Research Article

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Comparison of the Effect of Chitosan with Polyacrylic Acid Conditioner on Dentin Surface: In Vitro Study

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ABSTRACT

Background: This study was done to compare effect of Chitosan (CH) with Polyacrylic acid conditioner on dentin surface. For this study forty extracted molar were collected. Slabs of 6x6 mm were prepared using diamond disc and finished with diamond and grit sand paper. Twenty sample per group were distributed randomly. The samples were mounted on acrylic block. Conditioner (20% poly acrylic acid and 1% chitosan) were applied to one half of each surface. Group A- conditioned with 20% poly acrylic acid for 10 seconds. Group B- conditioned with 1% chitosan for 10 seconds .The samples were rinsed and subjected to visualize under Scanning Electron Microscope. Although both groups display open dentinal tubules, Chitosan (group B) gives modified smear layer as compared to complete removal of smear layer & erosion of dentin surface as seen in poly acrylic acid(group A).

Keywords: Chitosan, scanning electron microscope, polyacrylic acid.

INTRODUCTION

The dentin conditioning procedures have undergone revolutionary changes in recent decades. Despite the countless studies and the discovery of new more versatile materials, even today, the adhesive interface remains the weak point of the adhesive tooth-restoration complex.[1] Unfortunately, it is also the most vulnerable part of the restoration, because it is influenced by nano leakage, micro-permeability and by the degradation of metalloproteases.[2] Therefore, the technique of dentin conditioning is considered unstable since the tissue's heterogeneous composition does not enable ideal adhesive bonding, and inversely it may be affected by the hydrolytic degradation of hydrophilic monomers in the adhesive systems and by the action of the metalloproteinases that break down the exposed collagen fibers.[3] This results in loss of retention of adhesive restorations, increased bacterial microleakage, secondary caries, and irreversible pulp alterations.[4] Therefore, it is necessary to characterize and assess dentin, the conventional adhesion protocol, and current technical advances in order to use this knowledge as the basis for future research seeking the improvement of adhesive materials performance.[4]

Chitosan is an interesting polymer that has been used extensively in the medical field. It is either partially or fully deacetylated chitin. As chitin occurs naturally (for example in fungal cell walls and crustacean shells), chitosan is a fully biodegradable and biocompatible natural polymer, and can be used as an adhesive and as an antibacterial and antifungal agent[5]. The degree of deacetylation and the molecular weight of chitosan can be modified in order to obtain different physico-mechanical properties. The elemental composition of the chitosan polymer is carbon (44.11%),

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hydrogen (6.84%) and nitrogen (7.97 %). The viscosity average molecular weight of chitosan is ~5.3x105 Daltons.[6]

AIM OF THE STUDY

To compare the effect of Chitosan and Polyacrylic acid conditioner, on dentin surface under Scanning Electron Microscope.

Exclusion criteria

* Caries tooth
* Single rooted tooth
* Fracture tooth

Inclusion criteria

* Non carious molar

MATERIAL AND METHOD

* 40 extracted mola * normal saline * 20% poly acrylic acid

* 1% chitosan *[1]Acrylic block * Diamond disc

Prior to the commencement of this in vitro study, Institutional Ethical Committee approval was obtained. For this study forty extracted molar were collected. Slabes of 6* 6 mm were prepared using diamond disc and finished with diamond grit and sand paper. Twenty samples per group were distributed randomly. The samples were mounted on acrylic block. Single tooth was divided in two halves. Conditioners (poly acrylic acid and 1% chitosan) were applied to one half of each surface respectively. Group A- conditioned with 20% poly acrylic acid for 10 seconds. Group B- conditioned with 1% chitosan for 10 seconds. The samples were rinsed with sterile water and subjected to visualize under scanning electron microscope. Scanning Electron Microscopic analysis was performed to assess the presence or absence of smear layer. The data was analysed using Stastical Package for Social Sciences (SPSS) version 19.0 Armonk, NY IBM Corp software.

RESULTS

The pictures from the scanning electron microscopy showed that Group- B (teeth conditioned with 1% chitosan – figure 7) exhibited better efficacy in removing smear layer without altering the normal

Fig 1: Dentine conditioner.

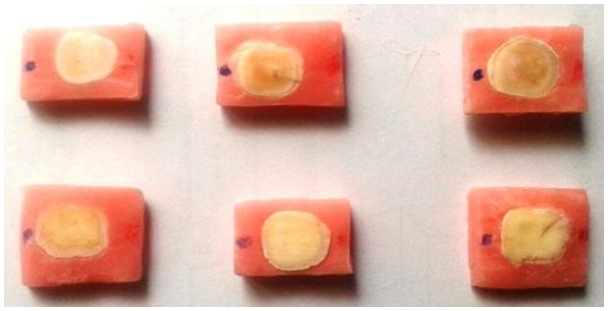

Fig 2: Sample prepared.

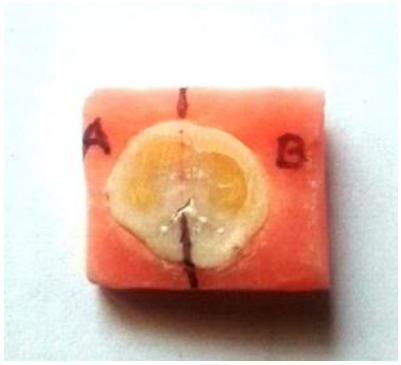

Fig 3: Two halves divided on sample tooth.

Fig 4: Scanning electron microscope.

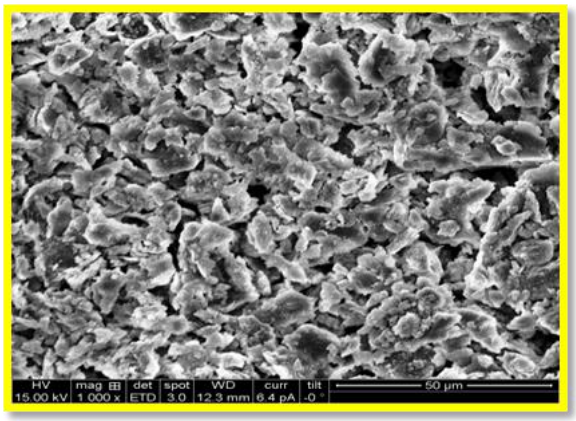

Fig 5: Unconditioned area with smear layer.

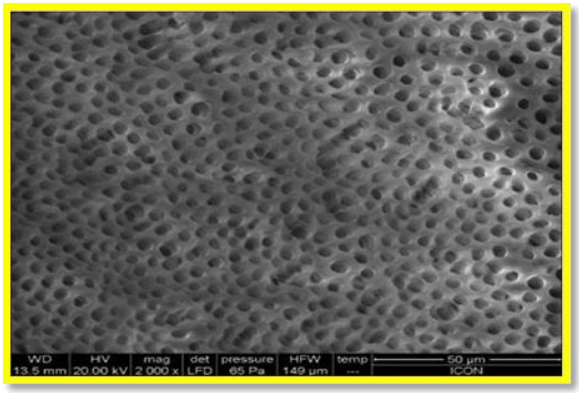

Fig 6: completely removed smear layer on dentin surface with PAA Group A.

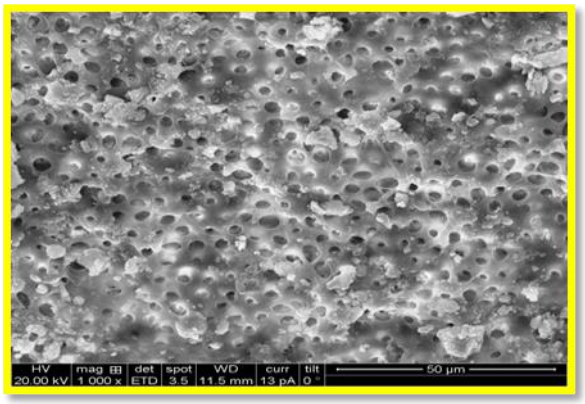

Fig 7: Modified smear layer on dentin surface and open dentinal tubules with chitosan group B.

dentinal structures with lowest mean scores ($p<0.001$)as compared to group- A (teeth conditioned with 20% polyacrlic acid- figure 6). Although both groups displayed open dentinal tubules the 1% solution of chitosan promoted exaggerated expansion of the tubular diameter. There was no statistically significant difference ($p<0.05$) between the groups regarding expansion of dentinal tubules.

DISCUSSION

Studies have shown the importance of using conditioner for the removal of the smear layer. However, despite being efficient in removing the smear layer, conditioners has an erosive effect on dentin.[3] Chitosan is a natural polysaccharide, biodegradable, biocompatible with human cells and with a high chelating capacity. The present study compares capacity to remove the smear layer as well as its structural effects on dentin. It is known that the efficiency of a chelating agent depends on several factors (application time, pH, concentration of the solution and amount of solution). Thus, in the present study, the volume of chitosan (pH 3.2) used as a conditioner was standardized at 1% .[5]

The 1% chitosan was more efficient for removing the smear layer and smear plug with minimal erosive effect. This result suggests the use of 1% chitosan as a possible alternative to replace poly acrylic acids.[6] Based on the results of the present study, It is concluded that 1% chitosan for 10 seconds removes the smear layer adequately and causes less erosion than poly acrylic acid[7].However the present study has limitations with regards to small sample size and in vitro use of Chitosan, to overcome this, study on larger scale are needed.

CONCLUSION

Chitosan is an antibacterial cationic biopolymer with increased surface tension & good chelating property which is less erosive & less harmful to dentinal surface as compared to poly acrylic acid. Thus Chitosan can be a possible alternative to existing acid conditioners.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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