Microleakage of Class V Compomer and Light-Cured Glass Ionomer Restorations in Young Premolar Teeth

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Introduction: The purpose of this in vitro study was to compare the microleakage rate of class V compoglass-F and Fuji II LC restorations.

Materials & Methods: Sixty class V cavity preparations with occlusal margins in enamel and gingival margins in cementum were prepared on the buccal and lingual surfaces of 30 extracted human premolar teeth. The teeth were divided randomly into 2 treatment groups. Group 1 was restored with Fuji II LC and group 2 with compoglass-F. After treatment, the samples were stored in tap water for 24 hours, then thermocycled, stained with dye, and finally scored for microleakage. The Mann-Whitney analysis of variance was done for data analysis (\( \alpha =0.05 \)).

Results: The Fuji II LC had a higher degree of microleakage in occlusal and occlusal plus axial walls compared with compoglass (P=0.000). Whereas, compoglass had microleakage in gingival and gingival plus axial walls (P=0.0003).

Conclusion: The results revealed that Fuji II LC had less microleakage in the gingival margin in which enamel does not exist. Whereas microleakage of compoglass restorations was significantly less than FujiII LC in the occlusal wall where enamel exists.

Key words: Compoglass-F, light-cured glass ionomer, microleakage.

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light-cured for 20 seconds using a curing light (coltolux 2.5 R Coltene Bri.Esthetic Line, Swiss). The application
of syntac was repeated and immediately light cured.
Next, the samples were filled with compoglass and
cured. The samples were light-cured for 40 seconds and
were kept in water at room temperature for 24 hours.
Then, the samples were thermocycled (5°C-55°C) in
synthetic saliva 500 times. After thermocycling, the
teeth were dried and sealed with nail polish, 2 mm short
of the margins of each restoration. The apices of all
teeth were embedded in putty optosil (Speedex
Polysiloxane, Swiss). For prevention of dehydration, the
samples were replaced in water. The teeth were then
immersed into a 0.5% solution of basic fuchsine for 24
hours. Then they were rinsed, dried, and invested in
polyester.
Following that, all the samples were sectioned bucco-
lingually through the center of the restorations with a
slow-speed water-cooled D&Z diamond disc. For each
restoration section, both the incisal and gingival margins
and axial wall were evaluated. Finally, they were
visually examined for dye penetration along cavity
walls by use of a stereomicroscope (Olympus at a
magnification of X40).
Scoring of dye penetration (0,1,2,3,4 and 5) as an
index of microleakage scoring are shown in Fig 1.
Rankings for the two materials were compared using
the Mann-Whitney analysis.

Fig 1. Schematic cross-section of restoration illustrating scoring system
0: No dye penetration. 1: Dye penetration within ½ of occlusal or gingival wall.
2: Dye penetration extending to the end of occlusal or gingival walls.
3: Dye penetration through the gingival or occlusal wall to 1/3 of axial wall.
4: Dye penetration through the gingival or occlusal wall to 2/3 of axial wall. 5: Dye penetration throughout the axial wall.

Results
Table 1 summarizes the frequency of dye penetration
scores in terms of materials with occlusal (oc), gingival
(g), occlusal plus axial (oc-a) and gingival plus axial
(g-a) walls. The Fuji II LC restorations (group 1)
showed significant occlusal microleakage when
compared to the compoglass group (P=0.000). Where as
compoglass restorations (group 2) showed significant
gingival microleakage when compared to the Fuji II LC
(P=0.0003).
Table 1. Dye penetration scores for class V restorations of a compoglass-F and Fuji II LC along occlusal (oc), gingival (g), occlusal plus axial (oc-a) and gingival plus axial (g-a) walls (n=30).

<table>
<thead>
<tr>
<th>Score</th>
<th>Wall</th>
<th>Compoglass-F</th>
<th>Fuji II LC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(oc) ++</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(g) **</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>(oc)</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>(g)</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>(oc-a) ++</td>
<td>2</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>(g) **</td>
<td>30</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>(oc-a)</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>(g-a)</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>(oc-a)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(g-a)</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>(oc-a)</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>(g-a)</td>
<td>13</td>
<td>7</td>
</tr>
</tbody>
</table>

++ P= 0.000
** P= 0.003
* Not significant

Discussion

Dye penetration (microleakage) in the gingival margins of compoglass restorations in this study was significantly more than in glass ionomer restorations (P=0.003). This confirms the results of the previous study, indicating a significantly greater degree of microleakage in gingival walls of compomers. This might have occurred because of the higher resin content of compoglass compared to the glass ionomer. As a result, polymerization shrinkage was noticed to be further accompanied by higher microleakage in the gingival margin. Another factor is a hydrolysis phenomenon that appears after thermocycling. Hydrolysis is usually observed in one-component dentin bonding like syntac in compoglass. This is because they have a high thickness and they do not completely penetrate in tags and the hybrid layer of dentin. Another point is that compomers compared to glass ionomers have lower bonding strength to dentin; thus, they need a stronger dentin bonding material for this purpose. This affects the amount of microleakage of compoglass.

Bonding by glass ionomers is achieved in part by mechanical retention and in part by chemical chelating; the former playing a more important role. This confirms the reason why there is less microleakage in the gingival margin in which there is no enamel. The potential of glass ionomers for chemical bonding is only an advantage in situations where it is difficult or impossible to produce micro-mechanical retention.

In a study of Brackett et al (1998), marginal microleakage of a compomer (dyrect) and two glass ionomer restorations (Fuji II LC, Vitremer) were evaluated. There was no significant difference between marginal microleakage of these three restorations. In that previous study, twelve Bovine teeth were used and the margin of the cavities were beveled and received 200 thermal cycles. While in this study, the cavity margins were not beveled and the restorations received 500 thermal cycles.

Dye penetration (microleakage) in axial walls from the gingival pathway was greater in compoglass restorations than that of glass ionomer restorations. It might have been caused by the further gingival microleakage of compoglass restorations compared to the glass ionomer.

In this present study dye penetration of occlusal walls of compoglass restorations were significantly less than Fuji II LC restorations (P=0.000). The bond strength of compoglass to enamel was more than that of the light-cured glass ionomer. The use of syntac as a dentin adhesive with compoglass according to the manufacturer might have been the other influencing factor.

The successful enamel and dentin bonding system was due to the hydrophilic properties. The dentinal tubule fluid in natural dentin reduced the glass ionomer dehydration during the polymerization process, thus it resulted in dimension stability of the material.

It should be noted that these results are based on in vitro data. Therefore, further studies should be done to evaluate the clinical performance of compoglass and light-cured glass ionomers.

Conclusion

These data indicated that compoglass had less microleakage in occlusal and occlusal plus axial walls of class V cavities compared with light-cured glass ionomer. In contrast, the light-cured glass ionomer had less microleakage in the gingival and gingival plus axial walls compared with compoglass.

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References


