Research Article

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Analysis of Microleakage in Restorative Materials Used for Primary Teeth: A Comparative Study

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ABSTRACT

Background: Dental amalgam has been used by dentists for more than a century. It has many advantages as a restorative material, because it has high strength, durable and easy to use. However, amalgam fillings have a number of drawbacks, such as, corrosion; they do not fulfill aesthetic demand; making undercuts for mechanical retention necessary, mercury toxicity and lack of adhesion to tooth structures. Recently popularity of resin-based composite restoration has increased than amalgam restoration because of its excellent aesthetic and other favourable characteristics. However, failure is also seen in composite restoration in posterior dentition as excessive wear, polymerization shrinkage, open inter proximal contacts, tooth sensitivity, secondary caries, irreversible pulpitis and restoration fracture. Aim of the study**:** To study microleakage in restorative materials used for primary teeth.

Materials and methods: The study was conducted in the Department of Pediatrics of the Dental institution. For the study, we collected 30 extracted non carious deciduous molars. 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.

Results: We observed that the highest frequency of score zero was seen in group B, followed by group A, and then group C. Score three was seen with one sample in group B.

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.

Keywords: Amalgam, GIC, restoration, microleakage.

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INTRODUCTION

Marginal microleakage is commonly observed with various restorative materials which can lead to marginal staining and secondary caries and if not treated in time, it can cause pulpal pathology. These factors have been cited as the main reasons for restoration replacement. Controlling microleakage has always been an important goal of operative dentistry. [1] Dental amalgam has been used by dentists for more than a century. It has many advantages as a restorative material, because it has high strength, durable and easy to use. However, amalgam fillings have a number of drawbacks, such as, corrosion; they do not fulfill aesthetic demand; making undercuts for mechanical retention necessary, mercury toxicity and lack of adhesion to tooth structures. [2, 3] Recently popularity of resin-based composite restoration has increased than amalgam restoration because of its excellent aesthetic and other favourable characteristics. However, failure is also seen in composite restoration in posterior dentition as excessive wear, polymerization shrinkage, open inter proximal contacts, tooth sensitivity, secondary caries, irreversible pulpitis and restoration fracture. [4, 5] Glass ionomer cements (GIC) is widely used as restorative materials, luting cements and base materials. These materials have widened the armamentarium of tooth-colored restorative materials and in particular, they have been successfully used for restoration of primary teeth. Their main advantages are relative ease of use, bonding potential to enamel and dentin and fluoride ion release. However, the disadvantage is the microleakage present with the GIC. Therefore, reinforcing the conventional GIC with additional antibacterial agents may be an effective measure. [6] Hence, the present study was conducted to study microleakage in restorative materials used for primary teeth.

MATERIALS AND METHODS

The study was conducted in the Department of Pediatrics of the Dental institution. For the study, we collected 30 extracted non carious deciduous molars. 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 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 statistically 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 B, followed by group A, and then group C. Score three was seen with one sample in group B. 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 (n=10)	6	3	1	0	0.4
Group B (n=10)	7	2	0	1	0.5
Group C	4	4	2	0	0.8

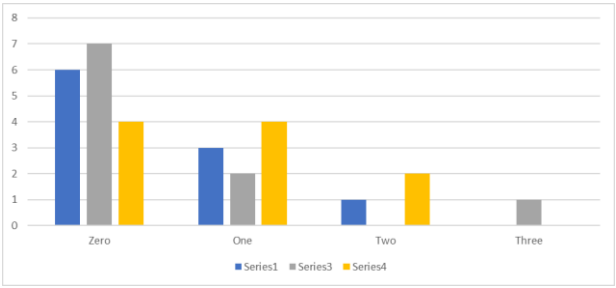

Fig 1: The lowest mean microleakage score was seen in group A.

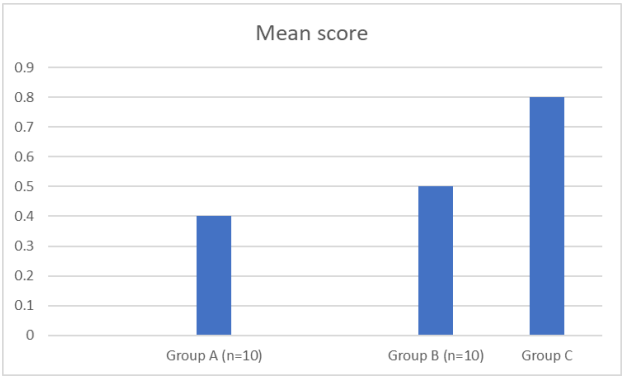

Fig 2: Mean Score.

DISCUSSION

In the present study, 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. Subramaniam P et al evaluated the microleakage of a composite resin restoration in primary teeth following laser irradiation of enamel and dentin. Forty freshly extracted sound human primary maxillary and mandibular anterior teeth were used in this study. The teeth were randomly divided into two groups (I and II), with 20 teeth in each. In group I, proximal cavities (Class III) were prepared using an airotor hand –piece and diamond bur. The cavities were etched for 15 seconds with 35% phosphoric acid gel, rinsed with water for 15 seconds, air dried and a bonding agent was applied onto the cavity surfaces and light cured for 20 seconds. The cavities were restored with composite resin and light cured for 40 seconds. In group II, proximal (Class III) cavities were prepared using Erbium, Chromium: Yttrium Scandium Gallium Garnet. The cavity was then rinsed, air dried and without etching, a bonding agent was applied and light cured for 20 seconds. The cavities were restored in the same manner as that of group I. The treated teeth were mounted on acrylic resin blocks and were subjected to a thermocycling regimen. Following, the teeth were immersed in 2% methylene blue for 24 hours. The teeth were sectioned longitudinally in a bucco-lingual direction using a diamond disc at slow speed. The sections of all the groups were examined under a stereomicroscope for micro-leakage. The mean scores for microleakage in group I was 1.95 ± 1.31 and in group II it was 1.4 ± 1.27. There was no significant difference between the two groups. They concluded that no significant difference in microleakage was noticed between the composite resin bonded to lased enamel and dentin and the teeth prepared with conventional method. 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. The restored teeth were thermocycled for 2000 cycles. After embedding in an acrylic resin, the degree of dye penetration at axial and gingival walls was assessed using a stereomicroscope. 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. They 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. [7, 8]

Cehreli SB et al evaluated the microleakage and marginal integrity of newly developed glass carbomer cement with and without protective surface coating (SC) in primary molars. Standardized cavities were prepared on extracted human primary molars, and the teeth were randomly assigned into the following groups (n = 10/each): (1) conventional glass ionomer cement (GIC) without SC; (2) GIC with SC; (3) glass carbomer cement without SC; (4) glass carbomer cement with SC; and (5) compomer without SC. Following thermocycling, the specimens were immersed in 0.5% basic fuchsin solution, sectioned, and digitally photographed. Microleakage was evaluated quantitatively by using open-source image analysis toolkit (ImageJ. The greatest amount of dye leakage was observed in the uncoated glass carbomer specimens, followed by the uncoated glass ionomer group. There was no significant difference between the microleakage values of coated glass ionomer, coated glass carbomer, and the compomer. The following statistical ranking was observed among microleakage of the test materials: uncoated glass carbomer > uncoated glass ionomer > coated glass ionomer ≈ coated glass carbomer ≈ compomer. Uncoated glass carbomer exhibited severe internal ice crack-like lines. They concluded that the use of the new glass carbomer cement without SC results in severe microleakage and catastrophic internal cracks. Gupta M et al evaluated microleakage associated with three placement techniques for compomer restorations in primary molars. This in vitro experimental study assessed the microleakage associated with bulk-fill, horizontal-incremental, and oblique-incremental compomer placement techniques in primary molars. Ninety specimens were divided into three groups of thirty for each of the placement techniques. Nearly 86.6% of the specimens presented with microleakage involving the entire axial wall and pulpal floor in the bulk-fill group, whereas 56.6% and 46.6% of the specimens in the horizontal-incremental and oblique-incremental groups showed microleakage up to two-third and one-third of the axial walls, respectively. A significant difference in scores was observed between groups. They concluded that microleakage was observed with all the three techniques but was comparatively lower with the incremental placement techniques. The oblique-incremental technique offered the least microleakage. [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.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

REFERENCES

1. FA Alvarenga, MA Andrade, C Pinellic, ANS Rastelli, KR Victorino, LCM Loffredo. Accuracy of Digital Images in the Detection of Marginal Microleakage: An Invitro Study. J Adhes Dent. 2012;14:335–38.

2. T Alptekin, F Ozer, N Unlu, N Cobanoglu, MB Blatz. Invitro Evaluations of Microleakage Around Class I Amalgam and Composite Restorations. Operative Dentistry. 2010;35(6):641–48.

3. VG Kanika, V Pradhuman, T Ashwaryan. Evaluation of Microleakage of Various

Restorative Materials: An invitro Study. J Life Sci. 2011;3(1):29–33.

4. Gupta SK, Gupta J, Saraswathi V, Ballal S, Acharya SR. Comparative evaluation of microleakage in Class V cavities using various glass ionomer cements: An in vitro study. J Interdiscip Dent. 2012;2:164–9.

5. Sainulabdeen S, Neelakantan P, Ramesh S, Subbarao CV. Antibacterial activity of triclosan incorporated glass ionomer cements – An in vitro pilot study. J Clin Pediatr Dent. 2010;35:157–61.

6. Grove C, Liebenberg W, du Preez JL, Yang W, de Villiers MM. Improving the aqueous solubility of triclosan by solubilization, complexation, and in situ salt formation. J Cosmet Sci. 2003;54:537–50.

7. Subramaniam P, Pandey A. Assessment of Microleakage of a Composite Resin Restoration in Primary Teeth Following Class III Cavity Preparation Using Er, Cr: YSGG laser: An In Vitro Study. J Lasers Med Sci. 2016;7(3):172-176. doi:10.15171/jlms.2016.30

8. Omidi BR, Naeini FF, Dehghan H, Tamiz P, Savadroodbari MM, Jabbarian R. Microleakage of an Enhanced Resin-Modified Glass Ionomer Restorative Material in Primary Molars. J Dent (Tehran). 2018;15(4):205-213.

9. Cehreli SB, Tirali RE, Yalcinkaya Z, Cehreli ZC. Microleakage of newly developed glass carbomer cement in primary teeth. Eur J Dent. 2013;7(1):15-21.

10. Gupta M, Rao D, Hegde S. An In vitro Evaluation of Microleakage Associated with Three Different Compomer Placement Techniques in Primary Molars. Contemp Clin Dent. 2017;8(1):48-52. doi:10.4103/ccd.ccd_1152_16.