Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies **NLM ID:** 101716117

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Indian Citation Index (ICI) Index Copernicus value = 91.86

(e) ISSN Online: 2321-9599;

(p) ISSN Print: 2348-6805

Original Research

Assessment of Compressive strength of glass ionomer cements

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ABSTRACT:

Background: The present study was conducted for assessing compressive strength of glass ionomer cements. **Materials & methods:** Two study groups were made; Bioglass R and Fuji IX. 60 specimens were prepared for each material. The cylinder dimensions were 7 mm diameter x 13 mm height. The powder/liquid ratios were used according to the manufacturers' instructions for all materials. Tests were made in an Universal Testing Machine. Analysis of results was done using SPSS software. **Results:** Comprehensive strength among specimens of Bioglass R group and Fuji IX group was 48.32 MPa and 91.43 MPa. Significant results were obtained while comparing the compressive strength among patients of the two study groups. **Conclusion:** Fuji IX exhibited significantly higher comprehensive strength. **Key words:** Comprehensive strength, Glass ionomer cement

Received: 16 June, 2022

Accepted: 24 July, 2022

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This article may be cited as: Altaf A, Mushtaq S, Jehan SS, Mubashir S. Assessment of Compressive strength of glass ionomer cements.. J Adv Med Dent Scie Res 2022;10(8):150-152.

INTRODUCTION

Conventional Glass Ionomer Cements (GICs) were introduced to the dental professional in 1971 by Wilson & Kent as materials consisting of a baseusually an ion-leachable, calcium-aluminumfluorosilicate glass powder that is combined with polyacrylic acid or its copolymers. These cements possess certain unique properties that make them useful as restorative and adhesive materials, including adhesion to moist tooth structure and base metals, anticariogenic properties due to release of fluoride, thermal compatibility with tooth enamel because of low coefficient of thermal expansion similar to those of tooth structure, biocompatibility and low cytotoxicity. The limitations include the brittleness and poor fracture toughness of the materials.¹⁻³

Due to their considerable advantages and improvement, GICs have been widely indicated in the Atraumatic Restorative Treatment (ART) technique. The ART is an approach of caries removal using only hand instruments, and restoring the cavity and sealing any associated fissures and pits with an adhesive restorative material, such as the currently used GICs. The approach combines a preventive component with a restorative procedure, and has the potential to be minimally invasive and maximally preserve the tooth structure.⁴⁻⁶ Hence; the present study was conducted for assessing compressive strength of glass ionomer cements.

MATERIALS & METHODS

The present study was conducted for assessing compressive strength of glass ionomer cements. Two study groups were made; Bio glass R and Fuji IX. 60 specimens were prepared for each material. The cylinder dimensions were 7 mm diameter x 13 mm height. The powder/liquid ratios were used according to the manufacturers' instructions for all materials. The specimens were made at room temperature. After mixing, the materials were inserted slowly to adapt the material into the matrix and avoid bubble formation. The matrices were slightly overfilled with the GIC; a polyester strip covered with a thin layer of petroleum jelly was placed on the material and a coverslip was placed on top of it. The specimens were afterward stored in 6mL of deionized water at 37±1°C. Tests were made in an Universal Testing Machine. Analysis of results was done using SPSS software.

RESULTS

Comprehensive strength among specimens of Bioglass R group and Fuji IX group was 48.32 MPa and 91.43 MPa. Significant results were obtained while comparing the compressive strength among patients of the two study groups.

Compressive strength	Bio glass R group	Fuji IX group	
Mean	48.32	91.43	
SD	12.8	18.4	
p-value	0.000 (Sign	nificant)	

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Table 1: Comparison	0	f comprehensive strength

DISCUSSION

Glass ionomer cements were introduced in dental practice in the '70s. Since then, several modifications have been introduced with the purpose of enhancing their mechanical properties and expanding their indications and clinical applications. For many years, glass ionomer cements were solely used for the restoration of anterior teeth, due to their poor mechanical strength. As improvements were introduced in their formulation, they started to be indicated for class I restorations of primary teeth. Nowadays, resin-modified glass ionomers and resin composites are commercially available, with superior values of mechanical strength when compared to conventional cements. Studies have been performed in an attempt to better understand their properties, and compressive strength testing is the most commonly employed method to evaluate the strength of these materials.⁶⁻⁹ Hence; the present study was conducted for assessing compressive strength of glass ionomer cements.

Comprehensive strength among specimens of Bioglass R group and Fuji IX group was 48.32 MPa and 91.43 MPa. Significant results were obtained while comparing the compressive strength among patients of the two study groups.Bresciani E et al compared, in different periods of time, the compressive and diametral tensile strength of a traditional high viscous glass ionomer cement: Fuji IX (GC Corporation), with two new Brazilian GIC's: Vitro-Molar (DFL) and Bioglass R (Biodinamica), all indicated for the Atraumatic Restorative Treatment (ART) technique. Fifteen disk specimens (6.0mm diameter x 3.0mm height) for the diametral tensile strength (DTS) test and fifteen cylindrical specimens (6.0mm diameter x 12.0mm height) for the compressive strength (CS) test were made of each GIC. Specimens were stored in deionized water at 37° C and 100% of humidity in a stove until testing. Five specimens of each GIC were submitted to CS and DTS test in each period, namely 1 hour, 24 hours and 7 days. The specimens were tested in a testing machine (Emic) at a crosshead speed of 1.0mm/min for CS and 0.5mm/min for the DTS test until failure occurred. The data were submitted to two-way ANOVA and Tukey tests (alpha=0.05). The mean CS values ranged from 42.03 to 155.47MPa and means

DTS from 5.54 to 13.72 MPa, with test periods from 1h to 7 days. The CS and DTS tests showed no statistically significant difference between Fuji IX and Vitro Molar, except for CS test at 1-hour period. Bio glass R had lowest mean value for CS of the cements tested. In DTS test Bio glass R presented no statistically significant differences when compared with all others tested GICs at 1-hour period and Bio glass R presented no difference at 24-hour and 7-day periods when compared to Vitro-Molar.¹⁰

Show kat I et al, in a previous study, compared the effect of various additives on the flexural strength of glass ionomer cement. 30 samples for evaluation of compressive strength were equally divided into 3 groups: Group 1- Control (Conventional GIC- Non modified), Group 2: GIC Powder modified with 3% TiO2 and Group 3: GIC Powder modified with 10% Nano Hydroxyapatite. The mean compressive strength value of Group 5 showed statistically significant higher flexural strength among all the groups (177.14 \pm 0.81). Conclusion: The results of the study revealed that glass ionomer cement powder can be modified with nano-hydroxyapatite and nanotitanium to improve its compressive strength.¹¹

CONCLUSION

Fuji IX exhibited significantly higher comprehensive strength.

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