

**How to Cite:**

Saini, R. S., & Kaur, K. (2022). Evaluation of flexural strength of glass carbomer cement and conventional glass ionomer cement: A comparative study. *International Journal of Health Sciences*, 6(S8), 932–936. <https://doi.org/10.53730/ijhs.v6nS8.9947>

## **Evaluation of flexural strength of glass carbomer cement and conventional glass ionomer cement: A comparative study**

**Dr Ravinder Singh Saini**

Associate Professor, COAMS, King Khalid University, Abha, Saudi Arabia  
Corresponding author email: [dr\\_ravi\\_saini@yahoo.com](mailto:dr_ravi_saini@yahoo.com)

**Dr. Kanwalpreet Kaur**

MDS, Pediatric and Preventive Dentistry, Consultant Pediatric Dentist, Ludhiana, Punjab

**Abstract**---Background: The conventional glass ionomer cement (GIC) has been advocated as a restorative material because of its ability to chemically bond to tooth structures and release fluoride. Recently, glass carbomer cement, a GIC-based restorative material, has been introduced with claims of improved physical characteristics. Hence; the present study was conducted for comparing the Flexural Strength of Glass Carbomer Cement and Conventional Glass Ionomer Cement. Materials & methods: The present study was conducted for comparing the Flexural Strength of Glass Carbomer Cement and Conventional Glass Ionomer Cement. Study moulds were made out of silicone putty material. Stainless steel scaffolding was used for creating a mould of desired dimensions. Total 40 specimens were prepared and divided into two study groups with 20 specimens in each group. One group was of conventional GIC while the other group was GCC. After preparation of the specimen, testing of flexural strength was done using universal force testing machine. All the results were recorded, analysed and compared. Results: Mean flexural strength of GIC and GCC was 28.3 MPa and 26.9 MPa respectively. Non-significant results were obtained while comparing the mean flexural strength of GIC and GCC. Conclusion: Flexural strength of glass carbomer cement was similar to conventional glass ionomer cement. Hence; its use should be limited to areas of minimal stress.

**Keywords**---glass ionomer cement, carbomer, flexural strength.

## **Introduction**

The conventional glass ionomer cement (GIC) has been advocated as a restorative material because of its ability to chemically bond to tooth structures and release fluoride. With additional benefits of biocompatibility, antibacterial effects, and the ability to remineralize hydroxyapatite crystals, conventional GIC has been well accepted in pediatric patients with high caries risk activity.<sup>1-3</sup> Resin-modified GIC and high-viscosity GICs have been developed in an attempt to overcome the inherent physical shortcomings of conventional GIC. Today, both restorative materials have been established in pediatric practice, and their favorable longevity as a permanent restoration in primary teeth have been demonstrated in several clinical studies. Recently, glass carbomer cement, a GIC-based restorative material, has been introduced with claims of improved physical characteristics. This new material contains nanosized powder particles and fluorapatite as secondary filler.<sup>4-6</sup> Hence; the present study was conducted for comparing the Flexural Strength of Glass Carbomer Cement and Conventional Glass Ionomer Cement.

## **Materials & Methods**

The present study was conducted for comparing the Flexural Strength of Glass Carbomer Cement and Conventional Glass Ionomer Cement. Study moulds were made out of silicone putty material. Stainless steel scaffolding was used for creating a mould of desired dimensions.

### **Preparation of GIC sample**

A chemically cured GIC was used. The material was adapted to the surface of the mold with slight pressure. Compression firming was done by hand using a plastic instrument to allow proper adaptation of the material. Once the material was set, material was removed from the mold. The samples were then examined visually for imperfections.

### **Preparation of Glass Carbomer Cement (GCC)**

A light-cured GCC was available in encapsulated form. The inner surface of the mold was coated with GCC gloss. The entire sample was cured using a high-power Carbo LED curing light for 60 s. After the material was set, it was carefully lifted out of the silicone mold using a metal instrument. The samples were then examined usually for imperfections.

### **Testing of samples**

Total 40 specimens were prepared and divided into two study groups with 20 specimens in each group. One group was of conventional GIC while the other group was GCC. After preparation of the specimen, testing of flexural strength was done using universal force testing machine. All the results were recorded, analysed and compared.

## Results

Mean flexural strength of GIC and GCC was 28.3 MPa and 26.9 MPa respectively. Non-significant results were obtained while comparing the mean flexural strength of GIC and GCC.

Table 1: Comparison of flexural strength (MPa)

Study group	Mean	SD	p- value
GIC	28.3	8.1	0.125
GCC	26.9	7.9	

## Discussion

Glass ionomer cements are materials that have several applications in restorative dentistry, including functioning as liners and bases, full restoratives, pit-and-fissure sealants, and adhesives for the fixation of orthodontic brackets. Bioactivity is an important feature of these materials, a phenomenon that has appeared in several observations. In saliva, glass ionomers have been shown to uptake calcium and phosphate ions with a resulting increase in hardness. At the interface with the tooth, an ion-exchange process occurs over time that leads to the formation of a distinctive layer that provides a highly durable and strong bond between the cement and the tooth. Lastly, at the bottom of pits and fissures, the morphology of the glass ionomer changes and a structure is formed, which is reported to be “enamel-like”. These features have been exploited in a new type of glass ionomer material known as glass carbomer™. This material is formulated with hydroxyapatite as secondary filler, although previous reports suggested that the filler was fluorapatite.<sup>7- 10</sup> Hence; the present study was conducted for comparing the Flexural Strength of Glass Carbomer Cement and Conventional Glass Ionomer Cement.

Mean flexural strength of GIC and GCC was 28.3 MPa and 26.9 MPa respectively. Non-significant results were obtained while comparing the mean flexural strength of GIC and GCC. Faridi MA et al evaluated flexural strength of a conventional GIC (Fuji IX) against a newly developed glass carbomer cement (GCP). For Fuji IX and GCP, a total of 80 blocks were prepared and divided into 16 groups (n = 5). These groups were further categorized according to the storage medium (artificial saliva and Vaseline) and time intervals (24 h and 1, 2, and 4 weeks). A 3-point bending test was carried out, and statistical analysis was done using ANOVA and Tukey post hoc tests. Fuji IX showed a mean flexural strength of  $25.14 \pm 13.02$  versus  $24.27 \pm 12.57$  MPa for GCP. There was no significant statistical difference between both materials when compared under storage media. Both materials showed the highest value for flexural strength at 2 weeks of storage and lowest at 4 weeks. The storage media do not affect the flexural strength of the specimens with reference to time.<sup>10</sup>

In another previous study, Hasan MHR et al studied the fluoride uptake and release properties of glass carbomer dental cements and compare them with those of conventional and resin-modified glass ionomers. Three materials were used, as follows: glass carbomer (Glass Fill), conventional glass ionomer (Chemfil Rock)

and resin-modified glass ionomer (Fuji II LC). For all materials, specimens (sets of six) were matured at room temperature for time intervals of 10 minutes, 1 hour and 6 weeks, then exposed to either deionized water or sodium fluoride solution (1000 ppm in fluoride) for 24 hours. Following this, all specimens were placed in deionized water for additional 24 hours and fluoride release was measured. Storage in water led to increase in mass in all cases due to water uptake, with uptake varying with maturing time and material type. Storage in aqueous NaF led to variable results. Glass carbomer showed mass losses at all maturing times, whereas the conventional glass ionomer gained mass for some maturing times, and the resin-modified glass ionomer gained mass for all maturing times. All materials released fluoride into deionized water, with glass carbomer showing the highest release. For both types of glass ionomer, uptake of fluoride led to enhanced fluoride release into deionized water. In contrast, uptake by glass carbomer did not lead to increased fluoride release, although it was substantially higher than the uptake by both types of glass ionomer. Glass carbomer resembles glass ionomer cements in its fluoride uptake behavior but differs when considering that its fluoride uptake does not lead to increased fluoride release.<sup>11</sup>

## Conclusion

Flexural strength of glass carbomer cement was similar to conventional glass ionomer cement. Hence; its use should be limited to areas of minimal stress.

## References

1. Smith DC. Polyacrylic acid-based cements-adhesion to enamel and dentin. *Oper Dent.* 1992;(Suppl 5):177–183.
2. Erickson RL, Glasspoole EA. Bonding to tooth structure: a comparison of glassionomer and composite-resin systems. *J Esthet Dent.* 1994;6:227–244.
3. Nikolaos K, Vassiliki T, Christine T, Eirini T. The early fluoride release pattern of an aged glass ionomer treated with fluoride. *Eur J Prosthodont Restor Dent.* 2007;15:135–141.
4. Hotta M, Hirukawa H, Yamamoto K. Effect of coating materials on restorative glassionomer cement surface. *Oper Dent.* 1992;17:57–61.
5. Watson T, Banerjee A. Effectiveness of glassionomer surface protection treatments: a scanning optical microscope study. *Eur J Prosthodont Restor Dent.* 1993;2:85–90.
6. Using glass ionomers Council on Dental Materials, Instruments, and Equipment. *J Am Dent Assoc.* 1990;121:181–188.
7. Guelmann M, Bonnin S, Primosch RE, Söderholm KJ. Microleakage and wall adaptation of conservative restorations. *Am J Dent.* 2002;15:407–411.
8. Chen X, Cuijpers V, Fan M, Frencken JE. Marginal leakage of two newer glassionomer-based sealant materials assessed using micro-CT. *J Dent.* 2010;38:731–735.
9. Davidovich E, Weiss E, Fuks AB, Beyth N. Surface antibacterial properties of glass ionomer cements used in atraumatic restorative treatment. *J Am Dent Assoc.* 2007;138:1347–1352.
10. Faridi MA, Khabeer A, Haroon S. Flexural Strength of Glass Carbomer Cement and Conventional Glass Ionomer Cement Stored in Different Storage Media over Time. *Med Princ Pract.* 2018;27(4):372–377.

11. Hasan MHR, Sidhu SK. Fluoride release and uptake in enhanced bioactivity glass ionomer cement ("glass carbomer™") compared with conventional and resin-modified glass ionomer cements. *J Appl Oral Sci.* 2019; 27: e20180230.
12. Sofija, G., & Ivan, T. (2018). Quality of life in children with disabilities placed in foster families. *International Journal of Health & Medical Sciences*, 1(1), 18-27. <https://doi.org/10.31295/ijhms.v1n1.35>
13. Widana, I.K., Sumetri, N.W., Sutapa, I.K., Suryasa, W. (2021). Anthropometric measures for better cardiovascular and musculoskeletal health. *Computer Applications in Engineering Education*, 29(3), 550–561. <https://doi.org/10.1002/cae.22202>