Uses of Glass ionomer cements in dentistry

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Abstract:

Background: To study and evaluate the glass ionomer cement used in dentistry. **Materials & methods:** A total of 30 teeth were enrolled. They were divided into different groups. Extracted teeth were included in the present study. Each experimental group consisted of 10 embedded teeth. The data was collected and evaluated. The result was analysed using SPSS software. **Results:** They were divided into groups. Mean shear bond strength was noted. The shear bond strength for glass ionomer cement in capping material was 6.01. **Conclusion:** Glass ionomer cements provide sufficiently high shear bond strengths as capping agent and in restoration.

Keywords: glass ionomer, Bond strength, Luting agent.

Introduction

Glass ionomer cements (GICs) were invented in the late 1960s in the laboratory of the Government Chemist in Great Britain and were first reported on by Wilson and Kent in 1971). [1] GICs set by means of chelation as a result of an acid-base reaction. They strongly adhere to enamel and to some extent to dentin and release fluoride. Initially used as a restorative material, GI further evolved into a luting agent, which is now the predominant application of this class of material. The powder consists of aluminosilicates with high fluoride content. The material is formed by the fusion of quartz, alumina, cryolite, fluortite, aluminum trifluoride, and aluminum phosphate at temperatures of 1100–1300°C. This glass frit is cooled to a dull glow and quenched in water. It is subsequently ground into 45 μm particles. The liquid is composed of polyacrylic acid and tartaric acid, the latter to accelerate the setting reaction. The reaction of the powder with the liquid causes decomposition, migration, gelation, postsetting hardening and further slow maturation. The polyacrylic acid reacts with the outer surface of the particles resulting in release of calcium, aluminum, and fluoride ions. When a sufficient amount of metal ions has been released, gelation occurs, and hardening continues for about 24 hours. [1]

The shear bond strength of luting agents to various core buildup materials should be within the range of clinical acceptability. [2] The water uptake leading hygroscopic expansion and dissolution or the restoration margin affects the bond strength of luting agent to core materials. It is reported that greater erosion in acidic storage media is seen in water based cement and a hygroscopic expansion is seen in resin based cement. [3] Immersion in lactic acid has been used effectively to evaluate the effect of acidic media on cements. [3,4] Acidic condition can occur in the oral cavity because of ingestion of acidic drinks, food or by degradation of polysaccharides. Thus, acid is of great clinical significance. There are various studies reported in the literature regarding the tensile bond strength of various luting cements with core buildup materials. [3,5,6] Hence, this study was conducted to evaluate the glass ionomer cement used in dentistry.

Materials & methods

A total of 30 teeth were enrolled. They were divided into different groups. Extracted teeth were included in the present study. Each experimental group consisted of 10 embedded teeth. All resin and glass ionomer cements were mixed and applied to the brackets and enamel in accordance with the manufacturers' instructions. They were classified as according to material gic as luting agent, EQUIA forte and EQUIA fil. The cement with luting

properties was taken showing luting of capping a crown. The data was collected and evaluated. The result was analysed using SPSS software.

Results

A total of 30 teeth were enrolled. They were divided into groups. Mean shear bond strength was noted. The shear bond strength for glass ionomer cement in capping material was 6.01.

Table 1: glass ionomer as luting agent

Material	Surface	Mean SBS
GIC luting agent	Capping crown	6.01

The mean stress at maximum load for EQUIA forte was 195.20 and for EQUIA coating was 168.45.

Table2: glass ionomer cement as restorative material

Groups and Materials	Mean stress at maximum load (MPa)	P- value
EQUIA forte coating	195.20	0.1
EQUIA coating	168.45	

Discussion

The choice of core foundation materials is confusing and the physical and handling properties may lead the clinician to favour one material over another. Ultimately, a core build-up must be able to withstand the forces of mastication and parafunction over a period of many years. [7,8] Cementation is one of the final steps in the sequence of clinical procedure for indirect restorations. Luting agents comprise a broad category of materials used to attach and seal dental restorations and prostheses to teeth. Proper selection of a luting agent is a last important decision in a series of steps that require meticulous execution and will determine the long-term success of fixed restorations. Hence, this study was conducted to evaluate the glass ionomer cement used in dentistry.

In the present study, a total of 30 teeth were enrolled. They were divided into groups. Mean shear bond strength was noted. The shear bond strength for glass ionomer cement in capping material was 6.01. A study by Patil SM et al, two-Way ANOVA showed significant differences in bond strength of the luting cements ($p<0.05$) and core materials ($p<0.05$) and the interactions ($p<0.05$). Pairwise comparison of luting cements by HOLM-SIDAK test, showed that the RMGIC luting cement had higher shear bond strength values than Traditional GIC luting cement for all the core buildup materials. RMGIC core material showed higher bond strength values followed by Composite resin, GI silver reinforced, GI and silver amalgam core materials for both the luting agents. [9]

In the present study, the mean stress at maximum load for EQUIA forte was 195.20 and for EQUIA coating was 168.45. Another study by Pereira JR et al, fifty human maxillary canines were transversally sectioned at 15 mm from the apex. Canals were prepared with a step back technique until the application of a #55 K-file and filled. Post spaces were prepared and specimens were divided into five groups according to the cement used for post cementation: Luting & Lining Cement; Fuji II LC Improved; RelyX Luting; Ketac Cem; and Ionoseal. After cementation of the glass fiber posts, all roots were stored at 100% humidity until testing. For push-out test, 1-mm thick slices were produced. The push-out test was performed in a universal testing machine at a crosshead speed of 0.5 mm/minute and the values (MPa) were analyzed by Kolmogorov-Smirnov and Levene's tests and by two-way ANOVA and Tukey's post hoc test at a significance level of 5%. [10] The bond strength of a luting agent to dentin or core buildup material is one of the important factors in the success of cast restoration and it should be within the range of clinical acceptability. As most of the failures of indirect restorations occur in the shear stress so in this study, the methodology used to access bond strength was the shear test as previously used by Tezvergil A et al., and Padipatvuthikul P et al.,. [11,12] Sinhoreti MA et al., stated that devices like Chisel systems i.e. straight or saddle shaped chisel, stainless steel tape

and piston can be used to platform the shear bond strength test. [13] Mclean JW and Um CM stated that the main drawback of traditional GIC luting cement is susceptibility to moisture attack & subsequent solubility, if exposed to water during initial setting period. [14,15] The reduced shear bond strength may also be because of absence of resin component and reduced physical and mechanical properties. Similar results were seen in study done by Sandra Hewlett et al., [16] Tensile bond strengths of glass-ionomers to untreated enamel and dentine are good. [17] Values on enamel vary between 2.6 to 9.6 MPa and values on dentine vary from 1.1 to 4.1 MPa. Bond strengths are typically higher to enamel than to dentine, which suggests that the bonding takes place to the mineral phase. Bond strengths develop quickly, with about 80% of the final bond strength being achieved in 15 minutes, after which it increases for several days. [18] GIC and its modifications have a wide array of uses. Owing to resiliency, very low shrinkage, and thermally compatible with tooth structure, these materials have proven results as liners underneath different restorative materials like dental composites (sandwich technique). [19] Attributing to the property of bonding to dentin surfaces without removing the smear layer, their biological compatibility, and fluoride release, GICs, and modified GICs are materials of choice in restoring carious teeth high-caries-risk patients. [20] Because of the ease of placement and snap set property light-cured GICs are the material of choice for restoration in children. [21]

Conclusion

Glass ionomer cements provide sufficiently high shear bond strengths as capping agent and in restoration.

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