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ORIGINAL RESEARCH

ASSESSMENT OF TENSILE BOND STRENGTH OF COMPLETE VENEER CAST METAL CROWNS USING VARIOUS LUTING AGENTS

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Abstract

Background: The present study tensile bond strength of complete veneer cast metal crowns using various luting agents

Materials & methods: 30 freshly extracted tooth specimens were obtained and were divided randomly into two study groups with 15 specimens in each group; Zinc phosphate and Zinc polycarboxylate cements. The mounted teeth were prepared following the principles of tooth preparation. Cast was poured with Type IV dental stone. Fabrication of wax pattern was done. Devesting of casting (Nickel-chromium alloy) was done followed by finishing and polishing. Luting of the specimens was done according to specific study groups and following manufacturer's instructions. After cementation, samples were soaked in distilled water for 48 h at 36°C. In Universal Testing Machine, the tensile load at which the crown detached from the prepared tooth was measured.

Results: Mean tensile strength observed in Zinc phosphate cement group was 1.568 N while mean tensile strength observed in Zinc polycarboxylate cement group was 0.925. while comparing the mean tensile strength among the two study groups statistically, non-significant results were obtained.

Conclusion: Zinc phosphate cement exhibited higher tensile bond strength in comparison to zinc polycarboxylate cement.

Key words: Tensile bond strength, Veneer cast metal, Luting

Introduction

The longevity of dental crowns depends on the retention and marginal integrity of restorations. Marginal leakage of cements has been documented as one of the major causes of failure because of secondary dental caries. Many factors have been demonstrated to influence the marginal seating and retention of crowns, such as the size and shape of prepared teeth, manipulation of cement, retentive properties of cement, cement film thickness, relieving space or venting for cement, cement application, and roughness of dentinal surface.[1- 4]

The retention of a single crown relies on several factors, such as the height of the preparation, surface texture, the method of placement (cemented or bonded), the closeness of fit, and the axial taper of the preparation walls. The total occlusal convergence angle (TOC), however, represents the most fundamental factor contributing to retention of crownwork and is the

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angle formed at the intersection of tapers between two opposite axial walls in a given plane.[5, 6] The degree of taper and the convergence angle are thus inextricably linked. Achieving axial preparation walls that are as parallel as possible will enhance retention but this can be hindered by various factors, including visibility, accessibility, location and anatomy of the tooth.[7, 8] Hence; the present study tensile bond strength of complete veneer cast metal crowns using various luting agents

Materials & methods

The present study tensile bond strength (TBS) of complete veneer cast metal crowns using various luting agents. Two different types of luting agents were used- Zinc phosphate and Zinc polycarboxylate cements. 30 freshly extracted tooth specimens were obtained and were divided randomly into two study groups with 15 specimens in each group. Tooth specimens with malformed shape, having carious destruction or any other deformity were excluded. Only freshly extracted maxillary first premolars fulfilling the exclusion criteria were enrolled. Mounting of the specimens was done in auto polymerizing acrylic resin block measuring 1.5 cm × 1.5 cm × 4 cm. The teeth were embedded in the acrylic block 2 mm below the cement enamel junction. The mounted teeth were prepared following the principles of tooth preparation. All the dimensions were predetermined to achieve the standardization of the preparation. This was followed by impression making using polyvinyl siloxane impression material. Cast was poured with Type IV dental stone. Fabrication of wax pattern was done. Devesting of casting (Nickel-chromium alloy) was done followed by finishing and polishing. Luting of the specimens was done according to specific study groups and following manufacturer's instructions. After cementation, samples were soaked in distilled water for 48 h at 36°C. In Universal Testing Machine, the tensile load at which the crown detached from the prepared tooth was measured. All the results were recorded and compared using student t test.

Results

Mean tensile strength observed in Zinc phosphate cement group was 1.568 N while mean tensile strength observed in Zinc polycarboxylate cement group was 0.925. while comparing the mean tensile strength among the two study groups statistically, non-significant results were obtained.

Table 1: Comparison of tensile bond strength

Stud group	Mean (N)	SD	p- value
Zinc phosphate cement group	1.568	0.125	0.000 (Significant)
Zinc polycarboxylate cement group	0.925	0.117	

Discussion

The principles of tooth preparation may be divided into three broad categories viz., the biologic considerations which affect the health of the oral tissues, mechanical considerations which affect the integrity and durability of the restoration and esthetic considerations which affect the appearance of the patient. Successful tooth preparation and subsequent restoration depend on simultaneous consideration of all these factors. The resistance to displacement of a cast restoration during function depends largely on the provision of adequate mechanical form in the preparation. These mechanical forms must adhere to certain principles, else the restoration may become dislodged or may distort or fracture during service. Certain

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mechanical provisions in the preparation that prevent these problems include, providing retention form, providing resistance form, and preventing deformation of the restoration.[7- 9] Hence; the present study tensile bond strength of complete veneer cast metal crowns using various luting agents.

In the present study, two different types of luting agents were used- Zinc phosphate and Zinc polycarboxylate cements. 30 freshly extracted tooth specimens were obtained and were divided randomly into two study groups with 15 specimens in each group. Mean tensile strength observed in Zinc phosphate cement group was 1.568 N while mean tensile strength observed in Zinc polycarboxylate cement group was 0.925. while comparing the mean tensile strength among the two study groups statistically, non-significant results were obtained. 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 degree, 12 degree and 24 degree. The highest values for retentivity were measured with 6 degree taper. White SN et al mentioned that polycarboxylate cements exhibit thixotropic or pseudo plastic behavior where in an apparently viscous mix flows readily under pressure. William D. Browing 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, glassionomer and zinc phosphate cement.[10- 12]

In a similar study conducted by Parameswari BD et al, authors 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 tensile bond strength (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. The chemical adhesiveness of the glass ionomer with calcium ions of enamel and dentin may be the attributed reason (ionic bonding).[9]

Conclusion

Zinc phosphate cement exhibited higher tensile bond strength in comparison to zinc polycarboxylate cement.

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