

Short Communication

Evaluation and Comparison of the Retentive Ability of Different Luting Cements Used in Fixed Prosthodontics - An In Vitro Study

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ABSTRACT

An ideal dental adhesive should provide a durable bond between two dissimilar materials, with favorable compressive, tensile and shear strengths, have sufficient fracture resistance to prevent dislodgement as a result of adhesive or cohesive failures. In this study, Glass Ionomer cement and resin cement are used as luting agent.

Keywords: Tensile Bond Strength, Glass Ionomer Cement, Resin Cement.

INTRODUCTION

The clinical success of fixed prosthesis depends upon the luting agent and the proper luting procedure. Most often the improper or inadequate cementation of these restorations causes failures. The marginal adaptation of the restoration is another critical factor to prevent or minimize the marginal leakage. ^[1] Film thickness of the luting agent is one of the vital factors for the complete seating of the restoration.

An ideal dental adhesive should provide a durable bond between two dissimilar materials, with favorable compressive, tensile and shear strengths, have sufficient fracture resistance to prevent dislodgement as a result of adhesive or cohesive failures. ^[2] In this study, Glass

Ionomer cement and resin cement are used as luting agent.

Aim of the study:

To evaluate the retentive ability- Tensile strength and marginal adaptation of cast metal restoration in relation to different luting cements.

MATERIALS AND METHODS

This study was performed to evaluate the tensile bond strength of two different types of luting agents in use.

TABLE 1

Sr. no.	Luting cement used	Form	Manufacturer's name
1	Glass Ionomer (Fig: 2)	Powder, liquid	GC Fuji I radio opaque luting cement, GC, Corp. Tokyo, Japan
2	Resin cement (Fig: 3)	Paste, paste	Multilink, Ivoclar Vivadent, Italy



Fig: 2 Glass Ionomer Cement



Fig: 3 Resin Cement

Methodology

Mounting of teeth, Tooth preparation, Impression and preparation of die, Wax pattern, spruing, investing, Casting, Finishing of casting, Mounting of finished casting, Grouping of Samples. Cementation and testing procedure done is testing tensile bond strength. Twenty samples were prepared totally for the proposed study and ten samples were allotted for each luting agent.

Preparation of Sample

Mounting of teeth: Twenty recently extracted caries free maxillary first premolar teeth were taken for this study. The teeth were mounted in the auto polymerizing acrylic resin blocks measuring

1.5cmx.51cmx6cm. The teeth were embedded in the acrylic block 2.5mm below the cemento enamel junction. [3] A hole was drilled in the root of the tooth, through which the stainless steel wire was placed perpendicular to the tooth. This helps in retaining the tooth in the resin, prevents dislodgement of tooth from resin block while testing the samples.

Teeth are prepared with the procedure by the axial reduction of 6 degree convergence. Impression making and die fabrication using addition silicone impression material then Preparation of wax pattern and spruing, and then casting done using the Ni-chrome alloy, The cast crowns with its attached sprue were mounted in the acrylic resin block using steel die (1.5cmx1.5cmx6cm).

The samples were used to test the tensile bond strength.

Testing procedure:

Cementation: The samples were luted with corresponding cements according to manufacturer's instructions.

Conditioning of Samples: After cementation, samples were soaked in distilled water for 72 hours at 36° C. After 72 hours, they were subjected to tensile testing

TABLE 2-shows the samples for testing the tensile bond strength

Serial. no.	Sub group	No of samples	Luting cement used
1	A	10	Glass Ionomer
2.	B	10	Resin cement

RESULTS

In this in vitro study, the tensile bond strength of luting cements is tested by using appropriate testing devices (Fig: 1). the results of the tests were obtained and calculated and analyzed.



Fig: 1 Lloyd's UNIVERS TESTING MACHINE

TENSILE BOND STRENGTH: One of the factors for the retentivity of the full metal cast crown is the tensile bond strength of the luting cements. In this study, the tensile bond strength of cement is measured

using universal testing machine and the results are tabulated.

Table 3 and 4 shows the tensile bond strength of two different types of luting cements such as Glass Ionomer and Resin cement.

The results are analysed using two statistical analysis tests:

1. One-way ANOVA test - to compare between groups
2. Turkey-HSD test - to assess the significant difference between and within groups.

Table 3 - shows the tensile bond strengths of samples A&B

Table 4 - shows the means and standard deviations of Group A-B

TABLE 3 (A -Tensile Bond Strength Glass Ionomer cement)

	Tensile Bond Strength (MPa) A	Tensile Bond Strength (MPa) B
1	1.734	2.296
2	1.821	2.236
3	1.655	2.366
4	1.801	2.414
5	1.752	2.301
6	1.707	2.217
7	1.710	2.390
8	1.709	2.225
9	1.694	2.357
10	1.782	2.522
MEAN	1.677	2.332

TABLE 4 (Means and Standard Deviations of two different types of luting agents)

GROUP	MEANS	STANDARD DEVIATIONS	RANGE	
			MINIMUM	MAXIMUM
A	1.677	0.206	1.655	1.821
B	2.332	0.097	2.217	2.522

Interpretation of Results

One way ANOVA test: TABLE 4 shows the means and standard deviations of tensile bond strength values of Group A&B Glass Ionomer cement and Resin cement.

Group B shows the highest value of 2.332 and Group

1. Variability of the observations within a group about the group mean.
2. Variability of the groups means between groups about the overall mean.

F value is compared with the table value of F distribution and significance. P value is obtained as $P < 0.001$. Null hypothesis: The tensile bond strength values of Group I A-I D are equal. The P value is ($P < 0.001$), which is less than $P < 0.05$. ** denotes that the difference significance at 1% level.

Tukey – HSD Test: GROUP I D (resin cement) comes under the subset ‘C’ which has the highest values for tensile bond strength when compared to other cements.

Group I D shows significant difference when compared to Group I A, I B & I C. So this study implies that the resin cement has the highest tensile bond strength when compared with other cements, when the zinc poly carboxylate cement has the least strength.

DISCUSSION

The retentivity of the luting cements assessed by the adhesive ability has been evaluated with in vitro testing, tensile bond tests.

Zidan O, Ferguson GC suggested that the taper of crowns had significant effect on retention. The samples were prepared of uniform dimensions with taper of 6°, 12° and 24°. The highest values for retentivity were measured with 6° taper. [4]

White SN et al mentioned that polycarboxylate cements exhibit thixotropic or pseudo plastic behavior where in an apparently viscous mix flows readily under pressure. [5]

William D. Browning et al compared the retentive strengths of resin, glass-ionomer and zinc phosphate cements under adverse conditions. The tensile bond strength higher in the order of resin, glass-ionomer and zinc phosphate cement. [6]

Two commercially available luting agents used in this study were Glass ionomer cement and Resin cement.

The bonding ability of resin composite cement, availability of various shades and opacities made the resin cement more popular than other existing luting agents.

Results of this in vitro study show that zinc phosphate and glass ionomer cements exhibit almost similar values 1.64MPa and 1.67MPa respectively. Resin cement found to be the strongest one with the value of 2.33MPa.

The chemical adhesiveness of the glass Ionomer with calcium ions of enamel

and dentin may be the attributed reason (ionic bonding).

SUMMARY & CONCLUSION

This study was performed to evaluate the tensile bond strength and of different types of luting cements used in clinical practice.

The study was divided into 2 groups with 10 samples for each of the luting cement taken up for testing tensile bond strength and groups with 10 samples for each luting agent chosen for assessing marginal fit. Resin cement had shown comparatively high tensile strength value than other cement included in this lists. Glass Ionomer cement had better tensile bond strength and low film thickness, with its adhesive ability makes it a good luting agent. When observing the results of the study, we conclude that the resin cement has higher bond strength.

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