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Original Article

Comparative analysis of microleakage with commonly used restorative materials for primary teeth

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***ABSTRACT*:**
Background: Restorative dentistry, in its infancy was dominated by the simple principle of "extension for prevention" laid down by G.V. Black and which was partially dictated by the restorative materials available at that time. Microleakage is observed to be one of the most frequently encountered problems with respect to the posterior resin restorations. Achieving a micromechanical and biomechanical bond between the tooth-restoration interface is marked as a standard procedure for an ideal restorative technique. **Aim of the study:** To compare the microleakage with three commonly used materials for restoration of primary molars. **Materials and methods:** The study was conducted in the Department of Pedodontics in Divya Jyoti College Of Dental Sciences And Research, Modinagar. For the study, we collected 60 extracted non carious deciduous molar teeth. The collected teeth were cleaned using hand instruments and were stored in normal saline solution at room temperature. The teeth were grouped into three groups, Group A, Group B, and Group C. The teeth in group A were restored with colored compomer, in group B were restored with Giomer, and in group C were restored with resin modified glass ionomer cement. Then, restored teeth were prepared for dye exposure to check the marginal leakage of restorations. **Results:** We observed that the highest frequency of score zero was seen in group A, followed by group B, and then group C. Score three was seen with one sample each of group B and group C. **Conclusion**: From the results of present study, this can be concluded that restoration of deciduous molars with colored compomer would be more long lasting because of minimal marginal leakage seen with the material.
Key words: Resin, Primary molars, Restoration, Microleakage.

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INTRODUCTION:

Restorative dentistry, in its infancy was dominated by the simple principle of "extension for prevention" laid down by G.V. Black and which was partially dictated by the restorative materials available at that time. The only materials available at that time were amalgam and gold. These materials were unaesthetic and were incapable of forming any chemical bond with the tooth structure.[1, 2] The boom in the aesthetic dentistry came with the advent of dentin adhesives.The choice of materials for restoring the primary molars is very expansive and complex. The only available options several years ago were limited to silver amalgam or stainless steel crowns, whereas, today, there are numerous materials. Available since 1993, compomers were evolved from composite materials, developed as a need for new materials that could replace silver amalgam. Compomers or polyacid modified composite resins are direct light-cured restorative materials.[3] They possess some properties in common with glass ionomer cement and others with hybrid composites. Microleakage is observed to be one of the most frequently encountered problems with respect to the posterior resin restorations. Achieving a micromechanical and biomechanical bond between the tooth-restoration interface is marked as a standard procedure for an ideal restorative technique.[4] Efforts have been made to decrease this problem associated with resin restorations. This includes various techniques for light polymerization for the reduction of the amount of resin

volumetric shrinkage, reducing the C-factor, and following strategic incremental placement techniques which result in the reduction of the residual stress at tooth-restoration interface.[5, 6] Hence, the present study was planned to compare the microleakage with three commonly used materials for restoration of primary molars.

MATERIALS AND METHODS:

The study was conducted in the Department of Pedodontics in Divya Jyoti College of Dental Sciences And Research, Modinagar. For the study, we collected 60 extracted non carious deciduous molar teeth. The collected teeth were cleaned using hand instruments and were stored in normal saline solution at room temperature. The teeth were grouped into three groups, Group A, Group B, and Group C. We prepared class I cavities on the teeth using round bur, straight bur and inverted cone bur. The depth of the cavity was kept at 1.0-1.5 mm for all the teeth. The teeth were restored using manufacturer's instruction. The teeth in group A were restored with colored compomer, in group B were restored with Giomer, and in group C were restored with resin modified glass ionomer cement. The prepared cavities were cleaned with water spray and air spray before restoring with material. After completing the restoration, the restorations were polished. The teeth were kept for 24-48 hours after restorations. Then, restored teeth were prepared for dye exposure to check the marginal leakage of restorations. The teeth were covered with nail varnish except for area about 2 mm from the periphery of restoration. To avoid leakage of materials from root apices, they were occluded with modeling wax. After preparation of the teeth, they were kept in dye solution for 24 hours at room temperature. The teeth were removed from the solution after 24 hours and were cleaned thoroughly. After cleaning of the teeth, buccolingual sections of each teeth were prepared cutting through center of restoration.
The buccolingual sections were viewed under microscope to determine the microleakage scores.

The following scoring criteria are used:
0— No dye penetration
1— Dye penetration between the restoration and the tooth into enamel only
2— Dye penetration between the restoration and the tooth in the enamel and dentin.
3— Dye penetration between the restoration and the tooth into the pulp chamber.

The results were tabulated and subject to further statistical analysis.

The ethical clearance for study protocol was obtained from ethical committee of the institution. The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

RESULTS:

Table 1 shows the comparison of microleakage scores in different groups. We observed that the highest frequency of score zero was seen in group A, followed by group B, and then group C. Score three was seen with one sample each of group B and group C. Fig 2 shows the mean microleakage score of different restorative materials. The lowest mean microleakage score was seen in group A. {fig 1 and 2}

Table 1: Comparison of microleakage scores in different groups

Groups	Microleakage scores				Mean score
	0	1	2	3	
Group A	18	1	1	0	0.15
Group B	15	3	1	1	0.4
Group C	13	5	1	1	0.5

Figure 1:

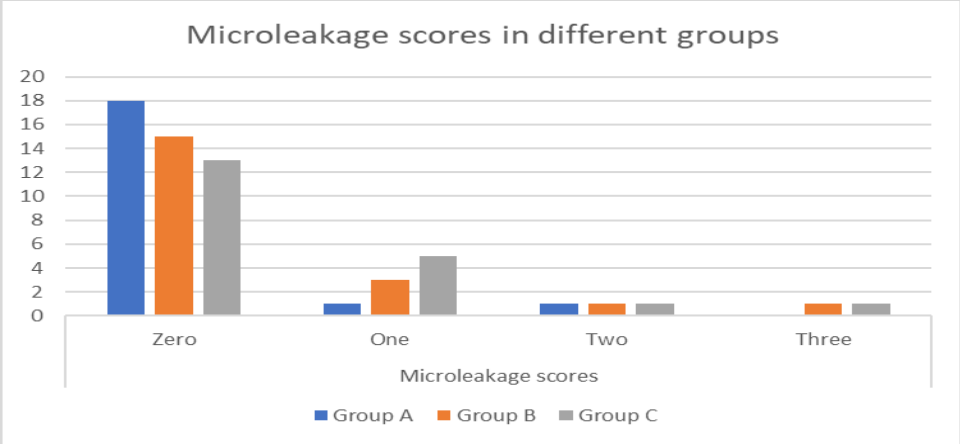
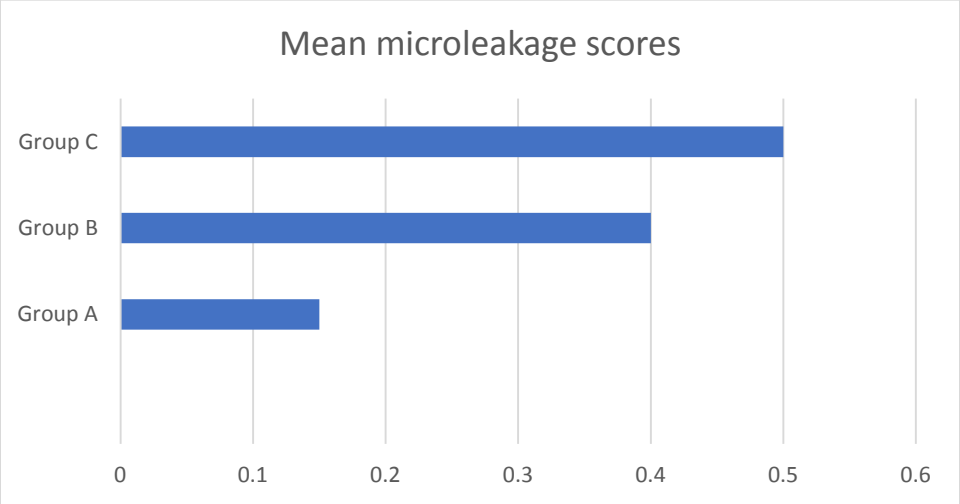


Figure 2:



DISCUSSION:

In the present study, we studied the microleakage of three commonly used restorative materials in deciduous teeth. We observed that teeth restored with colored compomer had least microleakage as compared to teeth restored with Giomer and resin modified glass ionomer cement. However, none of the restorative materials were seen to be totally failure. These materials can be used effectively for restoration of deciduous teeth. Results were observed to be statistically non-significant. Results were compared to previsou studies and were found to be consistent, Omidi BR et al compared the microleakage of Class II (box only) cavity restorations with ACTIVA Bioactive Restorative Glass, resin-modified GI (RMGI), and composite in primary molars. A total of 65 primary molars with at least one intact proximal surface were selected in this in-vitro study. After debridement of each tooth, Class II (box only) cavities were prepared. Based on the type of the restorative material and the application of etching and bonding adhesives, the samples were categorized into five groups: (1) composite; (2) RMGI (Fuji II LC)+conditioner; (3) RMGI (Fuji II LC); (4) enhanced RMGI (ACTIVA Bioactive Restorative Glass)+etching/bonding; and (5) ACTIVA Bioactive Restorative Glass. Resin-based composite (RBC) Z250 showed the least microleakage, while RMGI showed maximum microleakage at axial walls. The mean degree of microleakage at gingival margins was the lowest in RBC Z250 and ACTIVA+etching/bonding groups and the highest in RMGI+conditioner and RMGI groups. It was concluded that the microleakage of ACTIVA Bioactive Restorative material in the absence or presence of etching and bonding could be comparable to the microleakage of composites. Punnathara S et al compared and evaluated the influence of ultrasonic activation, halogen light irradiation and combined effect of both on microleakage of enamel adjacent to Type IX glass ionomer restorations. For forty premolar teeth, standard Class V cavities prepared were restored with GC Gold Label Type IX glass ionomer cement in vitro. The specimens were randomly divided into four groups: 1) Control group; 2) halogen group; 3) ultrasonic group; 4) ultrasonic with halogen group. The teeth were kept in distilled water for 24 hours. Teeth were exposed to 1500 thermocycles at temperature of 12°C ±2 and 60°C ±2 with alternate immersion in hot and cold water for one minute. First teeth were immersed in dye solution for four hours and then in developing solution for four hours. The samples were sectioned buccolingually through centre of the restorations and degree of dye penetration was assessed under stereomicroscope and scored. Statistically significant differences were found in microleakage among the four groups with respect to dye penetration. Halogen group showed least microleakage followed by control but differences between them were statistically not significant. Similarly, the differences between Ultrasonic plus halogen group and ultrasonic group were not significant. The differences between ultrasonic and halogen group were statistically significant. They concluded that the halogen light decreases the microleakage of enamel adjacent to GC Type IX glass ionomer restorations, when used to accelerate the setting reaction of glass ionomers and can be used as command set method in paediatric dentistry.[7, 8]

Raju VG et al evaluated and compared shear bond strength and microleakage of tricalcium silicate-based restorative material (Biodentine) and glass ionomer cement (Fuji IX GP) in primary and permanent teeth. Occlusal surface of crowns were ground flat. PVC molds were stabilized over flat dentin surface and filled with tricalcium silicate-based restorative material (Biodentine)/glass ionomer cement (Fuji IX GP) according to group ascertained. Shear bond strength was evaluated using universal testing machine (INSTRON). Standardized Class II cavities were prepared

on both primary and permanent teeth, and then restored with tricalcium silicate-based restorative material (Biodentine)/glass ionomer cement (Fuji IX GP) according to group ascertained, over which composite resin material was restored using an open sandwich technique. Microleakage was assessed using dye penetration. Microleakage was examined using a stereomicroscope. Results showed that glass ionomer cement (Fuji IX GP) exhibited better shear bond strength than tricalcium silicate-based restorative material (Biodentine). Mean microleakage score for glass ionomer cement (Fuji IX GP) in permanent teeth was 1.52 and for primary teeth was 1.56. The mean microleakage for tricalcium silicate-based restorative material (Biodentine) in permanent teeth was 0.76 and for primary teeth was 0.60. Glass ionomer cement (Fuji IX GP) exhibited more microleakage than tricalcium silicate-based restorative material (Biode, ntine), which was statistically significant both in permanent and primary teeth. They concluded that the shear bond strength of glass ionomer cement (Fuji IX GP) is greater than tricalcium silicate-based restorative material (Biodentine) in both primary and permanent teeth. Wilder AD Jr et al evaluated the effects of wet and dry finishing/polishing procedures on the microleakage and surface texture of resin-modified glass ionomer (RMGI) restorative materials. Class V cavity preparations were made at the cemento-enamel junction (CEJ) on the buccal and lingual surface of 30 extracted human molars. The teeth were restored in three groups of 10 (20 preparations in each group) using Fuji II LC and Vitremer, both RMGIs, and Fuji II, a capsulated conventional glass ionomer cement (control). One restoration per tooth was finished/polished with copious applications of water and the other was finished/polished without water. One specimen of each material was kept wet during all finishing/polishing procedures, while the other was kept dry. Atomic force microscopy was used to determine the average roughness (R (a)) of the specimens. For each material, microleakage at the enamel margin was very slight. Leakage of the conventional glass ionomer Fuji II was severe at dentin margins. Statistical analysis indicated that both Vitremer and Fuji II LC had significantly less leakage than Fuji II, and that Vitremer had significantly less leakage than Fuji II LC. Leakage at enamel margins was significantly less than at dentin margins. Differences related to wet and dry polishing were not statistically significant. Profilometry data indicated that polished specimens were rougher than those cured against a Mylar strip. Wet polishing created greater surface roughness than dry polishing. They concluded that the RMGIs rather than conventional glass ionomers should be used in Class V cavity sites to allow immediate finishing and to reduce the incidence of microleakage. Dry finishing of RMGIs with abrasive disks is recommended because it produces a smoother surface and does not contribute to microleakage. However, wet finishing of conventional glass ionomers is still recommended to avoid desiccation.[9,10]

CONCLUSION:

From the results of present study, this can be concluded that restoration of deciduous molars with colored compomer would be more long lasting because of minimal marginal leakage seen with the material.

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