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Original Research

Bonding strength of GIC versus Zinc phosphate in luting of orthodontic bands in PFM crowns: An in vitro study

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ABSTRACT:

Background: Orthodontic devices should interfere minimally with the patient's comfort, appearance, oral function, and hygiene. The present study was undertaken for assessing and comparing the bonding strength of GIC versus Zinc phosphate in luting of orthodontic bands in Porcelain fused to metal (PFM) crowns. **Materials & methods:** A total of 30 standard dies of a standard complete crown preparation were prepared. All the 30 samples were divided into two study groups depending upon the type of luting agent used; Group 1 included models in which GIC was used as luting agent for orthodontic bands, whereas Group 2 included models in which Zinc phosphate was used as luting agent for orthodontic bands. All the cemented specimens were mounted on Universal testing machine testing load of dislodgement. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. **Results:** Mean bond strength of Group 1 specimens was 1.12 MPa while mean bond strength of Group 2 specimens was 0.36 MPa. On analysing statistically, it was found that mean bond strength of specimens of zinc phosphate group was significantly higher in comparison to specimens of GIC group. **Conclusion:** Mean bond strength of zinc phosphate cement is significantly higher in comparison to GIC cement.

Key words: GIC, Orthodontic band, Zinc phosphate

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INTRODUCTION

Orthodontic devices should interfere minimally with the patient's comfort, appearance, oral function, and hygiene. Although various dental cements and resin adhesives are used to attach orthodontic devices to teeth, the higher-strength dental cements and improved resin adhesives permit the use of smaller, more patient-friendly orthodontic devices. In the past orthodontic band cementation has relied heavily on mechanically retentive cements such as zinc phosphate luting agents.[1-3]

The clinical performance of glass ionomer cement (GIC), chemically retentive cement, was evaluated against conventional zinc phosphate cement (ZP). The recementation values for ZP were significantly higher over a 2-year treatment period than those of GIC. Failures between cement and enamel, and cement and stainless steel were noted for the ZP. Glass ionomer cement had significantly better retentive strength to enamel than to band material. Moisture contamination does not appear to be a problem in orthodontic band cementation with glass ionomer cement.[4, 5]

Hence; the present study was undertaken for assessing and comparing the bonding strength of GIC versus Zinc phosphate in luting of orthodontic bands in Porcelain fused to metal (PFM) crowns.

MATERIALS & METHODS

The present study was conducted in the department of orthodontics and conservative dentistry and it included assessment and comparison of bonding strength of GIC versus Zinc phosphate in luting of orthodontic bands in PFM crowns. Ethical approval was obtained before the starting of the study. A total of 30 standard dies of a standard complete crown preparation were prepared. On each model, a uniform

thickness of gray die spacer was placed with an applicator brush in a single layer. Wax pattern of the restoration was fabricated using blue inlay wax. Nickel-chromium alloy was used for investing the models. All the 30 samples were divided into two study groups depending upon the type of luting agent used; Group 1 included models in which GIC was used as luting agent for orthodontic bands, whereas Group 2 included models in which Zinc phosphate was used as luting agent for orthodontic bands. All the cemented specimens were mounted on Universal testing machine testing load of dislodgement. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. Student t test was used for assessment of level of significant. P- value of less than 0.05 was taken as significant.

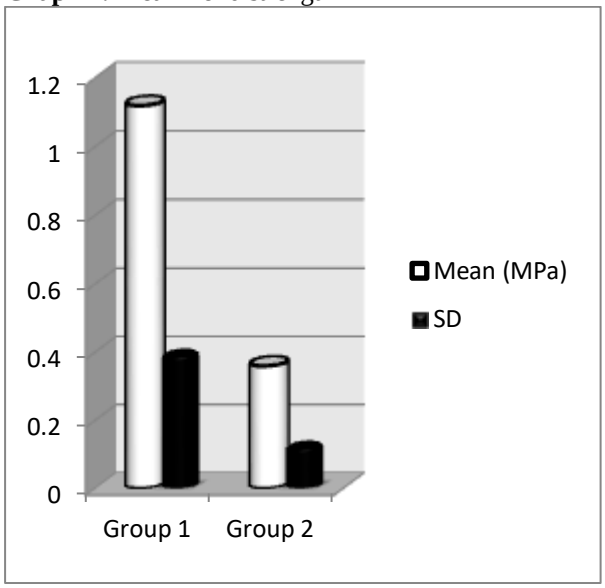
RESULTS

In the present study, a total of 30 standard dies of a standard complete crown preparation were prepared. All the 30 samples were divided into two study groups depending upon the type of luting agent used; Group 1 included models in which GIC was used as luting agent for orthodontic bands, whereas Group 2 included models in which Zinc phosphate was used as luting agent for orthodontic bands. In the present study, mean bond strength of Group 1 specimens was 1.12 MPa while mean bond strength of Group 2 specimens was 0.36 MPa. On analysing statistically, it was found that mean bond strength of specimens of zinc phosphate group was significantly higher in comparison to specimens of GIC group.

Table 1: Comparison in between two study groups

Bond strength	Group 1	Group 2
Mean (MPa)	1.12	0.36
SD	0.39	0.12
t-statistics	-1.992	
p- value	0.039 (Significant)	

Graph 1: Mean Bond strength



DISCUSSION

Dental cements consist of an acid component and an alkaline component that, when combined, result in the hardening or setting of the mixture. Cements set by a neutralization reaction. Typically, the hardened cement's microstructure shows partially reacted glass particles (alkaline) suspended in a salt matrix formed when the acid component reacts with the alkaline glass. Cements are brittle, with relatively high compressive strength, low tensile strength, and relatively low fracture resistance.[6- 8]Zinc phosphate since it has been introduced in 1878, has become the gold standard by which other cements are compared because of its long and well-documented history of clinical use in band cementation. GIC's introduced in 1971 by Wilson and Kent gain the adhesion from ionic or polar molecular interactions to tooth enamel and dentin as well as to stainless steel, which suggests their suitability as orthodontic luting cements. GICs form a stronger bond with enamel than with stainless steel, resulting in a position of bond failure mainly at the band-cement interface both in vitro and in vivo.[9]Hence; the present study was undertaken for assessing and comparing the bonding strength of GIC versus Zinc phosphate in luting of orthodontic bands in Porcelain fused to metal (PFM) crowns.

In the present study, a total of 30 standard dies of a standard complete crown preparation were prepared. All the 30 samples were divided into two study groups depending upon the type of luting agent used; Group 1 included models in which GIC was used as luting agent for orthodontic bands, whereas Group 2 included models in which Zinc phosphate was used as luting agent for orthodontic bands. Tomar SS assessed of various surface treatments of the intaglio surface of crowns in combination with various luting agents for maximal retention. Totally, 150 dies of a standard complete crown preparation were fabricated. Wax pattern with a loop on the occlusal surface was prepared on each die using standard procedures, and then crowns were cast with nickel-chromium alloy. These crowns were randomly divided into five groups as per the surface of the intaglio surface of the metal copings. The crowns in each group were again subdivided randomly into three groups as per the luting agents used resin-modified glass ionomer cement, glass ionomer cement, and zinc phosphate cement. Retention was measured (MPa) by separating the metal crowns from the metallic die under tension on a Universal testing machine. The retention differed both with surface treatment and type of luting agents. Untreated group showed the least bond strengths < sandblasting with 50 µm alumina < sandblasting with 50 µm alumina with ultrasonic cleaning < sandblasting with 110 µm alumina < sandblasting with 110 µm alumina along with ultrasonic cleaning. For luting agents, glass ionomer cement showed least bond strength because there was no chemical bonding present between metal crown and metallic die, followed by zinc phosphate cement and maximum

bond strength were found for resin-modified glass ionomer cement. Among all types of surface treatments used in this study, maximum bond strength was yielded by sandblasting with 110 µm alumina + ultrasonic cleaning and the best luting agent was resin-modified glass ionomer cement.[10]

In the present study, mean bond strength of Group 1 specimens was 1.12 MPa while mean bond strength of Group 2 specimens was 0.36 MPa. On analysing statistically, it was found that mean bond strength of specimens of zinc phosphate group was significantly higher in comparison to specimens of GIC group. Heravi F et al compared the retentive strength of orthodontic bands cemented with amorphous calcium phosphate (ACP)-containing and conventional glass ionomer cements (GICs). One-hundred-and-twenty mandibular third molars were embedded in acrylic resin blocks with the buccal surface of crowns perpendicular to the base of the mold. The teeth were randomly divided into four groups containing 30 teeth each. Groups 1 and 3 were cemented using conventional GIC and groups 2 and 4 were cemented using ACP-containing orthodontic cement. Groups 1 and 2 without thermocycling, and groups 3 and 4 after thermocycling (5000 cycles, 5° to 55°C) were tested for retentive strength using a universal testing machine (crosshead speed of 1mm/minute). The highest retentive strength belonged to group 1, and it was significantly higher than that of group 2 ($P<0.001$) and group 3 ($P=0.02$). The mean strength for group 2 was significantly lower than that of group 1 ($P<0.001$) and group 4 ($P=0.04$). Although retentive strength decreased when ACP was added to GIC, the retentive strength of the samples cemented by ACP-containing GIC was remarkably high after thermocycling.[11]

CONCLUSION

From the above results, the authors concluded that mean bond strength of zinc phosphate cement is significantly higher in comparison to GIC cement. However; further studies are recommended.

REFERENCES

1. Rosenstiel SF, Land MF, Fujimoto J. Contemporary Fixed Prosthodontics. 4th ed. St. Louis, MO: Mosby-Year Book; 2001. pp. 209–57. (258–71, 909–27).
2. Potts RG, Shillingburg HT, Jr, Duncanson MG., Jr Retention and resistance of preparations for cast restorations. J Prosthet Dent. 1980;43:303–8.
3. Gillgrass TJ, Millett DT, Creanor SL, MacKenzie D, Bagg J, Gilmour WH, et al. Fluoride release, microbial inhibition and microleakage pattern of two orthodontic band cements. J Dent. 1999;27(6):455–61.
4. Donly KJ, Istre S, Istre T. *In vitro* enamel remineralization at orthodontic band margins cemented with glass ionomer cement. Am J Orthod Dentofacial Orthop. 1995;107(5):461–4.
5. Voss A, Hickel R, Molkner S. In vivo bonding of orthodontic brackets with glass-ionomer cement. Angle Orthod 1993;63:149-53.
6. Fricker JP. A 12-month clinical study comparing four glassionomer cements for the cementation of orthodontic molar bands. Aust Orthod J 1989;11:10-13.
7. Mizrahi E. Glass ionomer cements in orthodontics. Am J Orthod Dentofacial Orthop 1988;93:505-7.
8. The glossary of prosthodontic terms. J Prosthet Dent. 2005;94:10–92.
9. Prabhavathi V, Jacob J, Kiran MS, Ramakrishnan M, Sethi E, Krishnan CS. Orthodontic cements and demineralization: an in vitro comparative scanning electron microscope study. J Int Oral Health. 2015;7(2):28–32.
10. Tomar SS, Bhattacharyya J, Ghosh S, Goel P, Das S, Chakarvarty K. Comparative evaluation of bond strength of all-metal crowns with different luting agents after undergoing various modes of surface treatments: An in-vitro study. J Indian Prosthodont Soc. 2015;15(4):318–325.
11. Heravi F, Omidkhoda M, Koohestanian N, Hooshmand T, Bagheri H, Ghaffari N. Retentive Strength of Orthodontic Bands Cemented with Amorphous Calcium Phosphate-Modified Glass Ionomer Cement: An In-Vitro Study. J Dent (Tehran). 2017;14(1):13–20.