Research Article

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Evaluation of Compressive Strength of High Fluoride Releasing Glassionomer (Type VII), and Type IX Glass-Ionomer Cement: An In-Vitro Study

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ABSTRACT

Background: The aim of this in vitro study is to assess and evaluate the compressive strength between type VII GIC, type IX GIC

Materials and Methodology: Class I cavities were made on a total of 20 extracted premolars and restored with type VII GIC, type IX GIC and (2 groups of 10 samples each). Samples were thermocycle, Cylindrical shaped moulds were taken and restored with Type VII GIC, Type IX GIC the specimens were tested for compressive strength by mounting them on a Universal testing machine.

Results: The comparison of the performance between the two groups showed a statistically significant difference value.

Conclusion: In this study, Type IX GIC showed high compressive strength when compared to the other restorative cement.

Keywords: Complete Denture Hygiene, Oral Health, Oral hygiene practices.

INTRODUCTION

Glass-ionomer cement (GIC) is inevitable in the field of dentistry after its development by Wilson and Kent in 1972.[1] Ideal care to children in an inaccessible area can be achieved by the usage of various restorative material which comes under the procedure of minimally invasive dentistry, but, yet glass-ionomer cement (GIC) is used world widely. However, the usage of GIC in many instances, mainly in obstinate children, is limited due to moisture contamination, lengthy setting time, desiccation, and also due to deprived wear resistance and less fracture toughness. The success of any restorative material depends on its bonding strength to the prepared cavity walls, and thus, it is most commonly considered to be the main causative factor to secondary caries, leading to the failure of restoration and pulpal irritation.[2] Meanwhile, the permanency of any dental restoration mostly depends on the sealing aptitude and retention of the material to the prepared tooth cavity walls.

The retention and sealing ability of the cement can be improved by improving the adhesive contrivance of the cement. On the other hand, confinement of any kind of restorative material includes the brittleness and poor fracture resistance of the materials. Thus, determining the compressive

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strength of the material plays a vibrant role which determines the mechanical properties of the cement.[2] Thus, the objective of this in-vitro study was to determine the compressive strength between Type VII GIC (high fluoride releasing), Type IX GIC(high strength)

MATERIALS AND METHODOLOGY

Twenty intact, caries-free human premolar teeth freshly extracted for orthodontic purposes were selected for the study. The selected teeth were also free from cracks, stains and restorations. After surface debridement with hand scaling instruments, the teeth were cleaned with pumice and stored in normal saline.[3]to prevent it from dehydration. The tooth was well cleaned using a slurry of pumice powder with a polishing rubber cup.

A standardized G. V. Black's Class I cavity preparation was occlusogingival depth and 3-mm mesiodistal width using a water-cooled, done in all 20 extracted premolars of 2-mm high-speed handpiece and fissure diamond bur which were divided into two groups and restoration was done following the manufacturer's instruction using Type VII

GIC, Type IX GIC.

- Group I: Ten teeth to be restored with Type VII GIC(high fluoride releasing)
- Group II: Ten teeth to be restored with Type IX GIC (high strength)

After restoration, the teeth were exposed to finishing and polishing and were stowed in de-ionized water at 37°C for 24 h. Each tooth of both the groups was then individually subjected to thermocycling at various temperatures such as 5°C, 37°C, and 55°C for 650 cycles, each with an interval of 30 s, and then stored in distilled water for 24 h to prevent dehydration,[4,5] The purpose of thermocycling is to simulate the oral environment. Then, the specimens were placed in a universal testing machine, and compressive force was applied with a crosshead speed of 1.0 mm/min, and the values were obtained for the Specimens in N/m

RESULTS

Compressive strength is also higher in group ii, followed by the group I, and least in group III.

Table 1: Values obtained for compressive strength in N/mm2 between two different restorative materials.

Numbers	GIC TYPE VII	GIC TYPE IX
1	115.02	156.00
2	124.02	162.12
3	120.03	162.00
4	139.00	166.12
5	132.02	178.12
6	112.00	172.00
7	116.00	183.25
8	122.22	188.26
9	117.12	176.12
10	146.00	182.00

Table 2: Comparison between both the restorative materials.

	MEAN	SE	Kruskal-Wallis	P value
Type VII GIC	124.341	3.49	24.82	0.0015
Type IX GIC	172.57	3.39		

$P<0.05$ is considered to be statistically significant. GIC: Glass-ionomer cement, SE: Standard error

DISCUSSION

In this study, the compressive strength obtained was highest for GIC TYPE IX, followed by GIC TYPE VII. Compressive strength testing is important *in vitro* studies since it is considered a good indicator for simulating the forces that the restorative materials are subjected to under mastication. Compressive strength is measured using the Instron Universal testing machine, as it is a simpler way to analyze the compressive strength. thermocycling procedure is used to simulate the oral environment as restorative material has to withstand various food materials at the different temperature inside the oral cavity

Thus, the compressive strength of the restorative material placed into the cavity walls plays a vital role mainly during the application of masticatory forces, while an increase of the compressive strength can be analyzed by the setting reaction of the restorative cement used.

A study conducted to compare the compressive strength and diametral tensile strengths of two different types of GIC. According to the manufacturer, type VII Gic is considered as high fluoride-containing as GIC was found to be lower (83.39–147.93 MPa) than that of the compressive strength of amalgam (300–450 MPa) and composite resin (210–340 MPa), and it was concluded that the compressive strength of amalgam is higher [3]Compressive stresses contribute to fracture or failure through masticatory forces, although an exact critical value is unknown. According to British specification, 125 MPa is considered as a minimal value to resist the normal masticatory force commonly used by humans, whereas some authors believe that this value should be 100 MPa in the primary dentition.[6] In this study, high compressive strength between the two different types of cement was compared and analyzed by the

Kruskal–Wallis test showed a statistically significant difference (P = 0.00015. Group II (Type IX GIC) exhibited a greater compressive strength, with a mean value of 172.57 N/mm2, when compared to Group I (Type VII GIC) with mean values of 124.341. N/mm2

CONCLUSION

From the present study, it can be concluded that type IXGIC showed greater compressive strength as compared to type VII GIC (high fluoride releasing). This in-vitro study needs a proper clinical investigation to be applied as a long-term clinical study to overcome the lack of exact oral environmental functions.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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