



## 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:** 40 freshly extracted maxillary first premolars were included in the present study. After thorough cleaning, all the specimens were stored in normal saline till further use. After finishing of the cavity preparation, 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 A: Zinc phosphate group, and Group B: Zinc polycarboxylate group. Universal Testing Machine was used for evaluation of mean tensile strength.

**Results:** Mean tensile strength of specimens of Group A, and Group B was found to be 1.88 MPa and 1.51 MPa respectively. While analysing statistically, significant results were obtained on comparing the mean tensile strength in between group A and group B.

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

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

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### INTRODUCTION

A dental cement used to attach indirect restorations to prepared teeth is called a luting agent [1]. Luting agents may be definitive or provisional, depending on their physical properties and the planned longevity of the restoration. A luting agent has to hold an indirect restoration in place for an indefinite period of time, and fill the gap at the tooth-restoration interface. Almost all cements are formed by the interaction of a powder capable of releasing cations into acid solution (a base) and a liquid (an acid) capable of liberation of cement-forming cations, and having acid anions that form stable complexes with those cations to yield a salt. The set cement is thus a salt hydrogel matrix surrounding unreacted powder.<sup>1-3</sup>

Typically, the matrix is the weakest and most soluble component of the set cement. Those materials are classified as AB (acid-base) cements, as opposed to cements formed by the polymerization of macromolecules. Zinc phosphate is the oldest luting cement (introduced in the 1800s), and has been used with a high degree of success for metal, metal-ceramic, and porcelain

restorations; it is the standard to which other cements are compared. Zinc polycarboxylate cement was introduced in 1968 by Smith as the first luting cement that would adhere to tooth structure. As a hybrid of zinc phosphate, the AB cement powder is mostly zinc oxide (10% magnesium oxide) and the liquid a 30% to 43% solution of high molecular weight poly(alkenoic acids).<sup>4-6</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

40 freshly extracted maxillary first premolars were included in the present study. After thorough cleaning, all the specimens were stored in normal saline till further use. After finishing of the cavity preparation, 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 A: Zinc phosphate group, and Group B: Zinc polycarboxylate group. Universal Testing Machine was used for evaluation of mean tensile strength. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Student t test were used for evaluation of level of significance.

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

Groups	Mean tensile strength	SD	p- value
Group A	1.88	0.35	0.0000*
Group B	1.51	0.29	

\*: Significant

## DISCUSSION

Multiple factors affect the success of fixed prosthodontic restorations with preparation design, oral hygiene/microflora, mechanical forces, and restorative materials being some of them. However, key factor to success is the choice of a proper luting agent and the cementation procedure. Loss of crown retention was found to be the second leading cause of failure of crowns and fixed partial dentures while a study listed uncemented restorations as the third leading cause of prosthetic replacement with failure occurring after only 5.8 years of service. The word 'luting' is derived from a latin word Lutum-which means mud. Dental luting agents provide a link between the restoration and prepared tooth, bonding them together through some form of surface attachment, which may be mechanical, micro-mechanical, chemical or combination. Luting agents may be definitive or provisional depending on their physical properties and planned longevity of the restoration.<sup>7-9</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

In the present study, Mean tensile strength of specimens of Group A, and Group B was found to be 1.88 MPa and 1.51 MPa respectively. While analysing statistically, significant results were obtained on comparing the mean tensile strength in between group A and group B.

Parameswari BD et al 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

## RESULTS

Mean tensile strength of specimens of Group A, and Group B was found to be 1.88 MPa and 1.51 MPa respectively. While analysing statistically, significant results were obtained on comparing the mean tensile strength in between group A and group B.

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.<sup>11</sup>

Piwowarczyk A et al examined 3 mechanical properties, namely compressive, flexural, and diametral tensile strength, of various commercially available cements and core materials as a function of time after mixing. The examined materials were 2 cermet cements (Ketac Silver [ESPE, Seefeld, Germany] and Chelon Silver [ESPE]), 1 metal-reinforced glass ionomer cement (Miracle Mix [GC Dental Industrial Corp, Tokyo, Japan]), 2 conventional glass ionomer cements (Ketac Bond [ESPE] and KetacCem [ESPE]), 1 standard cure zinc phosphate cement (Harvard Cement [Richter and Hoffmann, Berlin, Germany]), and 1 zinc phosphate cement with the addition of 30% silver amalgam alloy powder (Harvard Cement 70% with Dispersalloy 30% [Richter and Hoffmann/Johnson and Johnson, East Windsor, NJ]). Properties were measured using a universal testing machine at 15 minutes, 1 hour, and 24 hours after first mixing. Compressive strengths varied widely between the 3 times of measurement from 5.8 +/- 6.6 MPa for KetacCem to 144.3 +/- 10.2 MPa for Ketac Silver. Twenty-four hours after mixing, the Bonferroni test showed significant ( $p < 0.05$ ) differences between Ketac Silver and all other materials tested. Diametral tensile strengths ranged widely from 4.4 +/- 0.9 MPa for KetacCem to 11.5 +/- 2.2 MPa for Chelon Silver. At 15 minutes, 1 hour, and 24 hours after first mixing, the analysis of variance did not show any significant differences between Ketac Silver, Chelon Silver, and Miracle Mix. The 3-point flexural strength of Ketac Silver showed, at 15 minutes with 13.5 +/- 3.9 MPa and at 24 hours with 27.2 +/- 7.4 MPa, the highest values.<sup>12</sup>

## CONCLUSION

Mean tensile strength of Zinc phosphate cement is significantly higher in comparison to Zinc polycarboxylate group.

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