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Original Research

Comparative Evaluation of Bond Strengths of Different Core Materials

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ABSTRACT:
Background: To evaluate bond strengths of different core materials. **Materials & methods:** A total of 12 freshly extracted, single rooted mandibular 2nd premolars with adequate root length and uniformity in size and shape were collected. All the teeth were cleaned with hydrogen peroxide for remaining debris and tissue tags and stored in normal saline. Data was collected. student-t test was done. Results were analysed using SPSS software. **Results:** The tensile bond strengths of specimens in cast core, composite core and glass ionomer core cemented with resin cement and glass ionomer cement showed statistically significant difference. The glass ionomer cement with glass ionomer as a core material shows non-significant result. **Conclusion:** Specimens cemented with resin cement in cast core, composite core, and glass ionomer core exhibited significantly higher bond strengths as compared to specimens cemented with glass ionomer cement.
Keywords: bond strength, glass ionomer, resin cement

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INTRODUCTION

Practitioners of dentistry have been confronted with problems of restoring lost portions of tooth structure as a result of pulpal or periapical disease. Since preservation of what remains and its restoration is more acceptable to the patient than extraction, the means of restoring missing tooth structure by artificial materials continue to account for a large part of dental research. Recent advances in material science and techniques have led to a significant impact on the restoration of endodontically treated teeth. The use of prefabricated post in conjunction with various core materials viz., reinforced glass ionomer, composite etc., and their ability to bond with multiple restorative materials and to tooth structure will continue to revolutionize this relationship. [1] A post and core is used to provide retention and support for the coronal cast restoration. The important factors which influence the success of such a cast restoration are (1) the luting medium and its biophysical properties, (2) the degree of bond strength between the luting cement and core material, (3) the type of core material to which the casting is cemented (4) the design and quality of tooth/core and (5) the accuracy of the casting. [2,3]The tensile bond strengths of various luting agents to dentin and cast crown have been extensively researched and have been widely reported in the literature. Several studies have compared the tensile bond strengths of various luting media with different core materials. [4-6]

The shear bond strength of luting agents to various core buildup materials should be within the range of clinical acceptability. [7] 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. [8] Immersion in lactic acid has been used effectively to evaluate the effect of acidic media on cements. [8-10] 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. [11,12] Hence, this study was conducted to evaluate bond strengths of different core materials.

MATERIALS & METHODS

A total of 12 freshly extracted, single rooted mandibular 2nd premolars with adequate root length and uniformity in size and shape were collected. All the teeth were cleaned with hydrogen peroxide for remaining debris and tissue tags and stored in normal saline. The three groups were designated as Group C (cast post and core), Group B (composite core) and Group G (glass ionomer core) and the specimens in each group were subdivided into three groups of five samples each and were designated. In each sub group, the first alphabet denotes the type of core material and the second alphabet denotes the type of luting cement.C_R (cast core/resin cement), C_G (cast core/glass ionomer cement), B_R (composite core/resin cement), B_G (composite core/glass ionomer cement) and G_R (glass ionomer core/resin cement), G_G (glass ionomer core/glass ionomer cement). Data was collected. Student-t test was done. Results were analysed using SPSS software.

RESULTS

The measurements of tensile bond strength of Group C (cast core), Group B (composite core) and Group G (glass ionomer core) cemented with resin cement, polycarboxylate cement and glass ionomer cement were subjected to statistical analysis to draw conclusions from the experimental data. The tensile bond strengths of specimens in cast core, composite core and glass ionomer core cemented with resin cement and glass ionomer cement showed statistically significant difference. The glass ionomer cement with glass ionomer as a core material shows non-significant result.

Table 1: Statistical comparison for tensile bond strengths of luting agents between cast crown and cast core, composite core and glass ionomer core specimens cemented with resin cement

Cement	Core material	Mean	P- value
RESIN CEMENT	C_R	28.12	0.001
	B_R	41.46	
	C_R	28.12	0.001
	G_R	38.12	
	B_R	41.46	0.001
	G_R	38.12	

Table 2: Statistical comparison for tensile bond strengths of luting agents between cast crown and cast core, composite core and glass ionomer core specimens cemented with glass ionomer cement

Cement	Core material	Mean	P- value
Glass ionomer cement	C_G	26.12	0.00
	B_G	35.16	
	C_G	26.12	0.01
	G_G	30.56	
	B_G	35.16	0.08
	G_G	30.56	

DISCUSSION

The coronal cast metal restoration continues to be used commonly to restore a coronally mutilated, end odontically treated tooth. The bond strength of a luting agent to dentin is an important consideration in the success of cast restoration. [13,14] It is equally important that the bond strengths of luting agents to various core materials be within the range of clinical acceptability.[15,16] Hence, this study was conducted to evaluate bond strengths of different core materials.

In the present study, the measurements of tensile bond strength of Group C (cast core), Group B (composite core) and Group G (glass ionomer core) cemented with resin cement, polycarboxylate cement and glass ionomer cement were subjected to statistical analysis to draw conclusions from the experimental data. A study by Nayakar RP et al, the coronal cast restoration continues to be used commonly to restore mutilated, endodontically treated teeth. The tensile bond strength of luting cements is of critical importance as many of failures are at the core and the crown interface. An invitro study with aim to evaluate and compare bond strengths of luting cements between different core materials and cast crowns. A total of 45 extracted identical mandibular second premolars were endodontically treated and divided into 3 groups of 15 each. Specimens in first group were restored with cast post and core (Group C), and specimens in second group were restored with stainless steel parapost and composite core material (Group B) and specimens in third group were restored with stainless steel parapost and glass ionomer core build (Group G). Standardized crown preparation was done for all the specimens to receive cast crowns. Each group was further divided into 3 subgroups and were cemented using 3 different luting cements namely, resin cement, polycarboxylate cement, glass ionomer cement (Type I). The samples of each subgroup (n = 5) were subjected to tensile testing using Universal Testing Machine at a crosshead speed of 2 mm/min till the dislodgement of crown from the core surface was observed. The bond strengths were significantly different according one way ANOVA (F-150.76 and $p < 0.0000$). The results of the study showed that the specimens cemented with

resin cement in cast core, composite core and glass ionomer core exhibited significantly higher bond strengths as compared to specimens cemented with glass ionomer and polycarboxylate cement. Composite resin core and resin cement combinations were superior to all other cement and core combinations tested. [12]

In the present study, the tensile bond strengths of specimens in cast core, composite core and glass ionomer core cemented with resin cement and glass ionomer cement showed statistically significant difference. The glass ionomer cement with glass ionomer as a core material shows non-significant result. Another study by Patil SM et al, invitro study was to evaluate and compare the shear bond strength of luting cements with different core buildup materials in lactic acid buffer solution. Total 100 specimens were prepared with 20 specimens for each core buildup material using a stainless steel split metal die. Out of these 20 specimens, 10 specimens were bonded with each luting cement. All the bonded specimens were stored at 370c in a 0.01M lactic acid buffer solution at a pH of 4 for 7days. Shear bond strength was determined using a Universal Testing Machine at a cross head speed of 0.5mm/min. The peak load at fracture was recorded and shear bond strength was calculated. 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.[17]

CONCLUSION

Specimens cemented with resin cement in cast core, composite core, and glass ionomer core exhibited significantly higher bond strengths as compared to specimens cemented with glass ionomer cement.

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