

COMPARATIVE EVALUATION OF COMPRESSIVE STRENGTH OF CENTION N AND TYPE IX GLASS IONOMER CEMENT – AN INVITRO STUDY

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ABSTRACT

BACKGROUND: This study aimed to compare the compressive strength of glass-ionomer cement (GIC) Type IX and Cention N. **METHODS:** Five samples each of GIC Type IX and Cention N were prepared for testing the compressive strength. Cylinders of the samples measuring 1 cm diameter and 6 mm height were prepared for compressive strength. Testing was done by mounting the samples in a universal testing machine with a crosshead speed of 1 mm/min. **RESULTS:** The mean compressive strength of Type IX GIC (n=10) was 94.010 with standard deviation ± 15.654 while the mean compressive strength of Cention V (n=10) was 125.567 with standard deviation ± 7.890 . The values of the compressive strength Cention N were statistically significant ($P < 0.5$) as compared to GIC Type IX. **CONCLUSION:** The results suggest significantly higher values for mechanical properties of Cention N as compared to GIC Type IX.

KEYWORDS- Cention N, compressive strength, glass-ionomer cement Type IX, restorative dentistry.

INTRODUCTION

The initial signs of dental caries include surface softening, however, when the lesion progresses to the point of breaks in the continuity of the enamel surface, micro cavitations occur. Once cavitations occur, it is a critical stage in caries process as bacteria can easily invade into the dentin¹.

Historically, the management of dental caries was based on the belief that caries was a progressive disease that eventually destroyed the tooth unless there was a surgical and restorative intervention². The current management of dental caries includes assessment of an patient's risk for caries progression alongside management with appropriate preventive measures and restorative

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therapy when indicated. Conversely, some carious lesions may not progress and, therefore, may not need restoration³.

The advantage of restorative therapy includes removing caries and eliminating areas that are susceptible to caries, halting the progression of tooth demineralization, restoring the integrity of tooth morphology, preventing the spread of

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infection into the dental pulp, and loss of tooth structure⁴.

Silver amalgam has been used for many years for posterior teeth restoration due to its good mechanical properties. However, the controversy on the safety of mercury and any causal association with a systemic diseases is one of the oldest ongoing arguments in medicine⁵. Numerous restorative material came into dental practice addressing this. Concern the factors such as their ability to bear stress, durability, integrity of marginal sealing, esthetics, time taken, mechanical and physical properties are important to bear occlusal load in posterior teeth⁶. A leap in the direct restorative was made with the introduction of light-cured composites.

Composites introduced in 1960s, have been available for nearly 50 years⁷ which possess good physical properties, but with limitations like polymerization shrinkage resulting in marginal microleakage, postoperative sensitivity, and secondary caries⁸.

Glass-ionomer cement (GIC) can be viewed as basic filling materials; they are long established, economical, and simple to use. They are usually applied in bulk without an adhesive, are self-curing, and do not require complicated dental equipment⁵.

Recently, a tooth-colored, direct filling restorative material, Cention N, has attracted restorative dentistry. It is self-curing with optional additional light-curing. The alkasite Cention N thus redefines the basic filling, combining bulk placement, ion release, and durability in a dual-curing, esthetic product – satisfying the demands of both dentists and patients. Cention N has been said to possess compressive strength comparable to amalgam and the esthetics of GIC⁵.

In the quest to further study the properties of Cention N and to compare the compressive strength of GIC Type IX and Cention N, the following study

was conducted to establish Cention N as a material for the restoration of posterior teeth.

MATERIALS AND METHODS

The present study was conducted in the Department of Public health dentistry in saveetha dental college and hospital, Chennai.

The materials used in the study were Fuji IX GIC (GC Gold Label) and Cention N (Ivoclar Vivadent). The composition of GIC Type IX with powder consisting of alumina, silica and calcium fluoride and liquid consists of mainly polyacrylic acid and tartaric acid. Unlike the composition of GIC type IX Cention N consist of liquid made of monomer which is a combination of UDMA, DCP, an aromatic aliphaticUDMA, and PEG400 DMA and the powder consists of ytterbium trifluoride and barium aluminium silicate glass along with photo initiator Ivocerin

Ten samples each of GIC Type IX (Group 1) and Cention N (Group 2) were prepared for testing the compressive strength.

Sample preparation for compressive strength

Cylinders of the samples measuring 1 cm diameter and 6 mm height were prepared. Initially, molds using modelling wax were prepared with the measured dimensions. After this, the molds were filled with the restorative material by mixing the powder and liquid according to the manufacturer's instructions. The molds were filled up to the height of the cylindrical mold, and the sample was covered with Mylar strip, followed by covering with glass slab. The samples were then demoulded, and finishing was done using finishing burs. Testing was done by mounting the samples in a universal testing machine with a crosshead speed of 1 mm/min.

Statistical analysis

The data collected were tabulated accordingly and were subjected to statistical analysis using Statistical Package for the Social Sciences -

version-20 (IBM SPSS Statistics.) Mean and standard deviations were calculated for each group and analysed using Student's t-test used for the equality of means and Levene's test for the equality of variances.

RESULTS

The mean and standard deviation of compressive strength of GIC Type IX and Cention N are shown in Table 1. The mean compressive strength of Type IX GIC (n=10) was 94.010 with standard deviation ± 15.654 while the mean compressive strength of Cention V (n=10) was 125.567 with standard deviation ± 7.890 . The results suggest that the values for the compressive bond strength of Cention N are higher than the Type IX GIC with statistically significant value $p=0.002$ which is less than < 0.5 .

| Test Samples | Compressive Strength |
|--------------|----------------------|
| Type IX GIC | 94.010 ± 15.654 |
| Cention V | 125.567 ± 7.890 |
| P | p value 0.002 |

p value < 0.05 - significant value

DISCUSSION

Numerous direct filling materials are available to the modern dental practice from amalgams through to modern bulk-fill composites⁹. Coupled with the increasing rate of avoidance of dental amalgam because of its mercury content and the excessive replacement of serviceable amalgam restorations, amalgam has lost popularity as a restorative material¹⁰. GIC systems have become important dental restorative materials for use as they are easy and practical to use, leach fluoride, adhere to tooth structure, require conservative preparation, and undoubtedly offer better esthetics, cost effective, fluoride releasing, easy to use without complicated equipment, and that offers both strength and good esthetics. Cention N, a tooth-colored, basic filling

material for direct restorations, is self-curing with optional additional light-curing. It is available in the tooth shade A2, is radiopaque, and releases fluoride, calcium, and hydroxide ions⁵. The clinical success of restorative material depends on a good adhesion with dentinal surface so as to resist various dislodging forces acting within the oral cavity.

The compressive strength is an important property in restorative materials, particularly in the process of mastication. The results of the present study advocate that Cention N has compressive strength values significantly higher than GIC Type IX. Sadananda et al. in their study reported high compressive strength and flexural strength values on comparing Cention N and GIC¹¹. The higher values for Cention N could be attributed to the fact that monomers together with initiators, catalysts, and other additives form the reactive part of a resin-based restorative. The strong mechanical properties and good long-term stability can be attributed to the combination of UDMA, DCP, an aromatic aliphatic-UDMA and PEG-400 DMA, which interconnects (cross-links) during polymerization. UDMA is the main component of the monomer matrix. It exhibits moderate viscosity and yields strong mechanical properties. The highly cross-linked polymer structure is responsible for the high flexural strength⁵. This isofiller acts as a shrinkage stress reliever which minimizes shrinkage force, whereas the organic/inorganic ratio, as well as the monomer composition of the material, is responsible for the low volumetric shrinkage¹². Along with the high strength, other properties such as the dual-cured mechanism, fluoride ion release, calcium and hydroxide ion release, low polymerization shrinkage, and the capacity to remineralize make Cention N as a preferred restorative material in dentistry.

CONCLUSION

The results of the present study indicate significantly higher values for mechanical properties of Cention N as compared to GIC Type IX, thus recommending its use as a restorative material for posterior teeth. Further, in vivo studies are, however, required to authenticate it as an ideal restorative material.

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