Comparative evaluation for microleakage between Fuji-VΠ glass ionomer cement and light-cured unfilled resin: A combined in vivo in vitro study

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Abstract

Glass ionomer cement, besides being used as restorative material, can also be used as pit and fissure sealant. The use of glass ionomer cement as pit and fissure sealant has added benefit by its fluoride-releasing property that results in increased resistance of the fissures to demineralize. The capacity of a sealant to prevent microleakage into the fissure is important, since microleakage may initiate and support a carious lesion beneath the sealant. The study was carried out to compare marginal microleakage between Fuji-VΠ glass ionomer cement (G C Corporation, Tokyo, Japan) and the conventional light-cured unfilled resin as pit and fissure sealants (3M Concise, 3M Dental Products, St. Paul, USA).

The dye used was 2% methylene blue (Qualigens Fine Chemicals, Mumbai, India). The teeth were sectioned and studied under the stereomicroscope. The result revealed that there was no difference in microleakage ($P > 0.05$) between the two materials.

Key words: Fissure sealant, Fuji-VΠ glass ionomer, light-cured unfilled resin, microleakage, pit

Introduction

The introduction of glass ionomer cement to dentistry was mainly as a restorative, luting and lining material. Fissure sealing with glass ionomer cement was first introduced by Mclean and Wilson in 1974.

The important advantage of using glass ionomer cement as a pit and fissure sealant is the fluoride release which results in increased resistance of the fissures to demineralization. This fluoride release continues even when the sealants appear to have been lost clinically because of the remnants left at the bottom of the fissures. Studies carried out by Hatibovic and Kofman showed increased concentration of fluoride in saliva for as long as 1 year after placement of glass ionomer restorations. It has been claimed by the manufacturers that Fuji-VΠ glass ionomer cement releases six times the fluoride as compared to other high-strength glass ionomer cements and can be used as a pit and fissure sealant.

Considering the difficulty in obtaining isolation in children and the multiple steps involved in the placement of unfilled resins, glass ionomer cement can be quickly and easily placed into the pits and fissures.

The present study was conducted to evaluate and compare the microleakage of Fuji-VΠ glass ionomer cement and light-cured unfilled resins when used as pit and fissure sealants.

Materials and Methods

The study was carried out in the Department of Pedodontics and Preventive Dentistry at Manipal College of Dental Sciences, Mangalore.

The sample size consisted of 16 primary noncarious lower second molars selected from children aged between 10 and 12 years. Radiographs were recorded to evaluate the presence and stage of development of the underlying second premolars. Informed consent was obtained from the parents.

Air-Water spray was used to clean the fissures. The samples were divided into two groups of eight each:

Group 1: To be sealed with Fuji-VΠ glass ionomer cement (G C Corporation, Tokyo, Japan)

Group 2: To be sealed with light-cured unfilled resin (3M Concise, 3M Dental Products, St. Paul, USA).

The two materials were placed on the selected teeth randomly. Both the materials were placed according to the manufacturers' instructions.

The teeth were extracted after 14 days. All the extracted teeth were cleaned with hand instruments and stored in normal saline.

The teeth were subjected to thermocycling for 125 cycles at temperatures of $5^\circ C \pm 2^\circ C$ and $50^\circ C \pm 2^\circ C$ with a dwell time of 15 seconds. The apices of the teeth were covered with Fuji-VΠ glass ionomer cement (G C Corporation, Tokyo Japan). The teeth were covered completely with nail varnish except for the area within 2 mm of the sealant varnish interface. The teeth were then mounted on acrylic blocks extending till the bifurcation area.

This was followed by the immersion of the teeth in 2% methylene dye (Qualigens Fine Chemicals, Mumbai, India)
for 48 hours. After removal from the dye solution, they were cleaned and rinsed with tap water. The teeth were sectioned longitudinally in buccolingual direction with a double-faced diamond disc (K G Sorensen Ind e Com Ltd.) and two sections were obtained from each of the teeth.

The sections were then studied under a stereomicroscope to measure the depth of dye penetration from the sealant surface and the cavosurface margins. All the scoring was carried out by a single person and the scoring criteria used for the study was as follows:

0 = No dye penetration
1 = Dye penetration from the sealant and between the sealant and tooth into enamel only
2 = Dye penetration from the sealant and between the sealant tooth interface into enamel and dentin
3 = Dye penetration from the sealant and between the sealant tooth interface into the pulp chamber

The scores were tabulated, interpreted and statistically analyzed [Table 1].

Results

All the 16 samples were evaluated. Scores of dye penetration mean and standard deviations were calculated.

Table 1 summarizes the microleakage scores, the mean and standard deviations for the two groups. Standard statistical analysis, namely, Mann-Whitney U test was used for comparison between the groups. The result was statistically insignificant (P > 0.05) [Table 2].

Discussion

The study was carried out to evaluate the microleakage between Fuji-VII glass ionomer cement and the conventional light-cured unfilled resin when used as pit and fissure sealants. Since a clinical evaluation of the glass ionomer material was desired, the study was done on primary second lower molars in children aged between 10 and 12 years.

Traditionally, glass ionomer cements are not used as pit and fissure sealants due to the notion of increased microleakage. But the results showed no difference in microleakage between the two materials, indicating that the sealing ability of glass ionomer cement is comparatively similar to the conventional unfilled resins, with additional benefit of fluoride release.

The increased resistance to microleakage in Fuji-VII glass ionomer cements can be explained on the basis of:

- Conditioning done before application
- Chemical adherence to the tooth
- Protection with an enamel bond agent after application
- Absence of resin in spite of the dual cure system, so no polymerization shrinkage

Conclusion

The pink-colored Fuji-VII glass ionomer cement could be a promising material as a pit and fissure sealant due to its added fluoride release compared to the conventional unfilled resin, but independent long-term clinical data, especially concerning retention, would be beneficial.

References

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Table 1: Microleakage scores between the two groups

| Group | No. of samples | Microleakage scores | Mean score ± Standard deviation |
|-------|----------------|---------------------|-------------------------------|
| 1     | 8              | 0 1 2 3             | 1.25 ± 1.035                 |
| 2     | 8              | 0 1 3 3             | 1.429 ± 0.535                |

Table 2: Mann-Whitney U test

| Group 1 Vs Group 2 | Z = 0.105 | P > 0.05 (non significant) |