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KEYWORDS:
Micro-leakage, Tooth colored restorative materials, Resin modified glass ionomer cement, Nano composite resin, Hybrid composite resin,

INTRODUCTION:
The ultimate goal of a restoration is to restore the proper tooth form, function and esthetics while maintaining the physiologic integrity of the teeth in harmony with the oral environment. One of the essential factors in the longevity of the restoration is to adapt to the prepared tooth surface and seal the cavity wall. Theoretically, a tight, non leaking marginal seal should result from adhesion between the restorative material and tooth structure. In spite of tremendous improvement in technologies, none of the materials perfectly bond with the tooth structure. A marginal gap is left between the cavity wall and the restorative material leading to micro-leakage.

The properties of the restorative materials which contribute to micro-leakage are coefficient of thermal expansion, 2,3 polymerization shrinkage, 4,5 and adhesion. 6,7 Micro-leakage is defined as a clinically undetectable passage of fluids, bacteria, molecules and ions, and even air between a restorative material and the prepared cavity walls of a tooth. 8,9 With microchannels and microgaps between restorative materials and cavity walls, 10 there is movement of oral fluids in either direction, which causes dentinal pain and marginal staining. 11 This seepage can also cause hypersensitivity of restored teeth, tooth discoloration, recurrent caries and ultimately pulp death. 12,13

It is evident from past literature that marginal seal plays a major role in the longevity of restoration. 14 Thus, the creation of a perfect seal on the restoration-tooth interface is still one of the prime goals of restorative dentistry in order to prevent the penetration of contaminants and attain the lost peripheral seal of dentin.

The increase in concerns about conserving the tooth structure in esthetic conscious society has led to development of tooth colored restorative materials. 15 This has prompted studies to determine the extent of micro-leakage at the tooth-restoration interface. 16

MATERIALS AND METHOD:
The present study was conducted on 40 premolars extracted for orthodontic purpose which were free of cracks, caries and restorations. 17 The teeth samples were cleaned 18 and then stored in normal saline at room temperature. 19 On each tooth, two Class V cavities were prepared, one on buccal and other on lingual side. 20,21 Standard Class V cavities of size 3 x 2 x 2 mm were prepared 22, 23 mm occlusally from the cemento-enamel junction using a round/straight fissure/an inverted cone diamond points of an airotor hand piece (NSK, Dentsply International Inc., USA).

Each crown was then sectioned bucco-lingually and the sections were stored in 100% humidity before being examined under stereomicroscope (16 x magnification) to measure the depth of dye penetration. The results showed that minimal microleakage in Group II (Fuji IXGP) followed by Group IV (Z350), Group III (Z100) and Group I (Fuji II LC) showed maximum microleakage. The difference in the microleakage scores between the groups was statistically significant with high intergroup variability (F=26.085, p<0.001).

ABSTRACT:
The present in-vitro study aimed to evaluate the microleakage of four tooth coloured restorative materials in 80 restored Class V cavities. 40 human premolar teeth samples were selected and eighty standardized class V cavities were prepared on them. These were further divided into four groups, each group comprising of 20 prepared cavities, and were restored with four experimental tooth colored restorative materials (Glass ionomer cement, Resin Modified Glass ionomer cement, Hybrid composite resin and Nano composite resin) respectively. The restored teeth were subjected to thermocycling for 500 cycles in 37°C neutral bath, 5°C cold water bath and 55°C hot water bath followed by 2% methylene blue dye penetration for 24 hours at room temperature. Each crown was then sectioned bucco-lingually and the sections were stored in 100% humidity for later examination under stereomicroscope (16 x magnification).

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Table 1: Micro-leakage score of four groups (80 samples)

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of samples</th>
<th>Mean Micro-leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (Fuji II LC)</td>
<td>20</td>
<td>2.300±0.801</td>
</tr>
<tr>
<td>II (Fuji IXGP)</td>
<td>20</td>
<td>0.450±0.605</td>
</tr>
<tr>
<td>III (Z100)</td>
<td>20</td>
<td>1.200±0.951</td>
</tr>
<tr>
<td>IV (Z350)</td>
<td>20</td>
<td>0.500±0.607</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>1.113±1.055</td>
</tr>
</tbody>
</table>

Table 2: Mean micro-leakage of the four tooth colored restorative materials.
In the present study, during the inter-group comparison, no significant statistical difference was observed between Fuji IX GP (Group II with a mean of 0.450 and standard deviation of ± 0.605) and Z350 (Group IV with a mean of 0.500 and standard deviation of ± 0.607). Maximum micro-leakage was observed in Fuji II LC (Group I with a mean of 2.300 and standard deviation of ±0.801), while moderate micro-leakage was seen in Z100 (Group III with a mean of 1.200 and standard deviation of ± 0.951).

Neeedt Erdilek, Ferit Ozata & Figen Sepetcioğlu observed the sealing ability of hybrid composite resin, resin modified glass ionomer cement and glass ionomer resin cement. They found that hybrid composite resin provided a better seal than resin modified glass ionomer cement. The results were similar to the results of this study. Similar results were obtained by the studies done by Adrian U.J. Yap, C.C. Lim & Jennifer C.L. Neo and U.A. Nayak, P.Sudha & M.Vidya.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>&quot;t&quot;</th>
<th>&quot;p value&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I vs II</td>
<td>8.241</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Group I vs III</td>
<td>3.955</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Group I vs IV</td>
<td>8.008</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Group II vs III</td>
<td>2.975</td>
<td>0.005</td>
</tr>
<tr>
<td>Group II vs IV</td>
<td>0.261</td>
<td>0.796</td>
</tr>
<tr>
<td>Group III vs IV</td>
<td>2.774</td>
<td>0.009</td>
</tr>
</tbody>
</table>

Table 3: Intergroup comparison of mean micro-leakage of all the groups.

P. Mali, S. Deshpande & A. Singh conducted a study to evaluate and compare the micro-leakage of conventional glass ionomer cement (Fuji II) and hybrid composite resin (Z100). They found that conventional glass ionomer cement (Fuji II) showed maximum leakage followed by hybrid composite (Z100) which is contrary to our study.

Andreina Castro & Robert E. Feigal assessed micro-leakage of the Fuji IX GP material with Fuji II, Vitremer and a composite resin (TPH). They concluded that Fuji IX GP behaved similarly to the composite resin and to the Resin modified glass ionomer (Vitremer), while Fuji II showed more leakage than all the other groups. These results are in agreement with our study that new glass ionomer cement (Fuji IX GP) showed less micro-leakage and could be compared to composite resin. At the same time, it showed dissimilarity to our study that Fuji IX GP could be compared to Fuji II LC.

F. Yalcin, Y. Korkmaz and M. Baseren conducted a study to investigate the effect of polishing systems on the micro-leakage of a nanofill (Filtek Supreme & Single Bond), a nanohybrid (Grandio & Solobond) and a microhybrid (Arteis & Excite) composite resin. They concluded that micro-leakage was seen in nanohybrid composite resin, while least micro-leakage was observed in nanofill composite resin. In the present study, we have come across with similar findings that nano composite resin showed less micro-leakage when compared to hybrid composite resin.

In comparison to our study, most of the studies reveal that glass ionomer cement shows more micro-leakage when compared to resin modified glass ionomer cement and composite resin. Since Fuji IX GP is improved conventional glass ionomer cement, it behaves similar to composite resin. It can be attributed to the fact that free polyacrylic acid ions are available for immediate and effective ion exchange between enamel and dentin and the restorative material. Its high bond strength with flexibility allows a complete marginal adaptation to ensure a tight, chemically fused, bacteria-proof seal, thus leading to reduced micro-leakage.

Nano composite restorative material contains a filler of a combination of a non-agglomerated / non-aggregated 20 nm nanosilica and loosely bound agglomerated zirconia / silica nanocluster of size 5-20 nm. The cluster particle size ranges from 0.6-1.4 microns. This use of this fine particle size can be reasoned for the observation that less micro-leakage is present in a nanocomposite resin as compared to a hybrid composite resin.

CONCLUSION:

The present study led to the conclusion that micro-leakage was evident in all the four restorative materials tested in the study. No significant statistical difference was observed between Group II - Fuji IX GP (mean micro-leakage of 0.450 and standard deviation of ± 0.605) and Group IV - Z350 (mean microleakage of 0.500 and standard deviation of ± 0.607). Moderate micro-leakage was seen in Group III - Z100 (mean micro-leakage of 1.200 and standard deviation of ± 0.951). Maximum micro-leakage was observed in Group I - Fuji II LC (mean micro-leakage of ±3.000 and standard deviation of ±0.801).

The present study made a sincere attempt to investigate the micro-leakage of four tooth coloured restorative materials but inspite of tremendous improvement in technologies, none of the materials perfectly bond with the tooth structure. Further research is needed to divulge an ideal restorative material with excellent marginal sealing ability and adaptability.

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Nil.

CONFLICTS OF INTEREST:

There are no conflicts of interest.

REFERENCES:


