

Assessment of Occlusal Load Strength of Glass Ionomer Cement and Composite in Class 2 Cavities - An in-vitro study

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ABSTRACT:

INTRODUCTION: Glass Ionomer Cement is one among the preferred direct restorative material for a long time because of its good biocompatibility, chemical adhesion towards the tooth structure, anticariogenic nature but it also equally has various disadvantages such as high polymerization shrinkage and factors such as postoperative sensitivity, micro-leakage and enamel cracks. **AIM:** The current study focuses at assessing the occlusal load strength of Class II cavities restored using GIC and Resin Composite. **MATERIALS AND METHOD:** This study was carried out on 10 human molar teeth samples collected from the Department of Oral Pathology, Saveetha Dental College and Hospital. After sample collection Class 2 cavity preparation was carried out in all the collected samples following which they were divided into 2 groups with 5 samples in each group. Group 1 samples were restored using GIC and Group 2 samples were restored using Resin Composite following which Occlusal load strength of both the group samples were assessed using the Instron compression platform. **RESULTS:** The values were recorded and tabulated for statistical analysis for comparing the occlusal load strength of group 1 and group 2 samples. The results were analyzed using an independent t-test and it was found to be statistically significant $P = 0.012$ i. e P value <0.05 . **CONCLUSION:** The current study within the limitations depict that the occlusal load strength of the samples restored using Composite (Group 2) is greater when compared to samples restored using GIC (Group 1).

KEYWORDS: Occlusal load, GIC, composite, Class II cavity

INTRODUCTION:

Glass Ionomer cement (GIC) is among the conventional restorative material used in the field of dentistry for many years in different composition for various purposes such as luting the milled prosthetic crowns, restoring primary teeth or while doing an atraumatic restoration in a camp site (1). Glass ionomer cement is also termed as Glass Polyalketone Cement by the ISO (2).GIC is available in the market usually in the form of powder and liquid system which is mixed into a paste consistency during use (3). The powder component generally contains fluoroaluminosilicate glass and the liquid component contains an aqueous solution of Polyacrylic acid(4). GIC basically exhibits a Chemical bond towards the inorganic component of the tooth structure and it often exhibit a sustained release of fluoride ion which makes it a preferred option for the restoration involving the proximal caries sinceIt reduces the risk of secondary caries formation.(5)

Resin Composite, one among the latest revolutionary dental products which entirely shifted the entire perspective of restorative field from metal or alloy-based material to tooth colored light curable material . Resin composite is basically a mixture of resin matrix such as BIS-GMA or UDMA, coupling agent and a filler particle along with pigments in some forms(6,7). The Resin Composite is basically categorized into various types, one among the main classification parameters followed is the size of the resin component, based on the size of Resin Particle-Resin composite is divided into micro filled composite, macro filled composite(8). Incorporation of nanoparticles characterized and formulated using herbal products lead to the invention of a better quality of composite called nano composites(9,10).

Instron universal testing machine used in the current study is a new precise innovation in the field of science which aids in gaining a better insight towards a material property (8). The current study focuses at assessing the occlusal load strength of Class II cavities restored using GIC and Resin Composite.

MATERIALS AND METHOD:

SAMPLE PREPARATION:Ten Human Molar teeth without any carious lesions were collected from the Department of Oral Pathology, Saveetha Dental College and Hospital. After sample collection Class 2 cavity preparation was carried out in all the collected samples following which they were divided into 2 groups with 5samples in each group. Group 1 samples were restored using GIC and Group 2 samples were restored using Resin Composite. The restorations made on the samples of both the groups were polished using a polishing bur and then subjected to testing to assess the occlusal load strength.

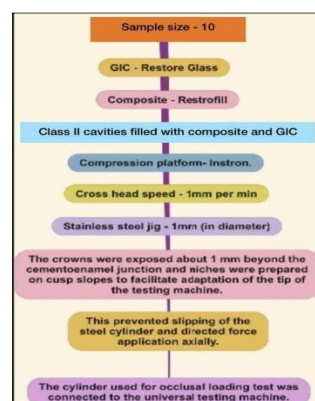
OCCLUSAL LOAD STRENGTH ASSESSMENT:

An eccentric load was applied to the tooth structure using a Universal testing machine (Instron) with a cross-head speed of 1 mm per min and the stresses were further analyzed in the presence of an occlusal loading test using a stainless-steel jig of 1mm diameter which led to the sectioning of the tooth buccolingually under the applied load, stresses were observed to occur at the peripherals of the class II restorations made using GIC as well as resin composite.

STATISTICAL ANALYSIS:

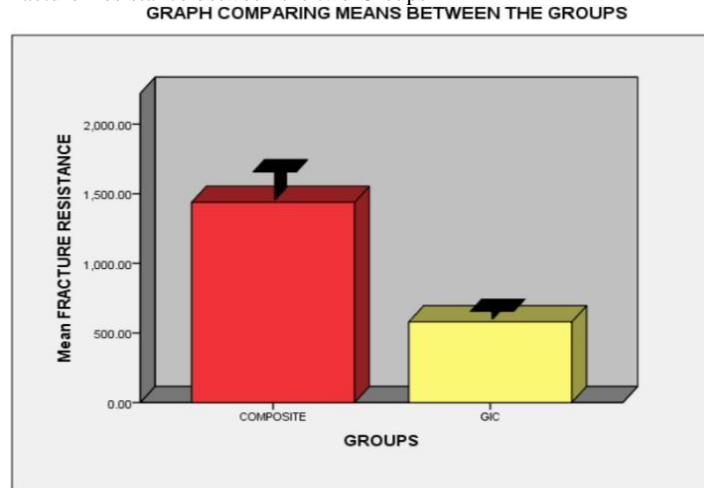
The occlusal load strength of both the groups was obtained and the values were tabulated, with the tabulated values descriptive analysis “independent t test” was performed using the statistical software “SPSS version 23” and the results were illustrated in the form of bar graphs.

FIGURE 1: METHODOLOGY :



RESULTS:

The values obtained from the Instron Universal Testing Machine were systematically tabulated and statistical analysis was carried out in order to compare the occlusal load-bearing strength between Group 1(GIC) and Group 2(COMPOSITE) samples. After the completion of independent t test the observed differences were statistically meaningful, the analysis revealed a p -value of 0.012. Since this value is less than the conventional threshold of 0.05, the result was considered statistically significant. In practical terms, this indicates that the difference in occlusal load strength between Group 1(GIC) and Group 2(COMPOSITE) was unlikely to have occurred randomly, and instead reflects a genuine disparity in the mechanical performance of the tested materials.

Figure 2: Graph Depicting Mean Fracture Resistance between the two Groups**DISCUSSION:**

The Comparative evaluation of restorative materials highlights the consistent superiority of composite resin in terms of mechanical performance, particularly under occlusal loading. In some studies, composite resin demonstrated significantly higher occlusal load strength than conventional glass ionomer cement (GIC) in Class V cavities (11). Similarly, few studies reported that microhybrid composite resin exhibited better durability and performance compared to GIC in Class I cavities, especially when subjected to occlusal forces. These findings reinforce the established understanding that composite resins are more suitable for stress-bearing restorations due to their superior mechanical properties(5). With respect to marginal integrity, in few studies it was observed that flowable composites were not effective in reducing gingival microleakage(12–14). Furthermore, gingival microleakage associated with bulk-fill composites in Class II cavities was not considerably different from that of incrementally layered conventional composites(15,16). Importantly, the increase in mean gingival microleakage after six months of storage was not statistically significant compared to values obtained after 24 hours, suggesting that the marginal seal of composite restorations remains relatively stable over time(17,18)

In the present study, composite resin once again demonstrated greater occlusal load strength compared to conventional GIC, confirming its suitability for posterior restorations where functional demands are high. Nevertheless, evidence from few studies indicates that resin- modified glass ionomer cement (RMGIC) can perform successfully in small to moderate Class II restorations, offering a balance between mechanical strength and fluoride release. Additionally, studies on atraumatic restorative treatment (ART) using high-viscosity GIC in school-based settings have shown comparable success rates to composite restorations performed in clinical environments(19,20)(12). This underscores the practical utility of GIC-based materials in community dentistry, particularly where ease of application and fluoride release are prioritized(12,13)

CONCLUSION:

The current study within its limitations draws to a conclusion stating the material Resin Composite possesses better occlusal load strength compared to the conventional Glass ionomer cement. However, to provide a definitive conclusion regarding this it still further needs the results of in -vivo studies and to prove it additional scientific evidence is also required.

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AUTHOR CONTRIBUTION:

Ms. Srivarsha Ranjeet: Literature search, survey, data collection, analysis, manuscript writing. Dr.Sanyukta Singh : Study design, data verification, manuscript, drafting, manuscript correcting.

CONFLICT OF INTEREST:

The authors declare that there are no conflicts of interest in the present study.

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