dentifrice. *Compend Contin Educ Dent*., 26(9, suppl 1):35-40.

Shivaprasad, BM., Padmavati, P., Nehal N Sanghani, 2014. Chair Side Application of NovaMin for the Treatment of Dentinal Hypersensitivity- A Novel Technique. *J Clin Diagn Res.,* Vol-8(10): ZC05-8.

Suge, T., Ishikawa, K., Kawasaki, A., Yoshiyama, M,. Asaoka, K. and Ebisu, S. 1995. Effects of fluoride on the calcium phosphate precipitation method for dentinal tubule occlusion. *J Dent Res.,* 74:1079–85

****