Compressive Strength of Direct Tooth Colored Restorative Materials

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ABSTRACT

New materials are being introduced to address the need for restoring both carious and non carious (caused by a combination of abrasion, erosion and abfraction) lesions. In an era when more and more patients are retaining their natural dentition, the need for this restoration is increasing. The ideal materials should be adhesive, tooth colored and abrasion-resistant Materials and Methods: Seven disc samples of Compomer, Giomer & Composite restorative materials were prepared for measurement of compressive strength. Results: The value of Compressive strength of Giomer becomes high in comparison to Compomer but not significant in comparison to Composite.

Keywords: Mechanical properties, Giomer, Compressive strength

Introduction:

During the last decade, resin based composite materials have used widely to restore posterior teeth. Occlusal and proximal wear have been identified as possible limitations of resin based composite materials in posterior restorations. Other areas of concern include marginal leakage, discoloration, polymerization shrinkage and post operative sensitivity. Some of these clinical characteristics have improved over time as the adhesive technology has advanced and additional features, such as fluorides, have been added to the materials. The mechanical properties, bonding properties and fluoride release abilities vary substantially across the continuum. Since compomers, glass ionomers, and resin modified glass ionomers are weaker than composite resins, the clinical application of fluoride releasing materials is usually limited to non load bearing areas. As we move across the continuum from glass ionomers and resin modified glass ionomers, to compomers and composite resins, the compressive strengths generally increase. One of the reasons is that the resin contents of each class of materials increase in the same trend. The cross linked polymer matrices in compomers and composite ( typically copolymes of Bis-GMA, UDMA and TEGMA) generally have higher strength and toughness than the gel network formed by acid base reaction in glass ionomers.

Filler load and composition may have significant influence on the mechanical properties. For the same type of materials, mechanical properties generally increase with the increase of the filler load. Fluoroalumino silicate glass in the major component of the filler in all fluoride releasing materials. Calcium is the essential part of glass filler particles in glass ionomers and resin modified glass ionomers. It initiates the reaction with the acids or polyacids to form crosslinked gel network. The Ca-Al-F silicate glass fillers are more soluble and weaker than those fillers used in composites that does not contain calcium. This partially contributes to the lower mechanical properties of glass ionomers and resin modified...
For compressive strength measurement, a Teflon mold was constructed 4mm in diameter and 6mm in depth. The assembled mold was filled with materials, any excessive materials were squeeze out and two microscope glass slides were placed over both ends of the mold. All specimens were light cured through the glass slides for 40 sec top and bottom surfaces. Then the specimens were taken out from the mold and again light curing for 40 sec on each cylindrical side surface. A visible light unit (selector, Taiwan) was used throughout the study. After polymerization all specimens were removed from the molds and then stored for 24 hr at 37°C in dry condition. The specimens were ground with a dry 800 grit silicon carbide paper and their diameter and thickness was measured.

<table>
<thead>
<tr>
<th>Table I. Restorative materials used in this study</th>
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<tr>
<td>Type</td>
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<tr>
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<tr>
<td><strong>Compomer</strong></td>
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<tr>
<td><strong>Giomer</strong></td>
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<tr>
<td><strong>Composite</strong></td>
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Compressive strength experiment procedure:
After measurement of all the surfaces of the samples, the specimens were placed into a compressive strength tester (Testometric AX, Universal Testing Machine) and were loaded (Cross-head speed 1.0mm/min) to the fracture of the sample. The compressive strength for each specimen was determined from Eq.

\[ p = \frac{CS}{\pi r^2} \]

Where CS is the compressive strength in MPa, P is the load at fracture, and r is the radius of the specimen.

Compressive strength:

<table>
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<tr>
<th>Table II. Compressive strength of Giomer, Compomer and Composite</th>
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<tr>
<td>Compressive strength (MPA)</td>
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<tr>
<td>Material</td>
</tr>
<tr>
<td>Giomer</td>
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<tr>
<td>Compomer</td>
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Thus, continuous small amounts of fluoride concentration in saliva and in adjacent hard dental tissues. The release from glass ionomer restorations increases the fluoride materials may have clinical implications in vivo. Fluoride is similar is higher than compomer but fluoride release of both of them present study we can see that compressive strength of giomer high fluoride release have lower compressive strength. In the compressive strength Xu et al. 2003 indicates the correlation between the is greater than that of compomer and composite. present result strength of composite 265MPa. This result supports the compressive strength. The results of this study have been compared with that of different authors and researchers. Observed results of different parameters showed some similarity as well as dissimilarity with the available information present on different publication. In the present study, the mean SD compressive strength of giomer was 271.356+ 19.653 MPa. Regarding compressive strength of giomer comparison could not be shown due to lack of data from other study. Xu et al. (2003) found the mean compressive strength of compomer 262 MPa. This finding is higher than the present study finding. The difference may be due to small sample size, defect in storage of sample of due to manufacturers problem10. Xu et al. (2003) found the mean compressive strength of composite 265MPa. This result supports the present result10. The value of compressive strength of giomer is greater than that of compomer and composite. Xu et al. 2003 indicates the correlation between the compressive strength and fluoride release that-materials with high fluoride release have lower compressive strength. In the present study we can see that compressive strength of giomer is higher than compomer but fluoride release of both of them is similar10. Finally, a low release of fluoride from dental materials may have clinical implications in vivo. Fluoride release from glass ionomer restorations increases the fluoride concentration in saliva and in adjacent hard dental tissues. Thus, continuous small amounts of fluoride supporting the teeth decreases demineralization of the tooth tissues although, it is not proven by prospective clinical studies whether the incidence of secondary caries can be significantly reduced by the fluoride release of restorative materials11. Cate et al. 1998 deduced that dentin demineralization was inhibited in a clinically relevant percentage only at fluoride levels above 1 ppm12. Near optimum fluoride effects can be achieved with quite low concentrations in a daily fluoride rinse13. The effect of a very low amount of continuous fluoride release from giomers and compomers on dental hard tissues needed to be further studied.

Conclusions and recommendations

Current restorative materials with a high fluoride release generally have lower mechanical properties. Therefore, they may not be as durable clinically as lower fluoride release materials, particularly in load bearing areas. Materials that have high fluoride release, high recharge capability, excellent mechanical properties and bonding properties are highly desirable and will be the targets of future development and Giomer to be a better restorative materials other than any fluoride releasing restorative materials.

References:


Discussion

The present work has been designed to study giomer, compomer, glass ionomer and composite where seven disk samples were used to examine their compressive strength. The present study has revealed important information regarding compressive strength. The results of this study have been compared with that of different authors and researchers. Observed results of different parameters showed some similarity as well as dissimilarity with the available information present on different publication. In the present study, the mean SD compressive strength of giomer was 271.356+ 19.653 MPa. Regarding compressive strength of giomer comparison could not be shown due to lack of data from other study. Xu et al. (2003) found the mean compressive strength of compomer 262 MPa. This finding is higher than the present study finding. The difference may be due to small sample size, defect in storage of sample of due to manufacturers problem10. Xu et al. (2003) found the mean compressive strength of composite 265MPa. This result supports the present result10. The value of compressive strength of giomer is greater than that of compomer and composite. Xu et al. 2003 indicates the correlation between the compressive strength and fluoride release that-materials with high fluoride release have lower compressive strength. In the present study we can see that compressive strength of giomer is higher than compomer but fluoride release of both of them is similar10. Finally, a low release of fluoride from dental materials may have clinical implications in vivo. Fluoride release from glass ionomer restorations increases the fluoride concentration in saliva and in adjacent hard dental tissues. Thus, continuous small amounts of fluoride supporting the
