

Effect of Two Different Cavity Disinfectants on Microleakage in Class II Cavities Restored with Composite Using Eighth Gen Bonding Agent - An Invitro Study

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Abstract: Aim: The aim of the study was to determine and compare the effect of two disinfectants (2% chlorhexidine and 19% EDTA) on gingival microleakage in class II composite restoration using eighth generation bonding agent. Materials and method: Class II cavities were prepared on mesial and distal surfaces of 45 non-carious mandibular molars, resulting in total 90 cavities. All the 90 cavities were rinsed with distilled water and dried with a blast of compressor air. Each 15 samples were assigned to the control group and into two experimental groups. Group I samples were applied with 2% chlorhexidine (Consepsis, Ultra dent) and Group II samples were applied with 19% EDTA (File-Eze Ultra dent, USA). cavity disinfectants were rinsed & dried, dental etch was applied and rinsed off and a coat of G-Premio bond was applied, samples were cured and restored with G-aenial posterior composite. Microleakage was evaluated at the gingival margin using dye penetration method. The sections were examined using stereomicroscope (X30) is scored on a scale of 0-3 is data analyzed using Chi-square test. Results & Conclusion: Group I samples disinfected with 2% CHLORHEXIDINE showed a least microleakage when compared to other two groups.

Keywords: 2% Chlorhexidine, 19% EDTA, G-Premio bond

1. Introduction

Success in operative dentistry depends on total removal of the infected structure and achievement of a good seal. However, the applied procedures for treating caries do not always eliminate all the cariogenic microorganisms in residual tissues^[1]. The bacteria left in the cavity preparation can remain viable for a long duration^[2].

According to Brannstrom, possible sources of infection in a prepared cavity are bacterial microleakage, bacteria present in the smear layer, in dentinal tubules, at the dentino-enamel junction & bacteria recontaminating the prepared cavity prior to placing a restoration^[3]. Therefore, after removal of the carious dentin, it is important to eliminate any remaining bacteria that may be present on the cavity walls, in the smear layer, at the enamel-dentin junction, or in the dentinal tubules^[4].

There has always been much speculation as to what happens to the bacteria sealed in the dental cavities under filling materials. From this speculation controversy has arisen over the need or value of cavity sterilization, the employment of germicidal filling materials, and the importance of removing every trace of carious dentin^[5,3].

The use of disinfectant solutions to cleanse cavity preparations is an alternative to reduce or eliminate bacteria from cavity preparations. Some antibacterial solutions such as: chlorhexidine, sodium hypochlorite, and fluoride solutions have been evaluated, but studies have reported adhesion could be impaired by a series of previous dentin treatments. Results of these invitro studies in permanent teeth are controversial with regard to whether the use of

disinfectants in cavity preparations affect adhesion including chlorhexidine gluconate, disodium ethylene diamine tetra acetic acid dihydrate (EDTA), sodium hypochlorite, Benzalkonium chloride^[1-2-6-7]. The ideal dentin disinfectant should combine the possession of a potent antimicrobial action and should not affect either the bond strength or sealing ability^[1].

The purpose of this study was to evaluate the effect of 2% chlorhexidine cavity disinfectant (Consepsis Ultra dent) 19% EDTA (File-Eze Ultra dent, USA) on microleakage at the gingival margins in cavities restored with eighth generation bonding agent G-Premio bond.

2. Materials and Methods

Forty-five freshly extracted caries free, human permanent mandibular molars were cleaned of debris and were stored in normal saline for a maximum period of one month. Proximal box-only cavities of standard dimensions were prepared on both proximal surfaces in all 45 samples resulting in 90 cavities. The occlusal portion of the preparation had a facio-lingual width of 1.5 mm. The gingival floor of the proximal box was kept 0.8mm-1.0mm below the cemento enamel junction (CEJ) to keep the gingival margins in dentin.

Each preparation was rinsed for 20 seconds with distilled water and dried with a blast of compressed air for 5 seconds. Caution was taken not to over dry the preparation.

The samples were distributed into one control group and two experimental groups, each consisting of 30 cavities. All the cavities were restored as given below.

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Control Group (N=15):

Cavity disinfectant was not used

All the cavities were etched with Dental Etch and rinsed off after 15-20 secs and dried.

A clear plastic matrix strip and tofflemire was placed, according to the manufacturer’s instruction the samples were bonded with One coat of G-Premiobond (light cured dental adhesive) dentin bonding agent using applicator tip and light cured for 20 sec. Then the cavities were restored with G-aenial posterior composite. Each increment of 3mm was cured for 20 secs. Curing was done initially from the occlusal direction and then from the buccal and lingual directions. After curing, the matrix strip was removed and gingival margins contoured with Composite polishing kit (SHOFU)

Group I (N= 15): According to the manufacturer’s instruction the samples were applied with the disinfectant of 2%Cholorhexidine (Consepsis Ultra dent) using an applicator brush tip and allowed to stay in contact with each cavities of the sample for 20 seconds, rinsed and dried. The samples of this group were Restored similar to control group.

Group II (N= 15): According to the manufacturer’s instruction the samples were applied with the disinfectant of 19% EDTA (File-Eze Ultra dent, USA) using an applicator brush tip and left undisturbed for 20 seconds, rinsed with water for 10 seconds and dried with absorbent paper. The samples of this group were Restored similar to control group.

All the teeth were stored in distilled water at 37 °C for 24 hours. The teeth were covered with two coats of nail varnish (Lakme) to within approximately 1.0mm of gingival margin, after the root apices were sealed with sticky wax. The specimens were immersed in methylene blue (3% SDFCL) dye in separate sealable vials at 37 °C for 24 hours. After staining the teeth were rinsed off to remove the residual dye. The radicular parts of the teeth were cut 6mm below the CEJ. Coronal parts were sectioned mesiodistally in the approximate center of the restorations with a diamond disk in a straight air motor hand piece. Microleakage was assessed for gingival margins at X30 magnification by two examiners according to the following scale: (TABLE I)

Score Details

- 0 No dye penetration
- 1 Up to 1/3rd of length of gingival margin
- 2 Up to 2/3rd of length of gingival margin
- 3 Covering full length of gingival margin

The data were submitted for the **chi square test (p < 0.5)** to compare the difference in microleakage scores among different disinfectants with the 8th generation bonding agent and Control group.

3. Data and Results

Since the data had categorical variables, the groups were compared using the proportions of samples with a particular score in each group. Two-way tables of proportions were calculated and used for statistical evaluation using Chi square test (Table I).63.3% of cavities, which were restored using 2% chlorhexidine disinfectant [group I] and 50% of cavities which were restored using 19% EDTA [group II] with 8th generation adhesive system, where appreciated minimal microleakage, but the number decreased to 6.7% with no use of any disinfectants (p<0.001) (Fig.1) and (Fig.2)

Hence, combining the disinfectants with 8th generation bonding agent not only helped in removal of cariogenic microorganisms in the cavity surface also enhanced the sealing ability of the bonding agent, Whereas the microleakage was seen maximum in the control group. This an Invitro study concluded that, 2% Chlorhexidine (Consepsis Ultradent) an established cavity disinfectant in preventing microleakage and was found not to interfere with bonding of composite resin to either dentin or cementum, holds potential to be used as an effective cavity disinfectant prior to restoration with composite resin.

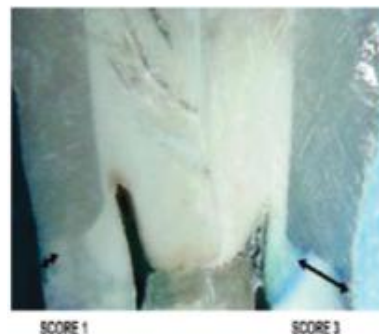


Figure 1: at X30 magnification showing dye leakage scores showing 1 in Group II and Score 3 in Control Group

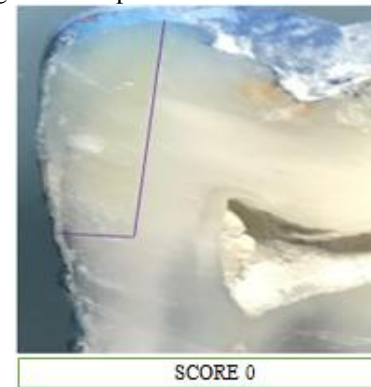


Figure 2: at X30 magnification showing Score 0 in Group I.

Table II: Using Chi-Square test

Comparison of marginal leakage scores between different groups using Chi Square test								
ML Scores	Control		CHX		EDTA		χ ² Value	P- Value
	n	%	n	%	n	%		
Score 0	2	6.7%	19	63.3%	15	50.0%	36.533	<0.001*
Score 1	4	13.3%	6	20.0%	8	26.7%		
Score 2	6	20.0%	3	10.0%	4	13.3%		
Score 3	18	60.0%	2	6.7%	3	10.0%		

4. Discussion

A major cause of secondary caries is the presence of bacteria in the smear layer, after cavity preparation, which can remain viable for long periods of time. An alternative approach to reduce residual bacteria is treatment with a cavity disinfectant. Various cavity disinfectants have been used in the recent past including chlorhexidine, fluoride gels, sodium hypochlorite, and benzalkonium based solutions, but studies have reported adhesion could be impaired by a series of previous dentin treatments. Results of these studies are controversial with regard to whether the use of disinfectants in cavity preparations affects adhesion^[8,9].

This study includes two suitable disinfectants in two subsequent experimental groups such as GROUP I-2% CHLORHEXIDINE (Consepsis ultradent) and GROUP II-19% EDTA (File-Eze, ultradent). With the Universal Bond-G-PREMIO BOND (8th generation) and G-AENIAL POSTERIOR (P-A2) composite resin and one control group where no disinfectants were used. The dental etch is used as an etchant, 8th Generation Dentin Bonding agent (G-Premio Bond) as an adhesive and resin composite G-aenial posterior as a restorative material.

In the present study, class II box preparation were chosen where gingival margins are kept below CEJ. The majority of Class II cavities exhibit cavity margins with gingival wall below the CEJ in both dentine and/or cementum^[10]. Therefore, the cervical margins of restorations will be placed at dentine or cementum surfaces, which may lead to a weaker marginal seal than at the enamel surface^[10,11]. This in vitro study examined the microleakage in “deep” Class II composite restorations with gingival cavosurface margin below the CEJ.

G-Premio Bond is a universal (8th generation) bonding agent that is compatible with total etch, self-etch and selective etch techniques. providing excellent versatility for whichever technique the situation requires or the practitioner prefers. Whereas in this study the G-Premio bond was used with a total etch technique^[12]

According to **Stoleriu et al** Universal bonding agent applied in self-etch strategy which led to lower leakage in the cervical area located in dentine when compared to etch and rinse strategy^[12]. Irrespective of etch and rinse or self-etch strategy of applying, the presence of saliva impaired the enamel or dentine leakage of universal bonding agents. In etch and rinse strategy water is needed to keep the collagen fibril expansion for resin infiltration, but in the same time it has a bad effect on hybrid layer formation, decreases mechanical properties of the interface and lowers the durability of the bonded surfaces. Enzymatic degradation of exposed collagen fibrils and the hydrolysis of the adhesive polymer might appear as a result of uneven stress distribution in the hybridized zones^[12].

In this study, when etch and rinse method was followed, Control group showed highest microleakage when compared to experimental groups.

Group I disinfected with 2% CHLORHEXIDINE (Consepsis Ultradent):

According to **Shafiei et al**^[13,14] CHX acts as a preservative on dentin bonding and showed no adverse effect on immediate bond strength and enamel or dentin leakage. The use of cavity disinfectants after tooth preparation and before the application of dentin-bonding agents could help reduce the potential for residual caries and postoperative sensitivity¹³.

According to the findings of **Meier's and Kresin**^[6,8,15] by scanning electron microscope (SEM), chlorhexidine-treated smear layers (without being rinsed off before bonding)^[6] showed that cavity disinfectants applied to dentin surfaces were resistant to acidic conditioning. This acid - resistant layer might inhibit the ability of the weak acidic Primers to effectively demineralize the dentin and hydrophilic resin to impregnate the dentinal surface^[13].

Gultz et al who had compared the antimicrobial activities of different cavity disinfectants found that Consepsis solution was superior as compared with other cavity disinfectants. Consepsis solution when used with Clearfil SE Bond and Prompt L-Pop demineralize the dentin and envelop the collagen fibers and hydroxyl apatite crystals. The scanning electron microscopic (SEM) observations of their study revealed the presence of resin –tags in the Consepsis treated group^[15].

In studies conducted by **Darabiet al** and **Singla M et al** using 2% CHX with self-etching showed increased in microleakage. Because a pH in Self-etching adhesives have relatively higher than phosphoric acid etchants^[6,10].

In a study conducted by **Carrilho et al** it has been suggested that application of CHX might be useful for the preservation of dentin bond strength in etch-and-rinse adhesive¹⁶.

Group II disinfected with 19% EDTA (File- Eze ultradent):

In a study conducted by **Shafiei et al** concluded that on contraction gap measurement, when the dentin was conditioned with EDTA, gap formation was completely prevented when using a multi-step adhesive. It has been suggested that the contraction gap width increases in conjunction with either reduction in dentin hardness or decalcification through conditioning, especially in the absence of functional monomer in the adhesive. Using EDTA instead of phosphoric acid can improve marginal integrity, as more than 90% of the dentin hardness remains^[17,18].

In our study the 19% EDTA used as a disinfectant in group II, which reduced the maximum microleakage when compared to control group. Whereas it is not as effective as 2% CHLORHEXIDINE (Consepsis Ultradent).

Microleakage Assessment

For evaluation of microleakage, 2% methylene blue dye penetration method was used in this study. Tooth immersion can be used in various types of Dyes (5% eosin, 0.5-2% methylene blue, 0.5-1% black India ink, blue ink, black ink, drawing ink, Procion brilliant blue, 0.5% Rhodamine B, 0.5% fuchsin and others) with regards to dyes, particle

molecule size, pH and chemical reactivity are expected to affect the degree of penetration. A large number of studies use Methylene blue as a dye, because it is an economic, easy to manipulate, has a high degree of staining and a molecular weight is even lower than that of bacterial toxins^[19] and also does not require the use of complex laboratory equipment. Also, the particle size of this dye is less than the internal diameter of the dentinal tubules (1-4 μm), so it is able to show dentin permeability^[19,20]

5. Conclusion

Control Group showed the significant increase in the microleakage values than the group with disinfectants used. This an Invitro study concluded that, 2% CHLORHEXIDINE(CONSEPSISULTRADENT) found to be an established cavity disinfectant in preventing microleakage and was found not to interfere with bonding of composite resin to either dentin or cementum, which holds potential to be used as an effective cavity disinfectant prior to restoration with a composite resin.

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