ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

*International Journal of Dental Science and Innovative Research (IJDSIR)*

*IJDSIR : Dental Publication Service*

*Available Online at: www.ijdsir.com*

*Volume – 5, Issue – 3, June - 2022, Page No. : 510 - 514*

# Comparative evaluation of microleakage in fiberglass primary molar crowns using conventional glass ionomer and resin luting cements – An in vitro study.

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**Citation of this Article:** Dr. Harsimran kaur, Dr. Gunmeen sadana, Dr. Sunil Gupta, Dr. Teena Gupta, Dr. Manjul Mehra, "Comparative evaluation of microleakage in fiberglass primary molar crowns using conventional glass ionomer and resin luting cements – An in vitro study", IJDSIR- June - 2022, Vol. – 5, Issue - 3, P. No. 510 – 514.



**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

## Abstract

**Background:** The margin of crown is a significant area for plaque accumulation. Due to limited extent of contouring and crimping in aesthetic crowns, these crowns might not have optimal marginal adaptation and retention, therefore, the ability of the cement to seal the margin is very important.

**Aim:** To compare and evaluate microleakage of three different luting cements in fibreglass crown (Figaro crown) of primary molar teeth.

**Method:** Thirty human primary molars were collected and divided into three groups (n=10) according to cement used for luting (Group 1: resin cement, Group 2: resin modified glass ionomer cement and Group 3: glass ionomer cement). Tooth preparations were done on all primary teeth and after cementation of fibreglass crowns with specific luting cement, the teeth were artificially aged by thermocycling (250 times at 5 to 55 °C with a dwell time of 30 sec) and samples were immersed in 0.5% basic fuchsin aqueous solution for 48 hour and sectioned to assess dye penetration. The luting cements showed wide range of scores of microleakage. The results were statistically analysed.

**Results:** Resin cement resulted in least microleakage with statistically significant differences from both glass ionomer cements.

**Conclusion:** Choice of luting cement is very important for crown cementation. In addition resin cement stands to be the most optimum luting cement.

**Keywords:** fiberglass crowns, resin cements, glass ionomer cement, microleakage.

## Introduction

Figaro crowns are composed of fiberglass, aramid, carbon, and quartz filaments embedded within a

composite resin material. The combination of these materials brings flexibility which enables a slight elastic deformation while placing the crown on the prepared tooth. This flex-fit technology allows minimal tooth reduction, unlike zirconia Esthetic crowns which require excessive preparation to compensate for the lack of flexibility.[1,2]

Long-term clinical success of fixed restorations (crowns) is influenced by many factors, one important factor being the selection of an appropriate luting agent. No single luting agent is capable of meeting all the stringent requirements, which is one reason why there is such a wide choice of luting agents currently available from conventional water-based to contemporary adhesive resin cements.[3]

Hence, this in vitro study was done to assess and compare microleakage extent of fiberglass (Figaro) primary molar crowns using different luting cements. i.e., Resin cement [Relyx U200 (3M ESPE)], RMGIC [Relyx luting 2 (3M ESPE)], and GIC [Ketac Cem radiopaque (3M ESPE)].

**Materials and method**

For this study 30 primary molars indicated for extraction were collected.

**Inclusion criteria**

- Sound teeth
- Teeth with more than one- fourth root
- Endodontically failed teeth
- Teeth with mesial or distal caries

**Exclusion criteria**

- Teeth with buccal and lingual caries
- Cracked or fractured teeth

Teeth which can be saved

**Sample collection and preparation**

Thirty extracted human primary molars were collected. They were cleaned of any soft tissue and calculus with the help of ultrasonic scaler and kept in distilled water at room temperature for no more than 3 weeks and used in the study.

The teeth were then embedded in clear cold-cure acrylic resin blocks below the cement-enamel Junction in an upright position utilising a mold obtained from cylindrical polyethylene pipe.

**Sample size and grouping**

Thirty extracted human primary molars were randomly divided into three groups based on type of cement used for luting, each group comprising of 10 teeth.

**Crown preparation**

Tooth preparation for Figaro crowns was done according to manufacturer instructions.

A coarse football diamond bur was used to prepare the occlusal surface of the teeth by 1–1.5 mm and occlusal table was bevelled.

A coarse tapered diamond bur was used for proximal, buccal and lingual reductions by 1-1.5 mm.

The preparation margin was carefully extended and refined to a feather-edge on all surfaces using a fine tapered diamond bur and all line angles were rounded.

Teeth were them luted with different luting cements (Fig 1) and grouped accordingly -

Group 1: Resin cement (Rely X U200)

Group 2: Resin modified glass ionomer cement (Rely X Luting 2)

Group 3: Glass ionomer cement (Ketac TM Cem radiopaque)

All the teeth were placed in distilled water at 37 °C for 24 h and artificially aged by thermocycling 250 times at 5 °C to 55 °C with a dwell time of 30 s.

**Microleakage evaluation**

After thermocycling samples were immersed in 0.5% Basic fuschin for 48 hours at room temperature. Then they were thoroughly rinsed with distilled water and air-

dried. The embedded crowns was sectioned bucco-lingually using a diamond disc. A digital photograph of each section was obtained under a stereomicroscope at an original magnification of 10 X. (Fig.2)

The extent of dye penetration was assessed on buccal and lingual surfaces at both tooth-cement (T-C) and crown-cement (M-C) interfaces and Qualitative assessment of microleakage was done according to the criteria proposed by Tjan et al.[4]

0—No microleakage.

1—Microleakage less than 1/3rd the axial wall length.

2—Microleakage more than 1/3rd but less than 2/3rd the axial wall length.

3—Microleakage all along the axial wall length.

4—Microleakage on the occlusal surface.

Microleakage along the crown cement and tooth cement interface was observed on both buccal and lingual surfaces.

The results were subjected to statistical analysis (unpaired t- test).

| Type | Tooth Interface | | Crown Interface | | t test | p value |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| Resin | 0.70 | 1.39 | 0.45 | 0.86 | 1 | 0.34 |
| RMGIC | 1.80 | 1.29 | 1.25 | 0.95 | 3.16 | 0.012* |
| Conventional GIC | 2.55 | 0.79 | 2.70 | 1.42 | 0.46 | 0.66 |

Table 1: Descriptive analysis of fiberglass crowns luted with different luting cements.

**Discussion**

A luting cement material must possess the dual abilities of adhering to tooth structure and crown as well as providing good marginal seal. These qualities are key to retaining the crown and eliminating coronal microleakage.[5]

In the present study, fiberglass crowns cemented with resin cement showed the least amount of microleakage (p=0.34). Resin luting cements have higher mechanical properties than GI and RMGI cements. Resin cements typically exhibit higher retentive strengths when light activated due to the higher degree of conversion under light polymerization conditions.[6,7,8]

Ionic bonding between the negatively charged phosphate ester monomer and the positively charged calcium ions on tooth may occur.[9,10]

Resin cements contains multifunctional phosphoric acid methacrylates that are claimed to react with the hydroxyapatite of the hard tooth tissue when these monomers dissociate into methacrylate and the acidic phosphoric acid in an aqueous solution. In addition to its inherent advantages of the resin cements in inhibiting microleakage, use of metal primers has been advocated to improve the bond strength between the cement and the metal surface which further reduces the microleakage and hence improve clinical durability.[11]

In the present study Resin cements were followed by RMGIC (p=0.012) and conventional GIC (p=0.66). Similar finding was observed by Memarpour et al that crown cemented with RMGI showed significantly less microleakage compared to GI cement. It has been reported that prolonged water storage of samples cemented with RMGI improves their bonding ability and marginal seal due to water sorption and hygroscopic expansion.[12.13]

In our study, fiberglass crowns cemented with conventional GIC showed the highest amount of microleakage (p=0.66), which had significant differences with other groups.

The high microleakage associated with GIC can be attributed to the high solubility of GIC in water; its setting reaction is sensitive to moisture conditions,

especially during its initial set stage and during the first 24 h.

In this study, the samples were placed in distilled water at for 24 hours at room temperature after crown cementation without applying a protective coat of varnish, petroleum jelly, or resin on the crown margins; consequently, the cement was subjected to both gain and loss of water. This process led to high solubility and increase in microleakage .[14,15,16]

**Conclusion**

Considering the results of this study and patient's demand for esthetics, fiberglass crowns cemented with resin cements can be considered as esthetic restoration with strong marginal seal, a good option for many pediatric patients. Though utilization of resin cement influences significantly the quality of marginal sealing and longevity of fixed restorations but disadvantages of resin is that they don't release fluoride which is important for preventing secondary caries.

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**Figure**

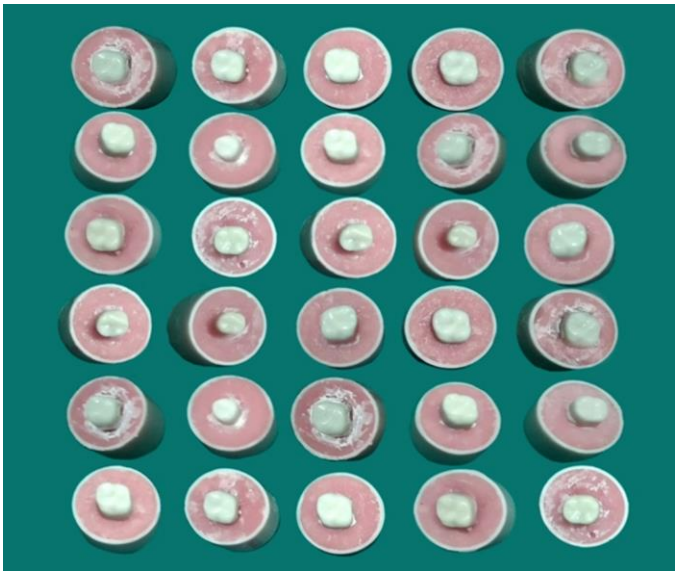

Figure 1: Fiberglass _ crowns _ luted _ with _ different _ luting _ cements (1).

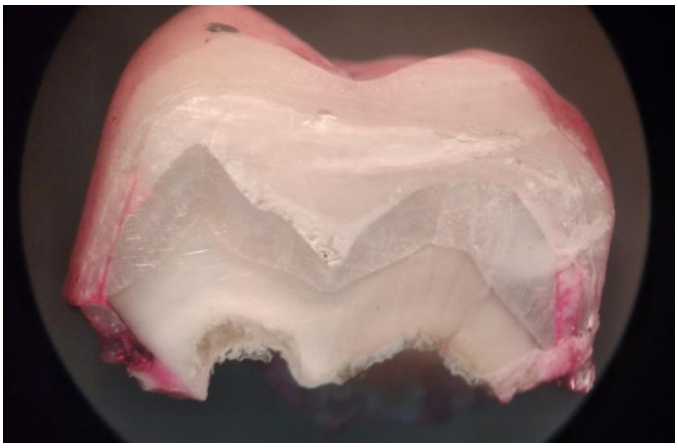

Figure 2: Sterio micro scopic _ assessment _ of _ micro leakage.