

**Original Article**

## The influence of desensitizing agent on the bond strength of various luting cements

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DOI: 10.5455/jrmds.2015347

### ABSTRACT

**Background:** Veneer restorations either an individual or component of fixed partial prosthesis play vital role in prosthetic dentistry. This study is carried out to evaluate retentivity of cementing medium i.e commercially available desensitizing agents.

#### Aims & Objectives:

1. To evaluate the retentive ability of different luting cements used in Fixed Prosthodontics.
2. To compare the retentive ability of different luting cements used in Fixed Prosthodontics after application of desensitizing agents.

**Methods & Material:** Three desensitizing materials are used i.e. Gluma, Systemp and Prime desensitizer. Zinc Phosphate, Zinc Polycarboxylate and Resin Reinforce Glass Ionomer cement used in study. Teeth were mounted in the auto polymerizing acrylic resin blocks. Sixty recently extracted caries free maxillary first premolar teeth of approximately similar sizes were selected. All sixty teeth grouped in to equal four groups. Group II, III & IV coated with Gluma, Systemp and Prime desensitizers respectively and group I left uncoated. Five samples from each group cemented with three different types of cement as mentioned. Samples were incubated and tested.

**Results:** The application of Gluma desensitizing agent increases the tensile bond strength of the cements and the application of Systemp and Prime desensitizing agent does not have any significance on the tensile bond strength of luting agents.

**Key Words:** Gluma, Systemp, Prime Desensitizer, Zinc Phosphate, Zinc Polycarboxylate, Resin Reinforce Glass Ionomer

### INTRODUCTION

The complete veneer restorations as an individual restoration or a component of Fixed Partial Prosthesis carry a vital role in the field of Prosthetic dentistry especially in fixed Prosthodontics. When teeth are prepared for complete crowns, approximately 1.0 to 1.5 mm of tooth structure is removed to ensure appropriate crown contours and adequate occlusal clearance [1]. Tooth sensitivity after cementation has been a problem with luting cements.

Hence this study is performed to evaluate the retentive ability or bonding ability of cementing medium in relation to few commercially available desensitizing agents, which could be applied over the prepared tooth before cementing the restoration.

### MATERIALS AND METHODS

The materials used in this study desensitizing agents, like Gluma, Systemp and Prime desensitizer. Cements used in this study are Zinc Phosphate, Zinc Polycarboxylate and Resin Reinforce Glass Ionomer cement. In the methodology the preparation of samples, application of desensitizing agent, cementation and testing procedure.

#### Mounting of teeth

Sixty recently extracted caries free maxillary first premolar teeth of approximately similar sizes were selected. The teeth were mounted in the auto polymerizing acrylic resin blocks measuring 1cmx1cmx4cm. The teeth were embedded in the acrylic block 2mm below the cemento enamel junction. 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.

### Tooth preparation

After the completion of tooth preparation the occlusogingival height, buccolingual width and mesiodistal dimensions were measured and recorded as follows. The overall axial convergence of 6° is given. Impression making and die fabrication, Preparation of wax pattern and spruing, Casting was done with Nickel-Chromium alloy.

### Grouping the samples

The total sixty samples are divided into four groups as group I, II, III and IV. Each group consists of 15 samples. The groups II to group IV samples are coated with Gluma, Systemp and Prime desensitizers respectively. The group I samples are left uncoated and used as control group. Five samples are taken from each group and allotted for each luting agent namely Zinc Phosphate, Zinc Polycarboxylate and Resin Reinforce glass ionomer cements and are used to test tensile bond strength.

Fig. 1 Desensitizer for group II sample



### Application of Desensitizing Agent

GLUMA desensitizing agent is applied on Group II samples. Systemp desensitizing agent is applied on Group III samples. Prime desensitizing agent is applied on Group IV samples.

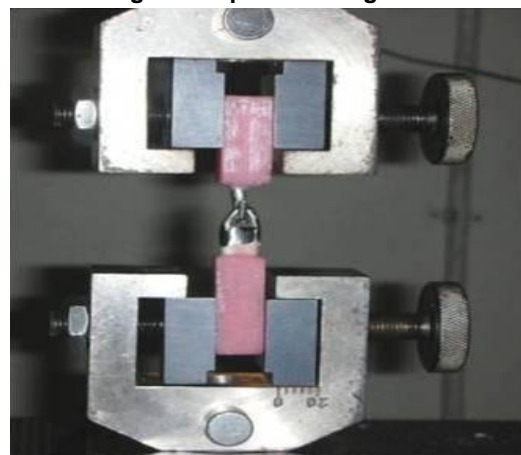
Fig. 2 Metal crown cemented on samples



### Cementation Procedure

- 5 samples from group I to IV were luted with Zinc phosphate,
- 5 samples from group I to IV were luted with Zinc Polycarboxylate cement.
- 5 samples from group I to IV were luted with Resin Reinforce Glass Ionomer cement. After cementation; all the samples were stored at 37° C in 100% humidity for 24 hours before tensile testing.

Fig.3: Sample in testing machine



Statistical test: One-way ANNOVA, Student 't' test

### Measuring Tensile Bond Strength

The Lloyd's Universal Testing Machine was used to test the samples. Using this load value, the tensile bond strength was calculated. The results are subjected to ANOVA statistical analysis and their significance is evaluated.

### RESULTS

In this In vitro study, the tensile bond strength of cementing medium after application of commercially available desensitizing agents, were tested by using appropriate testing devices. The results of the tests were obtained and calculated and analyzed.

### 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 results is tabulated.

Table 1 Shows the means and standard deviations of tensile bond strength values of Group II, which includes zinc phosphate cement (A), zinc poly carboxylate cement (B) and Resin reinforce glass ionomer cement (C) after application of GLUMA desensitizing agent. Group II C shows the highest value of 306.11 N and Group II A shows the lowest value of 101.91N

**Table 1: Three different types of luting agents after application of Gluma desensitizing agent**

GROUP-II (GLUMA)	TENSILE BOND STRENGTH		P - VALUE
	MEAN	STANDARD DEVIATION	
A. Zinc Phosphate	101.91 <sup>a</sup>	1.31	
B. Zinc Polycarboxylate	177.82 <sup>b</sup>	1.05	< 0.001**
C. Resin Reinforce Glass ionomercement	306.11 <sup>c</sup>	2.93	

\*\* significance at 1% level

a, b, c significance at 5% level.

Table 2 Shows the means and standard deviations of tensile bond strength values of Group III, which includes zinc phosphate cement (A), zinc poly carboxylate cement (B) and Resin reinforce glass ionomer cement(C) after application of Systemp desensitizing agent. Group III C shows the highest bond strength of 218.58 N and Group III A shows the lowest bond strength of 98.72 N. So in this group, the application of Systemp increases the tensile bond strength of Resin reinforce glass ionomer cement and the other two cements do not show any significant difference in bond strength.

**Table 2: Three different types of luting agents after application of Systemp desensitizing agent**

GROUP-III (Systemp)	TENSILE BOND STRENGTH		P - VALUE
	MEAN	STANDARD DEVIATION	
A. Zinc Phosphate	98.72 <sup>a</sup>	1.10	
B. Zinc Polycarboxylate	124.46 <sup>b</sup>	2.69	
C. Resin Reinforce Glass ionomercement	218.58 <sup>c</sup>	6.87	< 0.001**

Table 3 Shows the means and standard deviations of tensile bond strength values of Group IV, which includes zinc phosphate cement (A), zinc poly carboxylate cement (B) and Resin reinforce glass ionomer cement(C) after application of Prime desensitizing agent. Group IV C shows the highest bond strength of 124.86 N and Group IV A shows the lowest bond strength of 74.86 N. So in this group, the application of Prime desensitizing agent decreases the tensile bond strength of three cements when compared with the control group.

**Table 3: Three different types of luting agents after application of Prime desensitizing agent**

GROUP-IV (Prime)	TENSILE BOND STRENGTH		P - VALUE
	MEAN	STANDARD DEVIATION	
A. Zinc Phosphate	74.86 <sup>a</sup>	1.85	
B. Zinc Polycarboxylate	100.24 <sup>b</sup>	1.92	< 0.001**
C. Resin Reinforce Glass ionomercement	124.86 <sup>c</sup>	1.35	

The application of Gluma desensitizing agent increases the tensile bond strength of the cements and the application of Systemp and Prime desensitizing agent does not have any significance on the tensile bond strength of luting agents [2].

## DISCUSSION

Desensitizing agents can be applied on prepared tooth surfaces to avoid pulpal irritation and hypersensitivity during the interim stage, while the restoration is under fabrication, and also before cementation [3].

The retentive ability or bonding ability of cementing medium in relation to few commercially available desensitizing agents, which could be applied over the prepared tooth before cementing the restoration has been evaluated in this study with in-vitro testing, with tensile bond tests.

Systemp is the combination of Polyethylene glycol dimethacrylate, which precipitates proteins and thus leads to local concentrations, and glutaraldehyde which establishes stable, covalent bonds to proteins, results in the formation of firm plugs of protein that seal the tubules. These plugs considerably reduce permeability and the incidence of dentinal sensitivity.

Zinc phosphate cement does not exhibit any chemical bond to substrate and provides retention by mechanical means [4]. Hence, the taper, length and surface area of the tooth preparation are critical for successful outcome. The resin modified glass ionomer cements exhibited improved fracture toughness when compared with conventional glass ionomer.

Results of this In vitro study show that Resin reinforce glass ionomer cement exhibit high tensile bond strength of 179.23 N then Zinc Polycarboxylate with 117.90 N and Zinc Phosphate with 100.20 N before application of desensitizing agents and considered as control group [5].

After application of desensitizing agents, GLUMA desensitizing agent exhibits higher tensile bond strength of 195.28 N. So there is increase in the bond strength when compared with the control group. This higher value could be attributed to Polymerizing nature of cement with desensitizing agent.

Systemp desensitizing agent exhibits the tensile bond strength of 147.25 N. Though this is lesser than the Gluma desensitizing agent but there is

significant difference in the bond strength when compared with the control group.

Prime desensitizing agent exhibits the tensile bond strength of 99.99 N and this is found to be very low when compared with previous desensitizing agents but there is mild decrease in the bond strength when compared with the control group

## SUMMARY & CONCLUSION

Use of dentin desensitizing agents for reducing sensitivity after crown preparation and before cementation has been shown to be effective clinical treatment. The combination of desensitizer and crown cementation agent can affect the bond strength and retention of the fixed prosthesis<sup>5</sup>. This study was performed to evaluate the retentive ability of different luting cements used in Fixed Prosthodontics after application of desensitizing agents over the prepared tooth surface.

Sixty samples are prepared and these samples are divided into four groups each group consists of 15 samples. The groups II to group IV samples are coated with Gluma, Systemp and Prime desensitizers respectively. The group I samples are left uncoated and used as control group. This study was performed with five samples taken from each group and allotted for each luting agent namely Zinc Phosphate, Zinc Polycarboxylate and Resin reinforce glass ionomer cements respectively and the samples are used to test tensile bond strength.

The results were tabulated and statistically analyzed. The results show that use of Gluma Polymerizable dentin desensitizer has the ability to chemically react with the cement and provided enhanced crown retention, whereas the Prime Non-Polymerizable dentin desensitizer showed the low retention of the crown.

Within the limitations of this in vitro study, the following conclusions were made

1. The relative retentive strength of cementing agents was in the decreasing order of Reinforce glass ionomer cement > Zinc Polycarboxylate cement > Zinc Phosphate cement.
2. The retentive strength of crowns cemented to dentin coated with a dentin desensitizer depends on the combination of cementing agents and the type of desensitizing agents.
3. The combination of Reinforce Glass ionomer cement with a Polymerizable desensitizer GLUMA produced the greatest crown retention value. The

GLUMA with zinc Polycarboxylate shows slight increase in strength and with zinc Phosphate cement no significant difference.

4. The use of Systemp desensitizer shows slight increase in tensile strength with Reinforce glass ionomer cement but no significant difference with zinc Phosphate and zinc Polycarboxylate cements.
5. The use of Non-Polymerizing dentin desensitizer Prime significantly reduced crown retention when using Resin reinforce glass ionomer, zinc Polycarboxylate and zinc Phosphate cements.

The use of dentin desensitizer when cementing with zinc Phosphate cement significantly reduces the crown retention. However future studies have to be conducted with a model that closely resembles the oral environment and simulates the functional movements of the mandible.

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Date of Submission: 21/06/2015  
Date of Acceptance: 01/11/2015

**How to cite this article:** Rupkumar P, Vinayagavel K, Sabarigirinathan C, Sriramprabu G, Rajakumar M, Vinayakam S. The influence of desensitizing agent on the bond strength of various luting cements. J Res Med Den Sci 2015;3(4):280-3.

**Source of Support:** None  
**Conflict of Interest:** None declared