COMPARATIVE STUDY OF MICROLEAKAGE OF THREE DIFFERENT FLOWABLE RESTORATIVE MATERIALS AND LIGHT-CURE GLASS IONOMER CEMENT IN CLASS V CAVITIES: AN IN-VITRO STUDY

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In vitro study was done to compare the sealing ability of 3 Flowable restorative materials (Flowable composite, Flowable compomer, Flowable ormocer) and a Light cure Glass-ionomer cement in class V cavities at occlusal and gingival margin after 24 hrs of dye immersion. Standardized class V cavities were prepared on the buccal aspect of forty extracted premolars. These 40 teeth were divided into 4 main groups. Group A (Flowable ormocer), Group B (Flowable compomer), Group C (Flowable composite) and Group D (Light cure Glass-ionomer cement). The samples were then sectioned bucco-lingually through the centre of restoration and examined under stereomicroscope for dye penetration. Flowable ormocer showed least microleakage of all the material at occlusal and gingival margin after 24 hrs of dye immersion. Light cure Glass-ionomer cement showed the maximum microleakage and least sealing ability of all the materials. Flowable ormocer with best sealing ability can be advocated for class V situations.

Keywords: Flowable Compomer; Flowable composite; Flowable ormocer; Light Cure GIC.

The interest in esthetic dentistry has escalated considerably in recent years. Tooth colored restorative materials like composite resins and light-cure glass ionomer cement have been responsible for the advancement of esthetic dentistry. (1)

One of the challenges with Class V cavities is microleakage at the gingival margin located in dentin. Microleakage can cause hypersensitivity, tooth discoloration, recurrent caries, pulpal injury and accelerated deterioration of restorative material. (2) Over the years, dental materials have been modified to provide dentists and their patients with improved esthetics and better marginal seal. Flowable microhybrid composite resin has been developed in an effort to meet the needs of a number of restorative procedures. (3) They have many characteristics similar to conventional composite materials. These materials are highly polishable and have a low modulus of elasticity. (4) Widely used Glass ionomer cement's physical properties deteriorate due to moisture contamination and dehydration during setting. (5) To overcome these short comings, modified glass ionomer were introduced which contain glass ionomer components and a light cured resin. Another restorative material is compomer which has the advantages of both the Glass ionomer cement and light cure composites with improved physical properties and is advocated for class V situations.

A major breakthrough was made in 1999, with the advent of ORMOCERS (organically modified ceramic), a universal material for aesthetic restoration consisting of prepolymerized molecules which forms a matrix of inorganic- organic co-polymers. The rigid ormocer co-polymer molecules also result in specifically low shrinkage and perfect seal. (6) Therefore, this study was undertaken to compare microleakage of three different flowable restorative materials and a light cure Glass ionomer in class V Cavities at both the occlusal and gingival margins.

MATERIALS AND METHOD

Forty extracted premolars free of caries, restorations and fractures were taken.

The teeth were cleaned of debris and calculus and stored in normal saline at room temperature till

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the period of study. Standardized class V cavities were prepared on buccal aspect at gingival third of all the premolar teeth with straight fissure diamond bur in high speed handpiece.

GROUPING OF SAMPLES

The total 40 premolar were divided into 4 main groups of 10 teeth each.

Group A- Flowable Ormocer – Admira flow (Voco, Germany)

Group B- Flowable Compomer – Dyract flow (Dentsply)

Group C- Flowable Composite – Filtek Z 350 flow (3M ESPE, U.S.A)

Group D- Light cure Glass Ionomer Cement – Fuji II LC (GC America)

RESTORATION OF THE SAMPLES: According to the manufacturer instructions, in **Groups A, B & C**, the enamel and dentin walls of the preparation were etched for 15 seconds with 35% phosphoric acid, washed thoroughly with water for 15 seconds and blot moist with a sterilized endodontic absorbent points and then respective bonding agent was applied and cured for 20 seconds.

In Group A- Flowable ormocer, **In Group B-** Flowable compomer and **In Group C-** Flowable composite was injected into the cavity and light cured for 20 seconds.

In Group D- Cavities were conditioned with 10% polyacrylic acid for 20 seconds using a cotton pellet followed by thorough rinsing with water. Dry blotting was done with a cotton pellet or gently with an air syringe. The light cure glass ionomer was adapted into the cavity and light cured for 20 seconds.

The restored teeth were subjected to 200 thermocycles between two baths at 5degree and 55 degree. The immersion time in each bath was one minute and time of transfer between baths was 10 seconds. Specimens were then prepared for dye exposure. The apices of the teeth were occluded with self-cure resin and then two coats of nail polish were applied up to 1mm from the restoration margins, then were placed in 2% basic fushin for 24 hours to allow for dye penetration into possible existing gaps.

After 24 hrs specimens were taken out from the dye and rinsed until all dye was removed from the surface. Specimen were then sectioned in bucco-lingual direction through the center of the restoration with the diamond disc and examined under a stereomicroscope to measure the depth of dye penetration into occlusal and gingival walls of class V cavity.

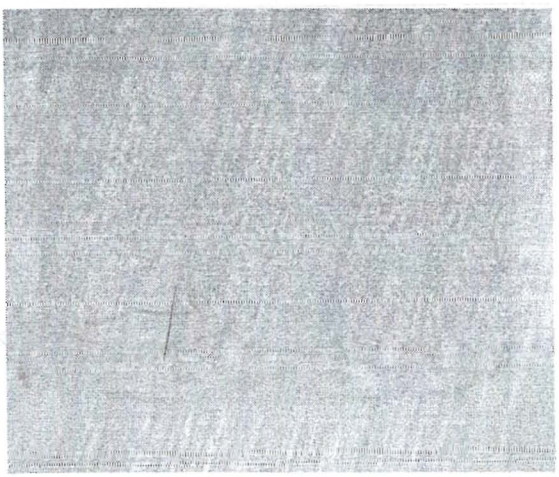


Fig. 1: Showing no penetration of dye (Score 0)

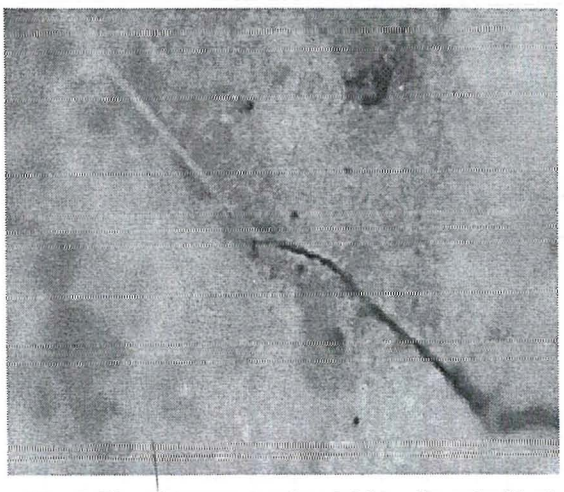


Fig. 2 Showing penetration of dye along half of the gingival wall (Score – 1)

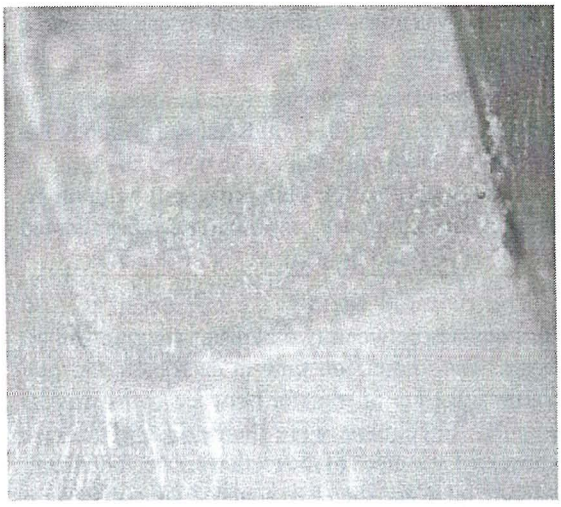


Fig. 3: Showing penetration of dye along

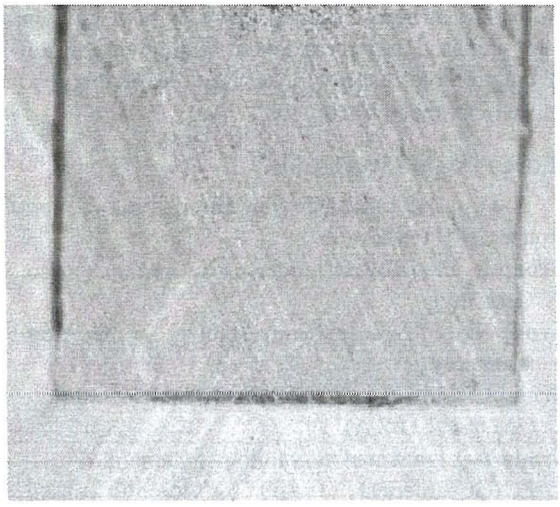


Fig. 4: Showing penetration of dye along whole of the gingival wall but not axial wall (Score- 3) involving the axial wall (Score- 2)

RESULTS AND OBSERVATIONS

The microleakage scores at the occlusal or gingival wall of the tooth and restoration interface were measured as:

Score 0 – No dye penetration (Fig. 1)

Score 1 – Dye penetration along half of the occlusal or gingival wall (Fig. 2)

Score 2 – Dye penetration along whole of the occlusal or gingival wall but not involving the axial wall (Fig. 3)

Score 3 – Dye penetration along axial wall (Fig. 4)

Results were subjected for statistical analysis. Mean & Standard deviation of all the groups and t test for intergroup comparison at both occlusal and gingival margins were done.

From this scoring (Table-I), it can be stated that Flowable ormocer showed least microleakage followed by Flowable compomer followed by Flowable composites and finally by Light-Cure Glass Ionomer at the gingival wall.

TABLE 1: Micro leakage scores of Groups at the occlusal & gingival margins with mean and standard deviation after 24 hrs of dye immersion

			MICROLEAKAGE SCORES								
			OCCLUSAL				GINGIVAL				
		0	**1**	**2**	**3**	Mean±S.D.	**0**	**1**	**2**	**3**	Mean±S.D.
A	10	10	0	0	0	0±.33	9	1	0	0	.1±.316
B	10	9	1	0	0	0.1±.316	7	3	0	0	.3±.48
C	10	9	1	0	0	0.1±.316	0	2	3	5	2.3±.82
D	10	8	2	0	0	0.2±.42	0	2	3	5	2.3±1.60

TABLE 2: Inter-Group comparison at Occlusal and Gingival margin

Under group comparison	t (cal.) at Occlusal margin(P>.05)	t (cal.) at Gingival margin(P>.05)
A&B	.709	1.12
A&C	.709	7.92
A&D	1.20	4.47
B&C	0	6.89
B&D	1.20	8.84
C&D	.613	0

In intergroup comparisons calculated t value for all inter-groups were less than 2.10. Therefore, p value at > .05. Table no. 2 shows there was statistical significant difference between:

- **flowable ormocers and flowable composites,**
- **flowable ormocers and LCGIC**
- **flowable compomers and flowable composites** and
- **flowable compomers and LCGIC**

at the gingival margin but there was no statistical significant difference among groups at occlusal margin.

DISCUSSION

The complex morphology of class V cavities with margins partly in enamel and in dentin presents a challenge for a restorative material. The problems are volumetric shrinkage of resin composites (7) and the leakage. Leakage that occurs at the gingival margin in dentin is due to high organic component of dentin, variation in the degree of mineralization and outward fluid movement.

In this study, flowable ormocers showed the best results at the occlusal and gingival margins of class V cavities. Unlike conventional polymers, ormocers have an inorganic backbone silicon dioxide and are functionalized with polymerizable organic units to produce 3-Dimensional compound polymers. They undergo considerably less shrinkage than composites or compomers. (8) It adapts well to the cavity, helps to avoid air pockets and accelerates the filling procedure. It has higher percentage of filler volume, which might explain its lower microleakage as compared to all the materials taken in the study. This is in accordance with **M M Stavridakis et al** (9) and **David Allian Gerdolle et al** (10).

A further explanation as concluded by **Michael Rosin et al** (11) in their study is the bonding agent supplied with ormocers contains special adhesive ormocers with calcium complexing functionality that enhances the bond strength on the tooth structure.

In this study, flowable compomers showed less microleakage as compared to flowable composite and light-cure Glass ionomer. As confirmed by study done by **Qingshan** (12) that flowable compomers have low modulus of elasticity, low surface tension and increased flexibility to dissipate the stress of polymerization shrinkage in comparison to flowable composite and light cure Glass ionomer cement. However, flowable composite showed better results than light cure Glass-ionomer cement but greater microleakage than flowable compomers and flowable ormocers. The reason for more microleakage in composites is the polymerization shrinkage that occurs during setting.

Study done by **Xie H. Zhang et al** (13) showed flowable composite and compomer provided stronger dentine bond strengths and better margin sealing than the conventional glass ionomer cement.

Therefore, from the parameters of the study, it can be stated that flowable ormocers exhibited the least microleakage and best sealing ability at the occlusal and gingival margins of class V cavities after 24 hrs of dye immersion.

Microleakage especially at the gingival margin of Class V restoration can be the "Achilles Heel" of restorative dentistry. So, further investigations are needed to explore the sealing ability of flowable restorative materials and light-cure glass ionomer in Class V situations under in-vivo conditions.

CONCLUSION

Flowable ormocers showed least microleakage and best sealing ability at both occlusal and gingival margin as compared to different flowable restorative materials and light-cure glass ionomer cement in class V cavities after 24hrs of dye immersion.

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(Continued from Page 211)

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