

Evaluation of microleakage in class v cavities using cavity disinfectants; chlorhexidine & aloe vera - An in-vitro study

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Abstract

Background: Microleakage and the lack of marginal integrity of restorations has been implicated in dentinal sensitivity, secondary caries, corrosion or dissolution of dental materials and surrounding tooth structure and percolation of fluid. The fact that restorations exhibit leakage at marginal interfaces comes as no surprise to practicing dentists. It's described as the movement of oral fluids between the tooth and restoration interface.

Objective: the aim of the present in-vitro study was to evaluate the microleakage in class V cavity using two

cavity disinfectants i.e Chlorhexidine and Aloe vera.

Method: Twenty freshly extracted, human premolars were selected. Standardised Class V cavity was prepared and randomly divided into 2 groups (n=10) and each group was disinfected with cavity disinfectants, Chlorhexidine and Aloe vera, and then restored with composite resin, and then subjected to thermocycling immersion in 1% methylene blue dye for 24 hours; sectioning longitudinally; evaluation of microleakage under a stereomicroscope at 30x magnification and scoring on an ordinal scale (0-3). The results were tabulated and

subjected to Kruskal-Wallis and Mann-Whitney test for statistical analysis.

Keywords: Thermocycling, Microleakage, Cavities.

Introduction

Polymerization shrinkage appears to be the most significant problem with the composite restorations, as it has the potential to initiate gap formation at the tooth-composite interface¹, which may result in microleakage², (clinically undetectable passage of bacteria, fluids, or ions between the cavity wall and the resin composite) secondary caries³ and eventually leads to failure of the bond⁴. Histological and bacteriologic studies have shown that only a small proportion of the teeth are sterile after cavity preparation.

Marginal leakage is considered a major cause of restoration failure, being responsible for over 50% of replacement procedures^{5,6}. Microleakage is an important property that has been used in assessing the success of any restorative material used in restoring tooth⁷. Marginal leakage is used as a measure by which clinicians and researchers can predict the performance of a restorative material (Alani, 1997). Microleakage can be studied by dye penetration method.

In the early 1970s with Brännström and Nyborg⁸, who emphasized the importance of eliminating bacteria remaining on cavity walls, including dentin and enamel, after caries excavation by means of antibacterial agents, and therefore recommended disinfecting the cavity preparation before inserting the restoration⁹. Thereafter, cleaning the cavity preparation with antibacterial agents, to aid in bacterial elimination, began to gain wide acceptance among dental practitioners¹⁰. Multiple disinfectants have been used in clinical dentistry, in an effort to reduce or eliminate bacteria during cavity preparation and prior to the placement of dental restorations.

Hence this study was conducted to evaluate effect of cavity disinfectant on microleakage. The cavity disinfectants used are 2% Chlorhexidine and a herbal disinfectant i.e, Aloe vera.

Aim: To evaluate the micro-leakage of class V cavities using two cavity disinfectants, CHX and Aloe vera.

Inclusion criteria: 20 Non- carious human premolars extracted for orthodontic/ periodontal reasons, straight single rooted teeth

Exclusion criteria: Fractured teeth, Calcified canals, Curved canals

Extracted teeth were scaled to remove debris, calculus, and rinsed with sodium hypochlorite. Standardized class V cavity preparation was carried out on all handpiece under air/water spray. Preparation was carried out according to the following specification.- mesiodistal width of 3 mm, occluso-gingival length of 2 mm and a depth of 2 mm on the buccal surface.



Figure 1: Cavity preparation and standardization

Each preparation was rinsed with distilled water for 20 seconds and dried for 20 seconds. Then the teeth were randomly divided into 2 Groups –A and B (n=15)

GROUP A: 2 % Chlorhexidine based cavity disinfectant, was applied on the cavity walls and on the floor using disposable micro applicators for 40 seconds and excess disinfectant was removed by 5 seconds of light air.

GROUP B: Aloe vera gel, was applied on the cavity walls and on the floor using disposable micro applicators for 40 seconds and excess was removed by 5 seconds of light air.

Teeth were then etched for 20s using 37% phosphoric acid and then rinsed with water for 20s. Bonding agent was applied (manufacturer's instruction) and restored with Bulk-fill composite. Horizontal layering technique for composite was followed, with the incremental curing of each layer using the conventional curing light for 40s. The final layer was contoured and polished using the composite polishing kit. All specimens were stored at room temperature in distilled water for 24h. Teeth were then subjected to thermocycling between 5°C and 55°C for 500 cycles. The dwell time in each bath and the time intervals at room temperature between baths were 20s. Specimens for evaluating microleakage were then sealed with a coating of nail polish, except margins of 1 mm around the restorations and immersed in 2 % methylene blue dye for 24 hr. The teeth were then washed under running water and dried.

Then teeth were sectioned longitudinally in mesio-distal direction with a slow speed diamond disk under continuous water spray. The cut surfaces were then examined under a Stereomicroscope for evaluation of marginal leakage. The dye penetration in the specimens was evaluated for both the occlusal and gingival surfaces based on the graded scoring system.¹

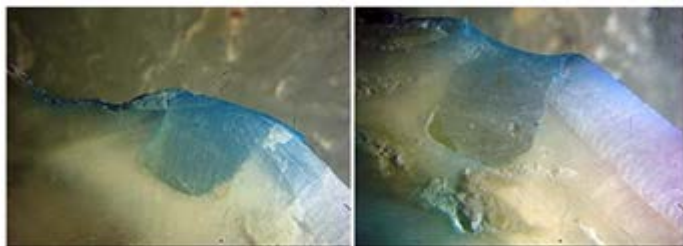


Fig 2: GROUP A-Score 1 GROUP B- Score 2

Table 1: Comparison of Microleakage Scores of Enamel

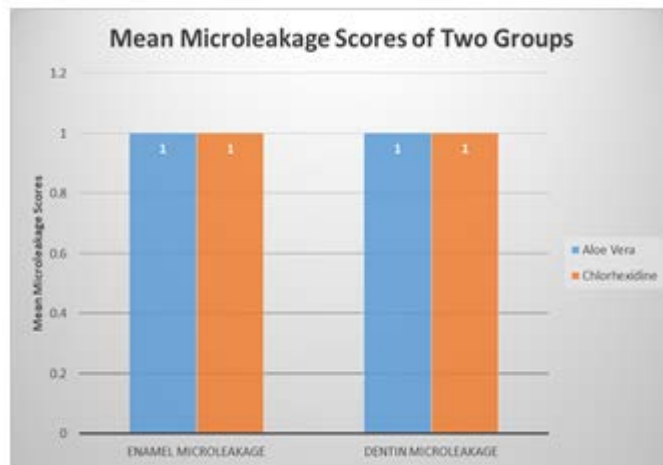
Groups	Mean Rank	Mann Whitney U	P-value
Chlorhexidine	10.75	47.5	0.835
Aloe vera	10.25		

There was no statistically significant difference in the microleakage scores in enamel between the two groups (p=0.835).

Table 2 2: Comparison of microleakage scores of dentin

Groups	Mean Rank	Mann Whitney U test	P-value
Chlorhexidine	10.8	47	0.810
Aloe vera	10.2		

There was no statistically significant difference in the microleakage scores in dentin between two groups (p=0.810)



Graph 1 : Mean Microleakage of Two groups

Discussion

Microleakage has been defined by as “the clinically undetectable passage of bacterial fluids, molecules and/or ions between the cavity wall and the restoration material applied to it.”(Sidhu & Andersen). The application of disinfectants after cavity preparation eliminates potential risks due to bacterial activity^{11,12}.

According to J C Meirs and J C Kresin (1996) chlorohexidine solutions have been found to be effective in reducing the levels of S.Mutans found in occlusal fissures and exposed root surfaces. The use of this product as cavity wash after tooth preparation and before the application of dentine bonding agents could help to

reduce the potential for residual caries and post operative sensitivity. Chlorohexidine has got the potential to stabilize the smear layer turning it from a semi permeable loosely bound layer to more impermeable firmly bound layer thereby decreasing the microleakage¹². Gultz et al (1995) stated that Consepsis solution did not adversely affect the sealing ability as it dissolve the smear layer and incorporate it into the primer, as they demineralize the dentin and envelop the collagen fibers and hydroxylapatite crystals¹³.

Whereas the antimicrobial activity of Aloe vera gel is attributed to its constituent compounds, the most important being the anthraquinones¹⁴. Aloe vera gel has a number of components such as aloin, aloe emodin, aloetic acid, anthracene, aloe mannan, aloeride, antranol, chrysophanic acid, resistanol, and saponin¹⁵. Aloin and aloe emodin possess strong antibacterial and antiviral activities. They inhibit protein synthesis from bacterial cells, thus explaining their antimicrobial activity¹⁶. It is noteworthy that some compounds like anthraquinones and saponin present in Aloe vera gel have direct antibacterial activities while some other components, such as acemannan, have been considered to exert indirect bactericidal activity through stimulation of phagocytosis¹⁷.

Gupta RK et al., in his study observed Aloe vera mouth rinse to be equally effective as 0.2% CHX¹⁸.

Thus, natural agent i.e Aloe vera used here could be effectively used as cavity disinfectant which will help in minimizing secondary caries and rendering a long term restorative success. Further clinical trials are required to support the result of this study.

CONCLUSION-

Within the limitations of the present in-vitro study, it can be concluded that CHX is a potent and gold standard solution for antimicrobial activity, whereas, Aloe vera gel

can be used as a cavity disinfectant thereby embracing the concept of Phytotherapy. However, further scientifically sound clinical research and studies should be carried out to broaden our understanding of various antimicrobial agents, particularly natural agents, in the prevention of dental caries.

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