



## GINGIVAL MICROLEAKAGE OF CLASS II RESIN COMPOSITE RESTORATIONS WITH FIBER OPTIC CABLE AS INSERTS. IN VITRO STUDY.

### Dental Science

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### ABSTRACT

**Introduction:** This investigation evaluated the effect of fiber optic cable as inserts on the microleakage of class II composite restorations with gingival margins on root surfaces.

**Methods:** 24 maxillary 1st premolar freshly extracted for orthodontic reasons were & mounted in acrylic bases. Class II slots cavities were prepared on both proximal sides (3 mm wide, 1.5 mm deep) with gingival margins on the root surface & then divided into 4 groups. Group I & II – 5th generation bonding agent (Primer & bond NT, Densply) with & without fiber optic inserts respectively. Group III & IV – self etching adhesive agents (Clearfil SE bond, Kuraray) with & without fiber optic inserts respectively. Z 350 (3M), posterior composite resin was restored incrementally & cured with LED light (Smartlite Dentsply). The teeth were then stored in 37 deg c distilled water for 2 weeks & thermocycled for 3000 cycles (5 deg c & 55deg c). The tooth surfaces were sealed with nail polish except at the restoration margin & immersed in 0.5% methylene blue for 5 hrs. The dye penetration was assessed with the help of stereomicroscope at 80x magnification.

**Results:** In Group I & III, microleakage scores were less when fiber optic inserts were used. Group III & IV specimen showed lesser microleakage in comparison with group I & II.

**Conclusion:** Microleakage was significantly less ( $p < 0.05$ ) when fiber optic inserts were used irrespective of bonding agents.

### KEYWORDS

#### INTRODUCTION

Esthetics has been a prime consideration in restorative dentistry which is always associated with anterior tooth restoration. However with increased awareness towards esthetics and advancement in materials the use of composite resin is extended to posterior teeth which is all most on the verge of replacing amalgam in day to day clinical practice. However, as we know the major drawbacks associated with composite resin is polymerisation shrinkage which leads to 1) Microleakage, 2) Recurrent caries 3) Post operative sensitivity<sup>2,3,4</sup>. Here is an attempt that is made to reduce microleakage by incorporating the fiber optic cables as inserts. Fiber optic cable works on total internal reflection enhancing the depth of cure and replaces part of the composite increment at the gingival margin, resulting in decrease in the overall volumetric shrinkage of the composite.

#### AIM OF THE STUDY

The purpose of this study was to determine the effect of fiber optic inserts on reducing the marginal gap in class II resin composite restoration with gingival margin on the root surface. This was achieved through determining the microleakage scores along the tooth/restoration interface when 2 types of bonding agents were used. 1) Clearfil S<sub>3</sub> bond & 2) Prime & Bond NT.

#### MATERIALS & METHODS

1) Etchant, 2) Brush, 3) Z350 composite, 4) Clearfil S<sub>3</sub> bond, 5) Primer & Bond NT, 6) Fiber optic cable, 7) Smartlite L.E.D 8) Tofflemire band & retainer, 9) Low fusing compound

Forty Eight freshly extracted premolars for orthodontic reasons were selected. First they were cleaned with periodontal scalers & rotary brushes. Next, the molars mounted on acrylic base 2mm below the CEJ

& stored in distilled water in a refrigerator until restoration. CLASS II slot cavities were prepared on mesial and distal proximal surfaces. These teeth with prepared cavities were randomly divided into 4 groups -Group I & Group II : 5th generation bonding agent Primer & Bond NT was used with & without fiber optic inserts respectively. Group III & Group IV : Self etching adhesive agent Clearfil s3 Bond with & without fibre optic inserts respectively. A Universal metal matrix band/retainer (Tofflemire) was placed, supported externally by applying Low –fusing compound. The predetermined bonding agents assigned to each group were applied according to manufacturer's instructions & cured for 20 sec. Cavities without fiber inserts were used as control. Z 350 (3M) posterior composite resin were placed incrementally 2mm layer & cured with L.E.D light for 40 secs. (Smartlite Dentsply). Stored in distilled water at 37 deg C for 2 weeks. Thermocycled for 3000 cycles between 5 deg C & 55 deg C with a 30secs dwell time. To prevent dye penetration in areas other than the exposed margins, the teeth were sealed with nail varnish within 1mm short of the tooth restoration margins. The samples were immersed in 0.5% methylene blue dye for 5 hours at 37 deg

#### Preparation for microleakage test:

Before sectioning, the teeth were rinsed with water overnight to remove the superficial dye. Each tooth was sectioned mesiodistally with sintered diamond disc. Each section was then inspected under a Steromicroscope at 80X magnification. Each section was then inspected under a Steromicroscope at 80X magnifications. The staining along the tooth restoration interface was recorded according to the following criteria:

- 0 – No evidence of dye penetration at tooth/restoration interface.
- 1 – Dye penetration along the interface half the depth of the cavity.
- 2 – Dye penetration to full depth of the cavity but not involving the

axial wall.  
3– Dye penetration along the axial wall.

**RESULTS**

The mean & standard deviations of microleakage scores for all groups are presented in Table 1. Generally specimens from groups with inserts had lower scores than the control groups ( without inserts ). In particularly clearfil SE Bond produced the lowest degree of microleakage among the two adhesives and among all groups, those with glass fiber inserts had the most consistent results.

**STATISTICAL ANALYSIS-**

The student t-test (unpaired) revealed significant difference in mean microleakage scores among the groups. (P < 0.05).Group I (fig1) and III (fig 3) shows microleakage scores less compared to group II (fig 2) and IV(fig 4) respectively. (P<0.05).

Group I show representative tooth sections belonging to groups with 2 adhesives . The restorations without inserts had microleakage along the gingival floor / restorations interface with some dye penetration through the dentinal tubules towards the pulp.

**DISCUSSION-**

Microleakage of composite restoration occurs due to stresses placed along the tooth/restoration interface from polymerization shrinkage, temperature fluctuations in the oral cavity & through repetitive masticatory loading.<sup>1,6</sup> Contaminants infiltrate through the formed gap, with subsequent sequela, such as post-operative hypersensitivity & recurrent caries, which may warrant restoration replacement.<sup>7,8</sup> Previous studies reported that composite restorations showed relatively greater microleakage at the gingival rather than the occlusal margins.<sup>4,7</sup> The most of this phenomenon is likely cause for polymerization contraction characteristics including shrinkage towards the center of the restoration , towards the stronger enamel-composite joint & towards the light source „The magnitude of contraction may be so great that water sorption & stress relaxation cannot compensate for it.<sup>10</sup> When fiber inserts are placed at the gingival margins of class II composite restorations, they enhance the quality of the marginal area in two ways, First, the fibers replace part of the quality of the marginal area in two ways. First, the fibers replace part of the composite increment at this location, resulting in a decrease in the overall volumetric polymerization contraction of the composite.

Second, the fibers assist the initial increment of composite in resisting pull-away from the margins toward the curing light. The fibers also may have a strengthening effect of Composite margins, which may increase resistance to dimensional change or deformation , which occurs during thermal & mechanical loading & hence improve marginal adaptation.<sup>11</sup> For light- polymerization of the first increment placed in the depth of the deep slot cavity preparation configuration used in this study is challenging. The light must travel approx 4mm before it reaches the surface of the first composite increment. However, the light unit used in this study produced light with high power density & as a result would be expected to sufficiently polymerize the first increment in the depth of the cavity. Thermocycling aims to thermally stress the adhesive joint at the tooth/ restoration interface. The effect of thermocycling on resin composite restoration is controversial composite restoration showed relatively greater microleakage at the gingival dentin. Etching adhesive, was reported to have superior bonding than the occlusal margins. The effect of thermocycling on resin composite restorations has a significant effect on microleakage, especially when the gingival margin of the preparations are located in dentin.<sup>12</sup> In the current study , all specimens were subjected to 3000 cycles, which equates to an no of years of intraoral Thermocycling .Three sited light curing tech was developed using Light transmitting wedge( Lutz E, Quint Inter ;1986 ). A Transparent, cone shaped light tip was developed.( Miller MB, J of Esthetic dentistry; 1996.The two bonding agents used in this study represent 2 current systems. Clearfil SE Bond, a two step self - etching adhesive was reported to have superior bonding to Dentin.

**CONCLUSION**

FIBRE OPTIC INSERTS replaces part of the composite increment at the gingival margin , resulting in decrease in the overall volumetric shrinkage of the composite.Fiber optic cable works on total internal reflection enhancing the depth of cure In this study groups with fiber optic inserts showed significantly lesser microleakage than those without fiber optic inserts irrespective of the bonding agent used.In this

study groups with fiber optic inserts showed significantly lesser microleakage than those without fiber optic inserts irrespective of the bonding agent used.

**Fig 1**

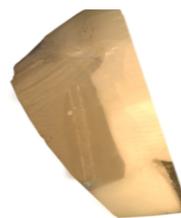


**PRIMER & BOND NT WITH FIBRE OPTIC INSERTS**

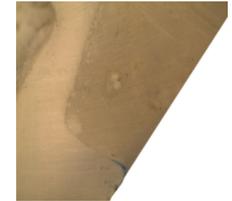
**Fig2**



**PRIMER & BOND NT without FIBRE OPTIC INSERTS**



**Fig 3 : CLEARFIL S3 BOND WITH FIBER OPTIC INSERTS**



**Fig 4 CLEARFIL S3 BOND WITHOUT FIBER OPTIC INSERTS**

**Table 1- Microleakage scores distribution among the test groups with means & standard deviation.**

GRP	NO	0	1	2	3	M	SD
GRP1	12	0	8	4	0	1.33	0.47
GRP2	12	0	3	8	1	1.83	0.55
GRP3	12	3	8	1	0	0.83	0.55
GRP4	12	1	6	5	0	1.33	0.62

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