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A Comparative Evaluation of the Effect of Different Liners on The Microleakage in Class Ii Cavities Restored with Composite Resin – An Invitro Study

Dr. Payal Patel, Dr.Rimil Nayak,, Dr.Chinmay Patel, Dr. Kailash Attur, Dr.Kamal Bagda, Dr. Kiran Vachaani

Dr. Payal Patel: MDS, conservative dentistry and endodontics; Consultant endodontist;
Dr. Rimil Nayak: MDS, conservative dentistry and endodontics Consultant endodontist;
Dr.Chinmay Patel: MDS, conservative dentistry and endodontics; pramukh dental clinic,mahesana;
Dr. Kailash Attur: MDS,Professor, Head; Department of Conservative Dentistry and Endodontics; Narsinhbhai Patel Dental College and hospital, Sankalchand Patel University,Visnagar;
Dr. Kamal Bagda: MDS; Dean,Professor & Head of Department; Department of Conservative Dentistry & Endodontics;Goenka Research Institute of Dental Science;Pethapur-Mahudi Road, Near G.G.S, Piplaj, Gandhinagar- 382610,Gujarat.India
Dr. Kiran Vachaani: MDS, Professor; Department of Conservative Dentistry and Endodontics; Narsinhbhai Patel Dental College and hospital, Sankalchand Patel University,Visnagar; H 404 Shilalekh,NearSubhash bridge, Shahibaug, Ahmedabad,380004

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KEYWORDS
composite, microleakage, glass ionomer cement

ABSRTACT

Introcution : The marginal seal of a composite restoration has long been a challenge to the clinicians. One of the weakest links of Class II cavity preparations restored with composite resin is microleakage at the gingival margin of the proximal box. The absence of enamel at the gingival margin leads to the adhesion of composite materials to cementum / dentin, an unstable substrate.

Aim and Objective: To compare the gingival marginal microleakage in class II cavities restored with composite resin in conjunction with different lining materials by dye penetration study using stereomicroscope.

Materials and method: Twenty freshly extracted intact human maxillary permanent molar teeth were selected for this study To simulate clinical posterior teeth alignment, the molars were mounted on stone jigs with one premolar and one molar each on the mesial and distal sides. Two standardized class II(proximal box) cavities were prepared on the mesial and distal surfaces. The dimensions of the cavities were as follows – buccolingual width 3 mm, width of gingival margin 2mm, occlusogingivally, the cavity was extended to just beyond the cementoenamel junction.

Result: There is high significant difference present in microleakage in various groups. The order of mean microleakage is
Group3>Group4>Group2>Group1

Conclusion: Glass ionomer cement, auto cure (GC IX)used as liner in class II cavities restored with composite resin showed the least microleakage among all other groups and better marginal adaptation.

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INTRODUCTION

The marginal seal of a composite restoration has long been a challenge to the clinicians. This is true especially when cavity preparation extends below cementoenamel junction.[1]

One of the weakest links of Class II cavity preparations restored with composite resin is microleakage at the gingival margin of the proximal box. The absence of enamel at the gingival margin leads to the adhesion of composite materials to cementum / dentin, an unstable substrate (Coli & Brannstrom, 1993; Carvalho & others, 1996). While enamel is almost exclusively an inorganic tissue, dentin is less mineralized and contains more moisture, which can cause variations in adhesion (Eick & others, 1997). In cavities with margins limited to the enamel, the contraction force during setting is counteracted by bond strength of the resin bonded composite to the beveled and etched enamel.[1]

The various factors causing marginal microleakage are dissolution of liners and smear layers, degradation of bonding material or restorative material used, variation between coefficients of thermal expansion of the restoration and the tooth material and varying degrees of deformation upon mechanical loading. To date none of the available resin restoration systems have been reported to provide complete adhesion to cementodentinal walls. Theoretically a closely adapted, non-leaking marginal seal could result from adhesion of the restorative material to tooth structure but clinically, such adhesive bonding is rarely achieved. Even the use of newer generation of bonding agents exhibiting bond strengths greater than 20Mpa and the use of hydrophilic monomers has not eliminated microleakage at cementum and dentin margins.[1,2]

A practical solution would be to place a lining material on the dentin which counteracts the polymerization stresses of resin restorative material either by virtue of its low elastic modulus or by chemical union to the dentin substrate. This study was designed to evaluate the microleakage phenomenon at tooth restoration interface extending below cementoenamel junction when posterior composite restorations were placed directly in the cavity or when various lining materials were used in conjunction with the composite restorative materials.

AIM AND OBJECTIVE

The aims and objectives of the present study are:

1. To compare the gingival marginal microleakage in class II cavities restored with composite resin in conjunction with different lining materials by dye penetration study using stereomicroscope.

MATERIALS AND METHOD

Twenty freshly extracted intact human maxillary permanent molar teeth were selected for this study. All the selected teeth were scaled, cleaned of debris and examined so that they were free from decay or cracks.

Armamentarium

· Airotor handpiece
· Burs
· Diamond disc
· Tofflemire retainer and matrix bands
· Wooden wedges
· Plastic instrument
· Light cure unit
· Paper pad and spatula

Materials used

· Etchant gel (Total Etch, 3M ESPE-Filtek™ Z350 XT)
· Bonding agent (3M ESPE-Filtek™ Z350 XT)
· composite resin (3M ESPE-Filtek™ Z350 XT)
· Flowable composite resin (3M ESPE-Filtek™ Z350 XT)
· Glass ionomer cement, auto cure (GC IX)
· Light cure calcium hydroxide (calci LC)

Methodology

To simulate clinical posterior teeth alignment, the molars were mounted on stone jigs with one premolar and one molar each on the mesial and distal sides. Two standardized class II(proximal box) cavities were prepared on the mesial and distal surfaces. The dimensions of the cavities were as follows – buccolingual width 3 mm, width of gingival margin 2mm, occlusogingivally, the cavity

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was extended to just beyond the cementoenamel junction.

The cavity preparations were accomplished by diamonds and carbide burs and the finished cavities were rinsed with water. The cavity preparations were tightly sealed with a metal matrix and wooden wedges. The teeth were randomly divided into four experimental groups, with five teeth in each group according to the materials to be used for their restoration.

Group I : Restoration with 3M ESPE-Filtek™ Z350 XT composite resin without any lining material (control group)

Group II: 3M ESPE-Filtek™Z350 XT Flow flowable composite resin used as a liner followed by restoration with 3M ESPE-Filtek™ Z350 XT composite resin.

Group III: GC IX autocure glass ionomer cement used as a liner followed by restoration with 3M ESPE-Filtek™ Z350 XT composite resin.

Group IV: Light cure calcium hydroxide used as a liner followed by restoration with 3M ESPE-Filtek™ Z350 XT composite resin.

MAXILLARY MOLAR TEETH

TEETH MOUNTED ON STONE JIG

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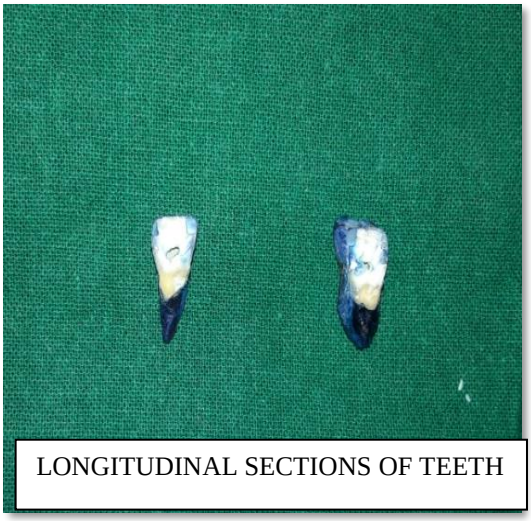
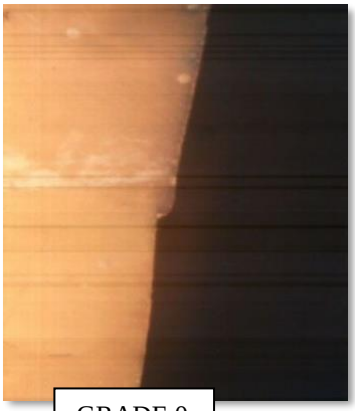


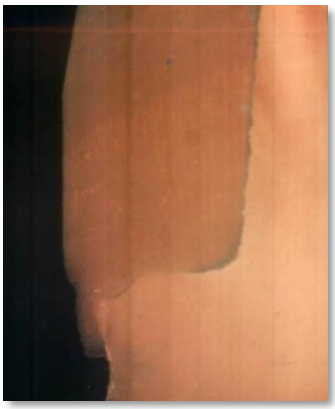
LONGITUDINAL SECTIONS OF TEETH



GRADE 0

GRADE 1

GRADE 2



GRADE 3

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RESULT

The gingival microleakage score for Group I, II, III, IV are shown(grade) in table Specimen No. Group I Group II Group III Group IV Table

Specimen No.	**Group I**	**Group II**	**Group III**	**Group IV**
1	3	1	1	1
2	3	2	0	1
3	2	1	1	1
4	3	2	1	2
5	3	2	0	1

DISCUSSION

Marginal integrity is an integral component of any restorative procedure. Restoring cervical lesions with resin composites has always been a problem, especially where no enamel is present for adequate bonding to the gingival margin. The higher organic component, tubular structure, fluid pressure and the lower surface energy of dentin make bonding to dentin more difficult than to enamel.

There are many experimental studies which have explored various aspects of dentin bonding. However few addressed one of the most critical parts of this interaction, that is at the dentinal or cementum margins. Ferrari and Davidson (1996) and Ferrari and others (1999) in their experimental study, described the existence of an outer layer of 200 – 300 microns thick at the cemento enamel junction margin. It was not identifiable as sound dentin and it was covered by a thin layer of cementum. A well – defined hybrid layer was not formed and the presence of resin tags were rare. This layer was considered hypo-mineralized and hyper – organic. They explained that this layer may affect the quality of bonding and could be the factor for the existence of moderate to severe leakage found in this study.[3]

A major disadvantage of resin – based materials is polymerization shrinkage that causes gap formation and microleakage. microleakage is defined as the passage of bacteria, fluid, molecules or ions between the cavity wall and the restorative material. (Kidd 1976). Microleakage primarily results in postoperative sensitivity, marginal staining, recurrent caries and in some cases loss of the restoration may also occur.[4]

In this study is to evaluate the gingival microleakage of class II cavities with the gingival margin apical to the cementoenamel junction restored with composite resin using various liners and bases. The experimental groups consisted of fifteen extracted human molars. To simulate clinical conditions the teeth were mounted on stone jigs. Class II box only cavities were prepared keeping the gingival floor apical to the cementoenamel junction.

the composite could only be light cured from the occlusal surface. As a result, polymerization

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shrinkage is directed away from the gingival margin of the preparation.[5,6]

Many studies have shown poor transmission of light through the reflecting wedges (Ciampain and other, 1974) so, in this study wooden wedges were used.[5] Assessment of microleakage is usually determined by dye penetration tests In the absence of clinical data, laboratory microleakage studies are an acceptable method to evaluate the adequate marginal adaptation of adhesive restorative materials.[3]

Cavities were restored with 3M ESPE-Filtek™ Z350 XT composite resin showed the highest microleakage in compared to other group. Than the flowable resin (3M ESPE-Filtek™ Z350 XT) liner shown greater microleakage as compared to glass inomer liner The polymerization shrinkage of the flowable composite it shown greater microleakage scores. The poor results with flowable resin could also be due to the utilization of occlusal irradiation leading to sub polymerization of cervical segment, mainly at its inner part resulting in poor adhesion

The group using autocure glass ionomer cement(GC IX) as liner showed better marginal adaptation than the flowable composite resin(3M ESPE-Filtek™ Z350 XT) and Light cure calcium hydroxide (calci LC) group. glass ionomer as a bonding mechanism between dentin / cementum and composite resin has been studied over recent years and has been shown to a high level of reliability along with tissue biocompatibility. It relies on the continuous presence of water for stability and the question of hydrolytic breakdown does not arise[7.] However, the setting shrinkage of the composite resin exerts considerable stress, and thus only the strongest glass ionomer can be relied upon to produce a sound ionic bond with dentin and cementum.[7]The group using light cure calcium hydroxide (calci LC) as liner showed better result than the flowable composite resin(3M ESPE-Filtek™ Z350 XT) and less result than glass ionomer cement(GC IX) because after adaptation there is a polymerization shrinkage and disintegration occur.

CONCLUSION

- Glass ionomer cement, auto cure (GC IX)used as liner in class II cavities restored with composite resin showed the least microleakage among all other groups and better marginal adaptation.
- Composite resin (3M ESPE-Filtek™ Z350 XT) alone used for restoration showed the highest microleakage and poorer marginal adaptation.

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