Research Article

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Comparative Evaluation of Tensile Bond Strength of Three Different Luting Cements Used In Dentistry

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ABSTRACT

Background: The mechanism by which metal burs remove tooth structure differs from the abrading action of a diamond rotary instrument. Dental cement must be used as a barrier against microbial leakage, sealing the interface between the tooth and restoration and holding them together through some form of surface attachment. Hence; the present study conducted for comparing the tensile bond strength of three different luting cement (Zinc phosphate, Zinc polycarboxylate, and Glass ionomer GC Fuji 1 radio-opaque luting agent) used in dentistry.

Materials & methods: A total of 30 freshly extracted maxillary first premolars were included in the present study. After a thorough cleaning, all the specimens were stored in normal saline until further use. After finishing of the cavity preparation, the impression was taken of all the specimens followed by pouring of casts with type IV dental stones. Wax patterns were made, and casting was done. Afterwards, the castings were devested, finished and polished. All the specimens were divided into three study groups as follows: Group 1: A zinc phosphate group, Group 2: Zinc polycarboxylate group, and Group 3: Glass ionomer group. All the samples were luted according to their respective groups. Universal Testing Machine was used for evaluation of mean tensile strength.

Results: Mean tensile strength of specimens of Group 1, Group 2 and Group 3 was found to be 1.72 MPa, 0.86 MPa and 1.69 MPa respectively. While analyzing statistically, significant results were obtained on comparing the mean tensile strength in-between group 1 and group 2 and in-between group 1 and group 3.

Conclusion: Mean tensile strength of Zinc phosphate cement and Glass ionomer cement is significantly higher in comparison to Zinc polycarboxylate group.

Keywords: Dental cement, Tensile strength.

INTRODUCTION

The complete veneer crown is one of the most important restorations in the armamentarium of the restorative dentist; however, a clinically recognized problem is that the surface character of a prepared tooth may prevent complete seating of the crown, resulting in hyper occlusion and inadequately sealed margins and local periodontal tissue inflammation. The mechanism by which metal burs remove tooth structure differs from the abrading action of a diamond rotary instrument.[1-3] As burs rotate, the flutes undermine dental tissue, and the amount removed is determined by the flute angle of attack, a basic feature of bur design. In the case of diamond burs, the abrasive particles pass across the

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tooth surface and plough troughs in the substrate surface. Tooth structure is ejected ahead of abrading particles, and the surface is transformed into a series of ridges running parallel to the direction of the moving particles.[4, 5] Dental cement must be used as a barrier against microbial leakage, sealing the interface between the tooth and restoration and holding them together through some form of surface attachment. This attachment may be mechanical, chemical, or a combination of both.[6] Hence; the present study conducted for comparing the tensile bond strength of three different luting cements (Zinc phosphate, Zinc polycarboxylate, and Glass ionomer GC Fuji 1 radio-opaque luting agent) used in dentistry.

MATERIALS AND METHODS

The present study was conducted for comparing the tensile bond strength of three different luting cements (Zinc phosphate, Zinc polycarboxylate, and Glass ionomer GC Fuji 1 radio-opaque luting agent) used in dentistry. A total of 30 freshly extracted maxillary first premolars were included in the present study. After a thorough cleaning, all the specimens were stored in normal saline until further use. Mounting of the specimens was done in acrylic resin block till two mm below the cementoenamel junction. Cavity preparation was done in all the samples in a predetermined size for achieving standardization. After finishing of the cavity preparation, the impression was taken of all the specimens followed by pouring of casts with type IV dental stones. Wax patterns were made, and casting was done. Afterwards, the castings were devested, finished and polished. All the specimens were divided into three study groups as follows:

Group 1: Zinc phosphate group
Group 2: Zinc polycarboxylate group
Group 3: Glass ionomer group

All the samples were luted according to their respective groups. Universal Testing Machine was used for evaluation of mean tensile strength. All the results were recorded in Microsoft excel sheet and were analyzed by SPSS software. Student t-test was used for evaluation of the level of significance.

RESULTS

In the present study, a total of 30 specimens were analyzed and broadly divided into three study groups as follows: Group 1: A zinc phosphate group, Group 2: Zinc polycarboxylate group, and Group 3: Glass ionomer group. Mean tensile strength of specimens of Group 1, Group 2 and Group 3 was found to be 1.72 MPa, 0.86 MPa and 1.69 MPa respectively. While analyzing statistically, significant results were obtained on comparing the mean tensile strength in-between group 1 and group 2 and in-between group 1 and group 3.

Table 1: Mean tensile strength (MPa).

Groups	Mean tensile strength	SD
Group 1	1.72	0.95
Group 2	0.86	0.53
Group 3	1.69	0.91

Table 2: Comparison of mean tensile strength

Groups comparison	T value	p- value
Group 1 Vs Group 2	-1.452	0.00*
Group 2 Vs Group 3	12.150	0.01*
Group 1 Vs Group 3	-1.338	0.45

*: Significant

DISCUSSION

Dental luting agents provide the link between a fixed prosthesis and the supporting prepared tooth structure. Traditionally, zinc phosphate cement has been the most popular material, despite its well-documented disadvantages, particularly solubility and lack of adhesion. These drawbacks notwithstanding, the success of fixed prostheses has been well-documented. Many alternative materials have been introduced and recently resin cements have become popular, primarily because they have addressed the disadvantages of solubility and lack of adhesion.[7- 9] Hence; the present study conducted for comparing the tensile bond strength of three different luting cements (Zinc phosphate, Zinc polycarboxylate, and Glass ionomer GC Fuji 1 radio opaque luting agent) used in dentistry.

In the present study, a total of 30 specimens were analyzed and broadly divided into three study groups was follows: Group 1: Zinc phosphate group, Group 2: Zinc polycarboxylate group, and Group 3:

Glass ionomer group. Mean tensile strength of specimens of Group 1, Group 2 and Group 3 was found to be 1.72 MPa, 0.86 MPa and 1.69 MPa respectively. Mohamed F Ayad described the morphologic features of dentin surfaces prepared by common rotary instruments of similar shapes and to determine their effects on the marginal fit for complete cast crowns. Ninety crowns were cast for standardized complete crown tooth preparations. Diamond, tungsten carbide finishing, and crosscut carbide burs of similar shape were used (N = 30). The crowns in each group were subdivided into three groups (n = 10) for use with different luting cements: zinc phosphate cement (Fleck's), glass ionomer cement (Ketac-Cem), and adhesive resin cement (Panavia 21). The marginal fit was measured with a light microscope in a plane parallel to the tooth surface before and after cementation between four pairs of index indentations placed at equal distances around the circumference of each specimen. The interaction effect was not significantly different (p= 0.685). For zinc phosphate cement, the highest marginal discrepancy value (100 +/- 106 micron) was for tooth preparations refined with carbide burs, and the lowest discrepancy value (36 +/- 30 micron) was for tooth preparations refined with finishing burs. For glass ionomer cement, the highest marginal discrepancy value (61 +/- 47 micron) was for tooth preparations refined with carbide burs, and the lowest discrepancy value (33 +/- 40 micron) was for tooth preparations refined with finishing burs. For adhesive resin cement, the highest marginal discrepancy value (88 +/- 81 micron) was for tooth preparations refined with carbide burs, and the lowest discrepancy value (19 +/- 17 micron) was for tooth preparations refined with finishing burs. Marginal fit of complete cast crowns is influenced by tooth preparation surface characteristics, regardless of the type of luting agent used for cementation.[10]

In the present study, while analyzing statistically, significant results were obtained on comparing the mean tensile strength in-between group 1 and group 2 and in-between group 1 and group 3. Pattanaik BK et al. compared the retention and marginal seating of Ni-Cr alloy restorations using newer luting cements: Resin-modified GIC and adhesive resin cement with those of the oldest cement, zinc phosphate. Thirty maxillary premolars of similar sizes were prepared to receive cast metal copings. Copings were placed on the prepared teeth, and the marginal opening was examined using a Nikon Measuroscope. The specimens were randomly assigned to three groups. Group I castings was luted with zinc phosphate, Group II castings luted with resin-modified GIC, and Group III castings luted with adhesive resin cement after marginal cementation seating was measured. Tensile loads required to dislodge the crowns were obtained using the MTS machine. For zinc phosphate cement, mean marginal seating was 31 microns. Mean retentive strength was 287 Newtons. For resin-modified GIC, mean marginal seating was 29.6 microns. Mean retentive strength was 610 Newtons. For adhesive resin cement, mean marginal seating was 49 microns. Mean retentive strength was 613 Newtons. Marginal seating of adhesive resin cement was significantly greater than that of zinc phosphate and resin-modified GIC.[11] M Piemjai et al. determined the marginal discrepancy and retention of silver-palladium crowns cemented with zinc phosphate (Phosphacap) and glass-ionomer cement (Fuji Cap 1) using different seating forces on preparations with various margin designs.

Crown preparations with three finish lines--chamfer, shoulder, and shoulder with a 45-degree bevel--were sequentially prepared on a dentiform premolar. A metal dies for each of the three finish lines was constructed. Complete metal crowns were fabricated for each metal die using a silver-palladium alloy. The higher seating forces produced better crown seating but had no significant effect on crown retention. The shoulder and shoulder with bevel finish lines provided better crown retention than the chamfer.

Glass-ionomer cement provided greater crown retention than zinc phosphate cement. No significant correlation between marginal seating and crown retention was revealed using a Pearson analysis. The marginal seal was not influenced by either margin design or type of luting cement but was improved with higher seating force.[12]

CONCLUSION

From the above results, the authors concluded that mean tensile strength of Zinc phosphate cement and Glass ionomer cement is significantly higher in comparison to Zinc polycarboxylate group.

CONFLICTS OF INTEREST

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

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