



Dentistry

COMPARATIVE EVALUATION OF COMPRESSIVE STRENGTH OF GLASS IONOMER CEMENT AFTER INCORPORATION OF ANTIMICROBIAL AGENTS- AN INVITRO STUDY

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ABSTRACT **Objectives:** The study was designed to investigate compressive strength when Anhydrous GIC (ChemFill Superior) mixed with antimicrobials Perfora Probiotic Mouth rinse, Iodine solution, Chlorhexidine solution **Materials and Methods:** Experimental materials were mixed and the mixed cement was packed in the mould within 2 minutes of start of mixing of the cement. Sample were stored in Distilled water at 37 degrees for 24 hours. Samples were tested for evaluation of compressive strength using Universal Testing Machine **Results:** Mixed cements exhibited inferior compressive strength than the control group **Conclusion:** Compressive strength of Glass ionomer cements are in the order ChemFill>Probiotic Incorporated ChemFill> Chlorhexidine incorporated ChemFill> iodine incorporated ChemFill

KEYWORDS : Glass ionomer cements, compressive strength, antimicrobials

INTRODUCTION

The most prevalent condition affecting the oral cavity globally is dental caries. The material of choice in the ITR approach is conventional glass-ionomer cements (GIC), which were first introduced in 1972 by Wilson and Kent. It is tooth-colored and chemically adhesive, and it has a caries-protective effect due to fluoride release and reduced thermal expansion. Dental restorative materials' ultimate objective is to replicate the biological, practical, and aesthetically pleasing qualities of healthy tooth structure. One of the key qualities a direct posterior restorative material must have in order to guarantee the lifetime of the restoration is good compressive strength.

Several antibacterial compounds have been investigated for use as glass-ionomer cement additives. These compounds need to be chosen carefully because it must not be toxic towards the cells of the pulp or the gingiva but must still be able to protect against the growth of cariogenic bacteria⁹. The therapeutic procedures used in the treatment of caries do not always eliminate all the microorganisms. Persisting cariogenic bacteria can cause recurrent caries and failure of restoration. Incorporation of an antimicrobial agent in the restorative material may be of paramount significance¹⁰ Owing to its antimicrobial properties, low cost, and well understood pharmacological properties CHX can be easily incorporated into several dental materials including GIC¹¹. Iodine is an antimicrobial and It was suggested that discolouration of the carious lesion can be avoided while the caries arresting effect of SDF is not changed. The suggested explanation is that the silver ions from the SDF solution will react with the iodide ions from the KI solution to form silver iodide. It was reported that the application of SDF + KI to dentine surfaces before the placement of GIC restorations did not affect the bond strength of GIC to dentine^(12,13). Probiotic technology represents a breakthrough approach to maintaining oral health by utilizing natural beneficial bacteria commonly found in healthy mouths to provide a natural defense against those bacteria thought to be harmful to teeth and gums. However, data are still sparse on the probiotic action in the oral cavity¹⁴ This study was designed to investigate effect on Compressive strength of Anhydrous Glass ionomer cement (ChemFill superior) when mixed with antimicrobial agents like Probiotic mouth rinse, Iodine solution, Chlorhexidine mouth wash. In ART and Minimally invasive dentistry this study will lead light as incorporation of antimicrobials will prevent caries has been already proven the simplest method to be used is mix it with antimicrobials should be evaluated. Mostly in clinical practice GIC powder and liquid are used. Anhydrous GIC is used rarely where liquid is incorporated in powder and is mixed with distilled water. Many studies had already proven antimicrobials incorporated GIC had caries prevention property. This study put an effort to see what happens with their compressive strength when antimicrobials are used to mix the Anhydrous Glass ionomer cement with antimicrobials instead of distilled water.

AIM

To Evaluate and Compare the compressive strength of glass ionomer cements after incorporation of antimicrobial



Chlorhexidine Povidine iodine Distilled water Aluminium mould



Universal testing machine Perfora probiotic mouth rinse ChemFill Superior

METHODOLOGY

Customized cylindrical Aluminum Mould (6 ± 1 mm Height * 4 ± 1 mm Diameter) was fabricated. 10 samples each of GIC+probiotic, GIC+Iodine, GIC+Chlorhexidine, GIC+ Distilled water prepared. The mixed cement was packed in the mould within 2 minutes of start of mixing of the cement. Sample were stored in Distilled water at 37 degrees for 24 hours Samples were tested for evaluation of COMPRESSIVE STRENGTH using Universal Testing Machine This was connected to a load measuring cell which recorded the load applied to the sample at a crosshead speed of 1mm/1min till the sample Fractures

Statistical Analysis

Sample size estimation

Using the formula,

$$n = \frac{2(SD)^2(Z_{1-\alpha/2} + Z_{\beta})^2}{(d)^2}$$

where, SD = STANDARD DEVIATION- 0.7

$Z_{1-\alpha/2} = 1.96$ AT 95% CONFIDENCE INTERVAL

$Z_{\beta} = 0.84$ AT 80% power

d = MEAN DIFFERENCE = 3

SUBSTITUTING THE VALUES, n = 6.6

10% sample is added to compensate for the sampling loss if any

Therefore the overall sample size is $10 \times 4 = 40$

Analysis performed using SPSS version 21.

Descriptive statistics calculated and expressed, ANOVA was performed.

P value is set at <0.05

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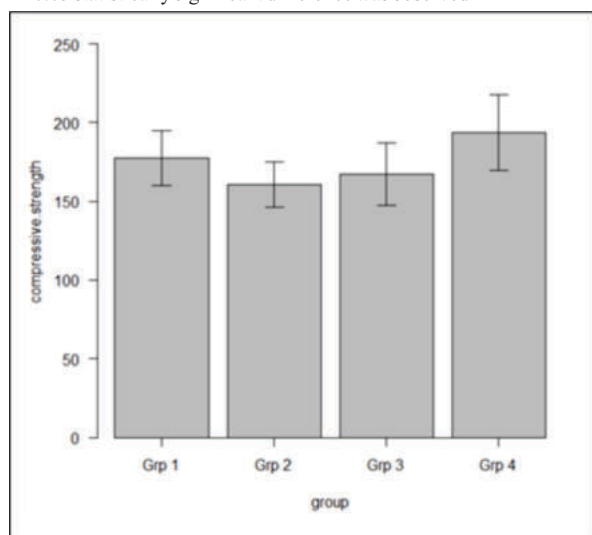
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RESULTS

Group	Compressive Strength	P Value
GIC +PROBIOTICS(GROUP I)	177.4 ±17.63	0.00331
GIC+IODIDE (GROUPII)	160.7 ±14.61	
GIC+CHLORHEXIDINE (GROUPIII)	167.3 ±20.02	
CHEMFIL SUPERIOR (GROUPIV)	193.7 ±24.09	

P<0.05 statistically significant difference was observed



DISCUSSION

When two sets of forces are applied to the body in a straight line and are pointed in the same direction, compression stress is the consequence. Therefore, compressive strength is a crucial mechanical characteristic to guard against material breakage when an occlusal force is applied⁴.

Alumino silicate glass and polyacrylic acid are combined to create the fast-setting glass-ionomer restorative compound known as ChemFil® Superior. In order to create a filling substance that clings to dentine and enamel and creates firmly sealed, durable, and aesthetically pleasing restorations, the powder is combined with distilled water. A mouthwash without alcohol that contains hyaluronic acid, vitamin C, and essential oils is called the Perfora Probiotic rinse. The primary base ingredients are Bacillus coagulans, Xylitol, and Sorbitol. Probiotics are living microorganisms or products that include living microorganisms that have a positive impact on a person's health. Consuming goods containing probiotic lactobacilli or bifidobacteria may reduce the amount of *S. mutans* in saliva, according to several studies. A cost-effective probiotic like *Bacillus coagulans* can prevent caries, according to a study by J et al. that assessed the impact of probiotics on salivary *mutans streptococci* (MS) levels in children. In the current investigation, the probiotic-incorporated GIC had a compressive strength of 177.4 ± 17.63, which was lower than the 193.7 ± 24.09 of the control group. Ingredients including aromatic oils, xylitol, and arachidonic acid may interfere with the acid-base reaction of glass ionomer cements and reduce the amount of the -COOH acid group that is accessible for the reaction, which could explain the decreased compressive strength. Betadine or Povidone-iodine are powerful microbicidal medicines that have affinity for the cell membrane, allowing free iodine to reach the bacterial cell surface directly and lysing the germs as a result.⁸ Iodine incorporation displayed the lowest compressive strength. A study by Knight et al. revealed that AgF and KI on the dentine surface that have been allowed to air dry interfere with the development of the binding between GIC and dentine⁶. It

could be caused by the presence of nascent Iodine and Ethanol, which interfere with the glass ionomer cements' ability to set. According to several research, adding chlorhexidine (CHX) to GICs may modify their antibacterial activity against cariogenic bacteria. Additionally, some research have shown that the integration of CHX frequently results in some changes in physical and mechanical properties, which concurs with the current study a high dosage of Mechanical qualities become more fragile as a result of CHX, for example, bonding potential is reduced and setting time is increased. Cationic salts may inhibit the polyacrylic acid glasses' ability to set, according to Prabhakar et al. This is mostly because the CHX molecule contains amine groups. According to a study by Patilla et al., the combination of probiotic and GIC was closely followed by that of betadine and GIC, whereas CHX-GIC had the least antibacterial impact on the bacteria under investigation. The objective of the current investigation was to assess the glass ionomer cements' compressive strength following their integration with these substances.

CONCLUSION

Within the limitation of the study it can be concluded that Compressive strength of Glass ionomer cements are in the order ChemFill>Probiotic Incorporated ChemFill> Chlorhexidine incorporated ChemFill> iodine incorporated ChemFill. Main reason for the decreased compressive strength of experimental groups might be due to the interaction with acid base reaction of Glass ionomer cements which might decrease the polyacrylic acid group available for setting reaction. But the compressive strength of experimental GIC was within normal range

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