



## Comparatively evaluation of tensile bond strength of two different luting cements (Zinc phosphate and Zinc polycarboxylate) used in dentistry

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### Abstract

**Background:** To compare the comparing the tensile bond strength of two different luting cements (Zinc phosphate and Zinc polycarboxylate) used in dentistry

**Materials & methods:** this research included 100 newly extracted maxillary first premolars. All of the specimens were thoroughly cleaned and kept in sterile saline for future use. Following the completion of cavity preparation, all specimens had their impressions taken, and then castings made of type IV dental stones were poured. Casting was done using wax patterns. The castings were then completed, polished, and devested. Following are the three study groups into which all the specimens were split: Group 1 is composed of zinc phosphate, whereas Group 2 is composed of zinc polycarboxylate. The mean tensile strength was assessed using a universal testing machine.

**Results:** Mean tensile strength of specimens of Group 1 and Group 2 was found to be 2.31 MPa and 2.09 MPa respectively. While analysing statistically, significant results were obtained on comparing the mean tensile strength in between group 1 and group 2.

**Conclusion:** It was concluded that the mean tensile strength of Zinc phosphate cement is quite higher in relation to Zinc polycarboxylate cement.

**Key words:** Dental cement, Tensile strength

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### Introduction

The restoration of primary and permanent teeth with advanced carious lesions has been a constant and The restoration of primary and permanent teeth with advanced carious

lesions has been a constant and The restoration of primary and permanent teeth with advanced carious lesions has been a constant and The restoration of primary and permanent teeth with advanced carious lesions has been a constant and The restoration of primary and permanent teeth with advanced carious lesions has been a constant and difficult problem for the dentist, to prevent premature loss of primary teeth and to maintain normal occlusion. Studies have shown that amalgam, a commonly used restorative material, had to be replaced with stainless steel crowns in 70% of multisurface amalgam restorations. Stainless steel crowns have proved to be efficacious and are relatively easy to use, they have become an important factor in the restoration of hypoplastic, endodontically treated teeth, malformed teeth and fracture teeth to perform their normal function.<sup>1,2</sup>

Many studies have investigated the retention of stainless steel crowns and clinicians have suggested that dental cement alone was responsible for retention of stainless steel crowns on primary molars.<sup>3-6</sup> Jefferey et al<sup>7</sup>, however, believe that the significant retentive feature is the close adaptation of the metal crown margin to the tooth surfaces in the undercut areas of the prepared teeth. Placement of well-fitted, contoured stainless steel crown on different crown preparations, without cement is not possible because of its insufficient strength to fit on the tooth. Stainless steel crowns have been cemented with zinc phosphate cement,<sup>8,9</sup> polycarboxylate cement<sup>8,9</sup>, and zinc oxide eugenol cement, but it would appear that glass ionomer cements, due to their adhesive properties to dentin and enamel and fluoride releasing ability, have definite advantages over the other cements.<sup>10</sup>

Hence; the present study conducted for comparing the comparing the tensile bond strength of two different luting cements (Zinc phosphate and Zinc polycarboxylate) used in dentistry.

### Materials and Methods

The current study included 100 newly extracted maxillary first premolars. All of the specimens were thoroughly cleaned and kept in sterile saline for future use. Following the completion of cavity preparation, all specimens had their impressions taken, and then castings made of type IV dental stones were poured. Casting was done using wax patterns. The castings were then completed, polished, and devested. Following are the divisions into 2 research groups of all the specimens: Group 1 is composed of zinc phosphate, whereas Group 2 is composed of zinc polycarboxylate. The mean tensile strength was assessed using a universal testing machine. The SPSS software was used to assess all the results, which were recorded in a Microsoft Excel spreadsheet. The significance level was evaluated using a student t test.

### Results

Mean tensile strength of specimens of Group 1, and Group 2 was found to be 2.31 MPa and 2.09 MPa respectively. While analysing statistically, significant results were obtained on comparing the mean tensile strength in between group A and group B.

**Table 1:** Mean tensile strength (MPa)

Groups	Mean tensile strength	SD	p- value
Group 1	2.31	0.76	0.0000*
Group 2	2.09	0.59	

\*: Significant

### Discussion

Zinc phosphate is the oldest of the luting cements used widely for cementation of stainless steel crowns. This cement is generally considered as adequate for clinical crown retention,

even though its retentive properties are purely mechanical in nature. It is brittle, has a relatively high solubility in the mouth, and it does not adhere to tooth structure. They do have high compressive strength and are also a potentially caustic substance, to vital pulp tissue due to their low pH.<sup>11,12</sup> The use of fluoride releasing cements with the potential for chemical adhesion and mechanical retention helps in retention of the crown. The polycarboxylates form an ionic bond with enamel and dentin and have a higher adhesive strength than the zinc phosphate. Addition of fluoride to this cement results an increase in strength and anticariogenic properties.<sup>13</sup> They also have a somewhat lower compressive strength than that of zinc phosphate cements and are relatively non toxic to vital tissue.<sup>14,15,16</sup>

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In the present study, Mean tensile strength of specimens of Group 1, and Group 2 was found to be 2.31 MPa and 2.09 MPa respectively. While analysing statistically, significant results were obtained on comparing the mean tensile strength in between group 1 and group 2.

David R. Myers<sup>8</sup> and Garcia Godoy<sup>9</sup> reported that no significant difference was found between zinc phosphate and polycarboxylate cements in the retention ability of the cements. Whereas in this study, zinc phosphate cement showed better retentive strength than polycarboxylate cement, which was statistically significant ( $P < 0.05$ ). The difference may be due to the fact that zinc phosphate cement lies on mechanical interlocking for its retentive effect and on close physical adaptation for sealing restorative margins, but it does not provide any chemical bonding to tooth or metal surfaces.

Mathewson et al<sup>4</sup> found the highest retentive strength with copper phosphate cement than zinc phosphate and polycarboxylate cements, which he attributed to the low pH of the copper cement during the setting reaction and a possible acid etching effect on the tooth creating a better bond between the cement and the tooth. He also speculated that the acidity of the copper cement potentially was harmful to pulp tissues in vital teeth. So in this study, copper phosphate cement was not considered for testing retentive strength.

Parameswari BD et al<sup>17</sup> compared the tensile bond strength and marginal fit of complete veneer cast metal crowns using various luting agents. The study is divided into four groups with 10 samples for each of the luting cement taken up for testing TBS and four groups with 5 samples for each luting agent chosen for assessing marginal fit. The results were tabulated and statistically analyzed. The TBS of luting cements, and marginal fit in relation to luting cements were tested by using appropriate testing devices. The TBS of cement is measured using universal testing machine, and the results are tabulated. The marginal gap that exists between the margin of the cast metal crown, and the finish line is measured using travelling microscope before and after cementation. The difference between these two values gives the discrepancy that is due to the film thickness of cement used for luting the restoration. The TBS value of zinc phosphate cement and glass ionomer cement were found to be almost same.

## **Conclusion**

It was concluded that the mean tensile strength of Zinc phosphate cement is quite higher in relation to Zinc polycarboxylate cement.

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