International Journal of Dentistry Research

***Research Article***

ISSN: 2581-3218
IJDR 2018; 3(2): 55-58

www.dentistryscience.com

# Influence of the application of Chlorhexidine at 2% in the Adhesive Protocol on the Tensile Bond Strength of Glass Fiber Post

*Juan Augusto Fernández Tarazona,[1] Zady Jackeline Torres Rivera[2]*

*1 [(a)]Visitant Professor, Department of General Dentistry, Private University Juan Pablo II, School of Dentistry, Lima, Peru*

*[(b)]Assistant Professor, Department of Integrated Clinic of the Adult III, Hermilio Valdizán National University, School of Dentistry, Huánuco, Peru*

*2 Graduate of Dentistry, University of Huánuco, School of Dentistry, Huánuco, Peru*

## Abstract

The decementation of glass fiber post can be attributed to the degradation of collagen fibers by matrix metalloproteinases (MMP) at the level of the intra radicular hybrid layer. The objective of the research was to compare the tensile bond strength of glass fiber posts that were cemented with previous treatment of the radicular dentine with chlorhexidine at 2% inside the adhesive protocol. Thirty eight bovine incisives were employed. The specimens were then divided into two groups (n=19): control group (it were realized the conventional procedure) and experimental group (it were realized the application of chlorhexidine at 2% inside the adhesive protocol). The tensile bond strength was measured with an Amsler universal tester machine. The data were statistically process with the T Student test for establish important differences in the two groups (p – value < 0.05). We obtained a great increases in the values to the tensile bond strenght to the glass fiber posts when apply chlorhexidine at 2% as an additional step between the acid etching and the application of adhesive system.

**Keywords:** Orthognathic surgery, Condylar atrophy, Complications.

***Corresponding author:**
***Juan Augusto Fernández Tarazon***
Visitant Professor, Department of General Dentistry, Private University Juan Pablo II, School of Dentistry, Lima, Peru
Assistant Professor, Department of Integrated Clinic of the Adult III, Hermilio Valdizán National University, School of Dentistry, Huánuco, Peru
Email: jaft57@hotmail.com

## INTRODUCTION

The rehabilitation of endodontically treated teeth with a great structural loss is associated with the use of intra radicular retention elements called posts that help retain the final restorative material and preserve the remaining tooth [1]. These devices have evolved vertiginously in the last decades from the cast metal post to the prefabricated systems being the glass fiber post a good option because exhibit better physical and esthetical properties closer to the tooth [2-3]. In spite of their excellent biomechanical behavior they present a high index of decementation that is associated to intra radicular hybrid layer failure due to the degradation of the collagen fibers by endopeptidases enzymes known as matrix metalloproteinases (MMP) [5,6].

Several studies claim that the use of 2% chlorhexidine can inhibit the collagenolytic activity of matrix metalloproteinases a long term and thus preserve the intra radicular hybrid layer to ensure the retention of the glass fiber post [7-13].

## MATERIALS AND METHODS

The methodology used for this study was based on the technical standards ISO / TS 11405 of "Dental Materials - evaluation of adherence to dental structures". In addition, the materials used in this study, their composition and manufacturers are shown in Table 1.

### Specimen Preparation

Thirty-eight freshly extracted bovine lower lateral incisors were used with an average age of 36 months, with straight roots, shape and similar sizes [14-16]. The teeth were cleaned with periodontal curettes and No. 15 scalpel blades to remove the remnants of the periodontal ligament, washed in tap water and examined with magnifying glasses with a 3X magnification for discarding teeth with cracks or fractures [14]. All pieces were submerged in distilled water for 1 day.

**Table 1:** Materials used in the study with the composition of materials according to information obtained from the manufacturers.

| MATERIAL | COMPOSITION | MANUFACTURER | Lot No. |
|---|---|---|---|
| White Post | Fiberglass composite and epoxy resin of high mechanical resistance. | FGM, Joinville – Brazil. | 24031 |
| Prosil | Is a 3 methacryloxypropyltrimethoxysilane hydrolyzate ethanolic solution. | FGM, Joinville – Brazil. | 130411 |
| Condac | Is an water-based gel containing phosphoric acid at 37%. | FGM, Joinville – Brazil. | 140111 |
| Excite | Phosphonic acid acrylate, Hydroxyethyl dimethacrylate, Methacrylate, Highly Dispersible silicon dioxide, Ethanol (solvent), Catalysts and stabilizers. | Ivoclar Vivadent, AG – Liechtenstein. | M66605 |
| Clorhexidina S | Chlorhexidine Digluconate at 2%, deionized water and volatile Surfactant. | FGM, Joinville – Brazil. | 160311 |
| All Cem Trans | TEGDMA, Bis EMA, Bis GMA, camphoroquinone, barium-aluminum-silicate micro glass, silica nano particles, methacrylic monomers, di benzoyl peroxide and stabilizers, barium-aluminum-silicate micro particles. | FGM, Joinville – Brazil. | 261110 |

The specimens were then stored in 2% Glutaraldehyde for 48 days for disinfection and preservation. Subsequently, they were washed in tap water and kept in distilled water until the time of experimentation, with distilled water being replenished every 24 hours. The teeth were embedded in condensed silicone (Speedex, Coltene Whaledent, Ohio, EE UU) matrices with a rectangular negative shape of 16 x 10 x 10 mm and filled with transparent acrylic resin, ensuring that roots previously measured at 14mm of the third apical to coronal will be centered in this. All roots were also varnished with clear nail polish and allowed to dry for 1 minute. The crowns of all specimens were then removed by covering the exposed root canals with the temporary sealing material to subsequently submerge all specimens in distilled water, finishing with metallographic polishing with water sanding and final polishing thereof with a paste fine abrasive abrasive (Diamond Excel, FGM, Joinville, Brazil) and a felt disc. The sample was then randomly into 2 groups of 19 specimens for both the control group and the experimental group, labeling them and identifying them respectively. Then all specimens were stored in distilled water at room temperature [14].

**Endodontic Procedure**

All endodontic treatments were performed with rotary instruments. During the preparation, all conducts were irrigated with 1% sodium hypochlorite (Zonident, Proquident - Colombia), 17% EDTA (Trisodium EDTA, Biodynamic - Brazil) and distilled water, and the conducts were dried with paper cones. The conducts were sealed with guttapercha cones and calcium hydroxide cement (Apexit Plus, Ivoclar Vivadent - Liechtenstein) using the lateral condensation technique, then the entries were sealed with Coltosol to store the pieces in distilled water for 48 hours [14].

**Adhesives Procedures**

The 38 teeth were prepared employing Peeso drill N°2 (Mailefer – Denstply, Brazil) and the proper drill of the glass fiber post system at the same length and under constant irrigation [14]. Next, the selected posts (White Post DC N°2, FGM, Joinville, Brazil) were prepared, it were immersed in 70% alcohol for 20 seconds, it were blown, a layer of silane was applied, 1 minute was waited for the drying thereof and as a last step a layer of adhesive was applied that was blown for 10 seconds and light cured for 20 seconds [14].

The conducts were then conditioned with phosphoric acid at 37 per cent in a lapse for 15 seconds and were rinsed with water. Conducts drying was performed with absorbent paper cones to avoid excessive dentin dehydration due to drying [14,15]. In the experimental group, 2% chlorhexidine was applied to the conducts for 1 minute, after which the conducts was not rinsed, only excess moisture was removed with paper cones. Then the etch and rinse adhesive system selected (Excite, Ivoclar Vivadent, AG - Liechtenstein) was applied to the interior of the conducts, scrubbing against the walls of the dentin for 15 seconds, it was blowing for a lapse of 10 seconds and for remove the excess of adhesive we employ endodontic paper cones, finally it was light cured for 40 seconds.

**Cementation Procedure**

The dual resinous cement agent was prepared according to the manufacturer's instructions and the posts were cemented removing the excesses and then each specimen was light cured on each of its surfaces for 30 seconds making a total of 120 seconds [14,15]. To finish, the excesses of the external surface of the test bodies were eliminated using polishing discs (Soft Lex, 3MESPE - USA) in a sequential and decreasing way until leaving the polished surface, after the external surface of the test bodies was varnished and the projecting end of the posts, was drying for 1 minute and stored in distilled water for 24 hours [14,15].

**Thermocycling Procedure**

After 24 hours the specimens were subjected to thermocycling at extreme temperatures of 5 °C to 55 °C for 30 seconds at each temperature, with a change interval of 10 seconds to fatigue the adhesive interface with a total repetition of 10,000 cycles to simulate 1 year of function [14]. Finally all the specimens were submerged in distilled water for 1 day before the tensile test. (Figure 1)

**Fig 1:** Specimens completed and stored before experimentation.

**Tensile Bond Strenght Test**

The specimens were placed in the Amsler universal testing machine (Mitutoyo brand), the test conditions were environmental, through a load cell of 500 kg, with a minimum reading unit of 1 kg, each sample was subjected it to a tensile load, at a speed of 1mm / minute, until the dislocation of the fiberglass post of the root canal [14]. (Figure 2)

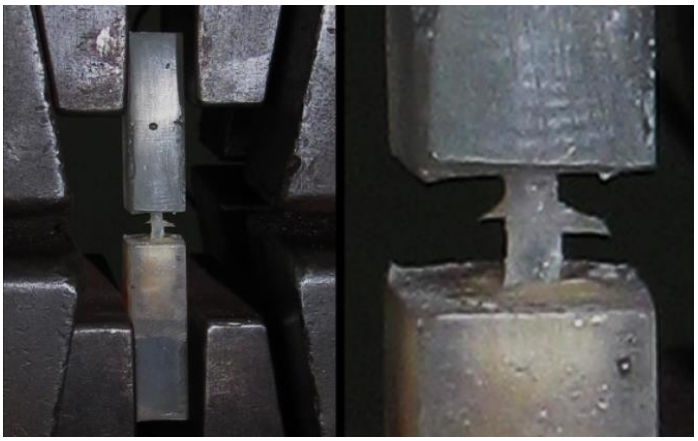


**Fig 2:** Specimen subjected to traction in the Amsler Universal testing machine.

**Statistical Analysis**

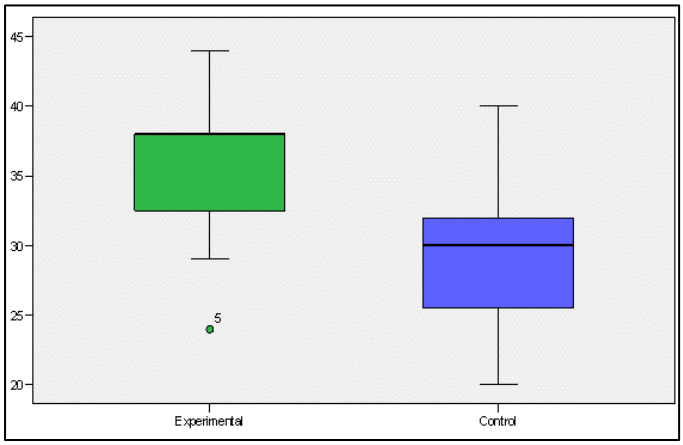
For statistical analysis, Student's T test was employed using a level of statistical significance of 5% (p value = 0.05). The differences among groups were analyzed using the statistical software SPSS v21.

**RESULTS**

In this study it was found that the value of the T- Student test Tc = -3.64 is less than T= -2.03, resulting in sufficient statistical evidence to reject the null hypothesis ($H_0$). Therefore, there will be an influence of the application of 2% Chlorhexidine in the adhesive protocol over the values of the tensile bond strength of glass fiber posts, at 95% confidence. Additionally, it was found that the average value of the tensile bond strength of glass fiber posts when 2% chlorhexidine was applied in the adhesive protocol was 35.47 Kg-f being higher than in the control group, as well it was found that the median value in the group with 2% chlorhexidine application was 38.00 Kg – f, being higher than that found in the control group as shown in the table 2 and figure 1.

**Table 2:** Comparison of the tensile bond strenght of glass fiber posts when applying and not applying 2% chlorhexidine in the adhesive protocol.

| | CONTROL GROUP | EXPERIMENTAL GROUP |
|---|---|---|
| Mean | 29.53 | 35.47 |
| Median | 30.00 | 38.00 |
| Mode | 30.00 | 38.00 |
| Standard Deviation | 5.12 | 4.96 |
| Note: n = 19 | | |




**Graphic 1:** Chart of boxes

**DISCUSSION**

The incorporation of 2% chlorhexidine within the application protocol of etch and rinse adhesives in the intra-radicular dentin is a valid clinical resource with the intention of avoiding the enzymatic degradation to the collagen fibers that occurs at the level of the hybrid layer thus increasing the longevity to the adhesive joint post - cement - adhesive - dentine [17-21].

In this study, significant differences were found over the values of the tensile bond strength in both groups where the intra-radicular dentin was re wetting with 2% chlorhexidine after etching with phosphoric acid and rinse it and before the application of the system adhesive to preserve the long-term adhesive interface.

The findings of this study coincide with the results obtained in previous studies [22], which evaluated the effect of various irrigating substances and endodontic medications on the bond strength to the dentin of the root canal, where it was found that the application of chlorhexidine for 60 seconds showed the values of bond strength higher in relation to the other substances, concluding that chlorhexidine is an appropriate irrigating solution for the treatment of the root canal before the application of adhesive posts.

Da Silva *et al* [23], evaluated the bond strength between radicular dentine and a resin cement it was employ to cement carbon fiber posts, they employing several irrigating agents to were used in the preparation for insert the posts. Based on the results obtained, they concluded that the 2% chlorhexidine gel is a suitable substance for the preparation of space for the posts; in addition it has the advantage of antimicrobial activity and low toxicity.

Lindblad *et al* [24,25] evaluated the effect of chlorhexidine at 2% on the retention of posts based on fiber reinforced composites (FRC) to dentin cemented with resin cement. Based on the results obtained, they concluded that chlorhexidine did not negatively affect the bonding of the cemented posts with any evaluated resin cement / adhesive, on the contrary there were improvements in the bonding [26,27].

It is important to note that our study not only demonstrated the effectiveness of 2% chlorhexidine by optimizing the intra-radicular bonding of fiber glass posts immediately after the clinical procedures were completed and to undergo the various mechanical tests of the test bodies as all the previous [22-25], but also showed the preservation of the adhesive interface over time, because the thermal fatigue of the adhesive interface was performed at 10000 cycles to simulate 1 year of clinical performance in the mouth [28,29], simultaneously improving the tensile bond strength of glass fiber posts over time [30], very important not only for clinicians but also for patients seeking more durable restorative treatments [28-30].

**CONCLUSIONS**

Under the experimental conditions of this in vitro study and based on the results obtained, we can concluded that: the experimental group obtained an average value of tensile bond strength of glass fiber posts to 35.47 kg-f compared to the control group obtained an average value of

29.53 kg-f, observing in this way statistically significant differences between both groups.

The application of 2% chlorhexidine as an intermediate step between acid etching and the application of the adhesive system to re wetting the intra-radicular dentine maintained the stability of the adhesive interface over time and therefore increased the values of tensile bond strength of glass fiber posts.

**Clinical Relevance**

It is advisable to apply 2% chlorhexidine within the adhesive protocol for the luting of glass fiber posts because it increases the tensile bond strength and optimizes the clinical survival to the glass fiber posts.

**Conflicts of interests**

We as the authors to the present research declare to there is not conflicts of interests in relation to the publication of this paper.

**REFERENCES**


1. Baraban DJ. The restoration of endodontically treated teeth: an update. Journal of Prosthetic Dentistry. 1988; 59(5):553 - 8.
2. Khan AS, Azam MT, Khan M, *et al* . An update on glass fiber dental restorative composites: a systematic review. Journal of Materials Science and Engineering. 2015; 47(1):26 - 39.
3. Monticelli F, Grandini S, Goracci G, Ferrari M. Clinical behavior of translucent – fiber posts: a 2 – year prospective study. International Journal of Prosthodontics. 2003; 16(6):593 - 6.
4. Bandeca MC, El - Mowafy O, Shebi A, Porto - Neto ST. Nonmetallic post – endodontic restorations: a systematic review. International Journal of Dentistry. 2010; 9(2):57 -62.
5. Bru E, Forner L, Llena C, Almenar A. Fibre post behaviour prediction factors. A review of the literature. Journal of Clinical and Experimental Dentistry. 2013; 5(3):150 -3.
6. Gomes Franca FM, Vaneli RC, Conti C de M, *et al* . Effect of chlorhexidine and ethanol application on long – term push – out bond strenght of fiber posts to dentin. Journal of Contemporary Dental Practice. 2015; 16(7):547 -53.
7. Cecchin D, de Almeida JF, Gomes BP, *et al* . Effect of chlorhexidine and ethanol on the durability of the adhesion of the fiber post relined with resin composite to the root canal. Journal of Endodontics. 2011; 37 (5):678- 83.
8. Osorio R, Yamauti M, Osorio E, *et al* . Effect of dentin etching and chlorhexidine application on metalloproteinase – mediated collagen degradation. European Journal of Oral Sciences.2011; 119 (1):79 -85.
9. Kim YH, Shin DH. Effect of chlorhexidine application on the bond strength of resin core to axial dentin in endodontic cavity. Journal of Restorative Dentistry and Endodontics. 2012; 37(4): 207- 14.
10. Cecchin D, Farina AP, Giacomin M, *et al* . Influence of chlorhexidine application time on the bond strength between fiber posts and dentin. Journal of Endodontics. 2014; 40(12):2045 - 8.
11. Bueno CE, Pelegrine RA, Silveira CF, *et al* . The impact of endodontic irrigating solutions on the push – out shear bond strength of glass fiber posts luted with resin cements. Journal of General Dentistry. 2016; 64(1):26 -30.
12. Dionysopoulos D. Effect of digluconate chlorhexidine on bond strength between dental adhesive systems and dentin: a systematic review. Journal of Conservative Dentistry. 2016; 19(1):11-16.
13. Mohammadi Z, Yaripour S, Shalavi S, *et al* . Root Canal irrigants and dentin bonding: an update. Iranian Endodontic Journal. 2017; 12 (2):131- 6.
14. Technical specification ISO/TS 11405. Dental Materials – testing of adhesion to tooth structure. Second ed. Switzerland; 2003.
15. Reis AF, Giannini M, Kavaguchi A, *et al* . Comparison of microtensile bond strenght to enamel and dentin of human, bovine, and porcine teeth. Journal of Adhesive Dentistry. 2004; 6(2):117 - 21.
16. Soares FZM, Follak A, da Rosa LS, *et al* . Bovine tooth is a substitute for human tooth on bond strength studies: a systematic review and meta – analysis of in vitro studies. Journal of Dental Materials. 2016; 32(11):1385-93.
17. Moon PC, Weaver J, Brooks CN. Review of matrix metalloproteinases' effect on the hybrid dentin bond layer stability and chlorhexidine clinical use to prevent bond failure. The Open Dentistry Journal. 2010; 4(1):147-52.
18. Collares FM, Rodrigues SB, Leitune VC, *et al* . Chlorhexidine application in adhesive procedures: a meta – regression analysis. Journal of Adhesive Dentistry. 2013; 15(1):11-18.
19. Montagner AF, Sarkis – Onofre R, Pereira – Cenci T, *et al* . MMP inhibitors on dentin stability: a systematic review and meta- analysis. Journal of Dental Research. 2014; 93(8):733-43.
20. Sabatini C, Pashley DH. Mechanisms Regulating the degradation of dentin matrices by endogenous dentin proteases and their role in dental adhesion. A review. American Journal of Dentistry. 2014; 27(4):203-14.
21. Ekambaram M, Yiu C, Matinlinna J. Bonding of adhesive resin to intra radicular dentine: A review of the literature. International Journal of Adhesion and Adhesives. 2015; 60 (4):92 -103.
22. Erdemir A, Güngüneş H, Belli S. Effect of medications for root canal treatment on bonding to root canal dentin. Journal of Endodontics. 2004; 30(2):113-16.
23. Da Silva RS, de Almeida Antunes RP, Ferraz CC, Orsi IA. The effect of the use of 2% chlorhexidine gel in post-space preparation on carbon fiber post retention. Journal of Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontics. 2005; 99(3):372-77.
24. Lindblad RM, Lassila LV, Vallitu PK, Tjäderhane L. Effect of chlorhexidine on initial adhesion of fiber-reinforced post to root canal. Journal of Dentistry. 2010; 38(10):796-801.
25. Lindblad RM, Lassila LV, Salo V, *et al* . One year effect of chlorhexidine on bonding of fibre – reinforced composite root canal post to dentine. Journal of Dentistry. 2012; 40(9):718-22.
26. Cecchin D, de Almeida JF, Gomes BP, *et al* . Effect of chlorhexidine and etanol on the durability of the adhesion of the fiber post relined with resin composite to the root canal. Journal of Endodontics.2011; 37(35):678-83.
27. Cecchin D, de Almeida JF, Gomes BP, *et al* . Influence of chlorhexidine and ethanol on the bond strength and durability of the adhesion of the fiber posts to root dentin using a total etching adhesive system. Journal of Endodontics. 2011; 37 (9):1310-15.
28. Toman M, Toksavul S, Tamaç E, *et al* . Effect of chlorhexidine on bond strength between glass-fiber post and root canal dentine after six month of water storage. European Journal of Prosthodontics and Restorative Dentistry.2014; 22(1):29- 34.
29. Cecchin D, Farina AP, Giacomin M, *et al* . Influence of chlorhexidine application time on the bond strength between fiber posts and dentin. Journal of Endodontics. 2014; 40(12):2045-48.
30. Gomes França FM, Vaneli RC, Conti CM, *et al* . Effect of chlorhexidine and ethanol application on long-term push-out bond strength of fiber posts to dentin. Journal of Contemporary Dental Practice.2015; 16 (7):547-53.