

**Original Article****Comparison of Endodontic Medicaments on Bond Strength of Fiber Post to Root Dentin Using Resin Cement**Maryam Zare Jahromi <sup>1</sup>, Mehrdad Barekatin <sup>2</sup>, Shirin Ravanbod <sup>3</sup>, Parisa Ranjbarian <sup>4</sup>, Sara Kousehlar <sup>5</sup><sup>1</sup> Dept. of Endodontics, Dental School (Faculty), Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.<sup>2</sup> Dept. of Operative Dentistry, Dental School (Faculty), Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.<sup>3</sup> Dentist, Shiraz, Iran.<sup>4</sup> Dept. of Endodontics, Dental School (Faculty), Shahrekord University of Medical Sciences, Shahrekord, Iran.<sup>5</sup> Post Graduate Student, Dept. of Endodontics, Dental School (Faculty), Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.**KEY WORDS**Chlorhexidine;  
Calcium Hydroxide;  
Fiber Post;  
Resin Cement**ABSTRACT****Statement of the Problem:** Endodontic irrigants and medicaments may affect the bond strength of intracanal posts to root dentin.**Purpose:** The aim of this study was to compare the effect of calcium hydroxide (Ca(OH)<sub>2</sub>) and 2% chlorhexidine gel (CHX) on bond strength of fiber post cemented with resin cement to root dentin.**Materials and Method:** This *in vitro* experimental study was conducted on 36 mandibular premolars. Canals were prepared using the step back technique. After root canal irrigation, the teeth were divided into three groups of 12. Ca(OH)<sub>2</sub> paste and CHX gel were used as intracanal medicaments in the first and second groups respectively. No intracanal medicament was used in the third group (control group). Access cavities were then sealed and the teeth were incubated for one week. The root canals were then filled using gutta percha and AH26 sealer and the teeth were incubated for 72 hours. Tooth crowns were then cut at the level of the cemento-enamel junction and intracanal posts were placed. The teeth were mounted in auto-polymerizing acrylic resin, and incubated for one week. They were then sectioned into 1.5mm thick slices from their coronal surface using a fully automated cutting machine, and subjected to push-out test until failure. The load at debonding was recorded and data were analyzed using one-way ANOVA, post-hoc test and t-test. The coronal margin of the root was at the level of the surface of acrylic resin in the mold.**Results:** The mean bond strength was 4.45 MPa in the Ca(OH)<sub>2</sub>, 2.45 MPa in the CHX and 2.48 MPa in the control group. The difference in this regard was statistically significant among groups ( $p=0.04$ ). The Ca(OH)<sub>2</sub> group had significant differences with the CHX and control groups ( $p=0.03$  and  $p=0.02$ , respectively). The difference between the CHX and control groups was not significant ( $p=0.974$ ).**Conclusion:** Based on the results, Ca(OH)<sub>2</sub> increased the bond strength of fiber post to root dentin but 2% CHX had no effect on bond strength.**Corresponding Author:** Kousehlar S., Dept. of Endodontics, dental school (Faculty), Isfahan (Khorasgan) branch, Islamic Azad University, Isfahan, Iran. Tel: +98-31336263583  
Email: sara\_kousehlar@yahoo.comReceived April 2016;  
Received in revised form July 2016;  
Accepted August 2016;**Cite this article as:** Zare Jahromi M., Barekatin M., Ravanbod Sh., Ranjbarian P., Kousehlar S. Comparison of Endodontic Medicaments on Bond Strength of Fiber Post to Root Dentin Using Resin Cement. J Dent Shiraz Univ Med Sci., 2017 March; 18(1): 56-60.**Introduction**

Biomechanically, teeth with root canal treatment are at higher risk of fracture compared to vital teeth. [1-2]

Tooth-colored restorative materials and non-rigid clear posts are commonly used for the restoration of endodontically treated teeth. These posts are made of glass

and translucent or white fibers and provide optimal esthetics and used in conjunction with resin bonded composites. Since they require luting cements for bonding in the root canal system, they further strengthen the roots. [1]

Any change in the structure of root dentin can affect the quality of bond. Thus, the effects of root canal irrigants and intracanal medicaments in this regard are extremely important. Fiber posts are commonly and conveniently used in the clinical practice due to having a modulus of elasticity similar to that of dentin. Thus, they better distribute the functional loads applied to root compared to cast posts. [1-2] However, root canal treatment prior to post cementation may compromise the bond of post to root dentin. Any change in dentin structure caused either by the effect of irrigants, intracanal medicaments or sealers used in endodontic treatment, may compromise the bond strength. [3] Calcium hydroxide is among the most commonly used intracanal medicaments. It prevents the proliferation of bacteria in the root canal system and alters the biological properties of bacterial lipopolysaccharides. Also, it induces hard tissue formation and mediates the nitro-genation of lipopolysaccharides. [1] Chlorhexidine is another commonly used irrigant and intracanal medicament. It has optimal substantivity and long-term antimicrobial activity attributed to its bond to hydroxyapatite crystals. [4] Chlorhexidine has dose-dependent bacteriostatic and bactericidal properties. It also has antifungal and antiviral properties and shows strong antimicrobial activity against obligate anaerobes and therefore, has extensive applications as an intracanal medicament and irrigant. [5-6]

The use of fiber posts for restoration of endodontically treated teeth is increasing. Thus, the retention of these posts, the influential factors in this regard, and their bond to root dentin are important research topics since they play an important role in achieving a coronal root seal and preventing vertical root fracture in endodontically treated teeth. [6]

Lee *et al.* [7] assessed the effects of  $\text{Ca}(\text{OH})_2$  intracanal medicament and acid etching on push-out bond strength of three resin cements to root dentin. They reported that the bond strength of resin cements to dentin decreased following the use of  $\text{Ca}(\text{OH})_2$ . Renovato *et al.* [2] showed that  $\text{Ca}(\text{OH})_2$  paste had no

significant effect on bond strength while sodium hypochlorite and EDTA decreased the bond strength of endodontic posts to root dentin. Bayram *et al.* [8] evaluated the effect of calcium hydroxide (CH), triple antibiotic paste (TAP) and double antibiotic paste (DAP) on the push-out bond strengths of three different self-adhesive resin cements and concluded that the bond strength of BisCem, RelyX and Maxcem was not negatively affected by the use of DAP, CH and TAP as intracanal medicaments. Ercan *et al.* [9] demonstrated that 1% CHX gel had no adverse effect on dentin bond strengths of composite resin when self-etch or etch and rinse systems were used.

Since the use of intracanal medicaments is inevitable in endodontic treatment of some teeth, this study sought to assess the effect of two commonly used intracanal medicaments  $\text{Ca}(\text{OH})_2$  and 2% CHX on bond strength of fiber post to root dentin using resin cement.

#### Materials and Method

This experimental study was conducted on 36 sound (caries-free) human mandibular single root premolars extracted within the past six months. After collection, the tissue remnants on teeth surface were cleaned with Cavitron (Dentsply international Inc.; PA, USA). The teeth were then immersed in 5.25% sodium hypochlorite for two hours. Then the sodium hypochlorite was neutralized by sodium thiosulfate, following which the teeth were stored in saline.

After obtaining periapical radiographs, access cavities were prepared, working lengths were determined, and the canal apex were prepared up to #40 k file using the step-back technique. Shaping was performed using Gates Glidden drills #2 and #3 (Mani; Tokyo, Japan). After use of each file, the root canals were irrigated with 2cc of saline. The teeth were then divided into three groups of 12. In the first group  $\text{Ca}(\text{OH})_2$  paste (Merck, Germany) and in the second group, CHX gel (Cerkamed, Poland) was used as intracanal medicaments. No intracanal medicament was used in the third group (control group). Access cavities were filled by Cavisol (3mm thickness) (Golchai, Iran). Specimens were coded, placed in screw-top vials containing saline and incubated for one week. Afterwards, the access cavities were opened and the root canals were rinsed with 10cc of saline solution. After a

final rinse, then the root canals were dried with paper points and filled with gutta percha (Gapadent, China) and AH26 sealer (Dentsply Maillefer, Germany) using the lateral condensation technique. A control radiograph was then obtained. For final setting of AH26, the specimens were incubated for 72 hours.

Tooth crowns were cut below the CEJ in such a way that 15mm of root length remained. Post space was then prepared in each root canal using #2 Angelus endodontic post drill, and approximately 10mm of the gutta percha was extracted. A tooth-colored #2 Angelus post was then cemented into the prepared post space using Panavia F2 resin cement (Kuraray, Japan) according to the manufacturer's instructions and light cured using a light curing unit (Ledturbo, USA) with 2,100mW/cm<sup>2</sup> of curing power for 20 seconds from coronal direction. After post cementation, a few grooves were created on each root and the roots were mounted in cylindrical molds (3cm in diameter and 3cm in length) containing auto-polymerizing acrylic resin (Acropars, Iran) in such a way that the long axis of the root and the cylindrical mold were parallel. The coronal margin of the root was at the level of the surface of acrylic resin in the mold. Next, specimens were incubated for one week and were then sectioned into 1.5mm thick slices from their coronal surface using a fully automated cutting machine (Nemofanavaran Pars, Iran). Afterwards, they were subjected to push-out test in a mechanical universal testing machine (Walter+Bai AG Testing Machines, Switzerland). The load was applied along the direction of the posts and acrylic blocks from the larger cross-section of the root at a crosshead speed of 0.5 mm/minute until failure. The diagram of load application was also drawn. The load at post-root dentin debonding (fracture load) was displayed on the monitor of the machine and recorded.

Before failure, the R, r and h values were measured by a digital caliper and to express the bond strength in MPa, the load at failure recorded in Newtons was divided by the area of the bonded interface as calculated by the following equation:

$$S = \pi(R+r)\sqrt{(R-r)^2 + h^2}$$

R=post's large diameter r= post's small diameter  
h= height

The surface area was the same for all specimens. Data were analyzed using SPSS version 18 (Microsoft, IL,

USA) and one-way ANOVA, post-hoc test and t-test.

## Results

The highest mean bond strength belonged to the Ca(OH)<sub>2</sub> group in an amount of 4.45 MPa while the lowest value was noted in the CHX group in an amount of 2.44 MPa. ANOVA revealed a significant difference in this regard between the two groups ( $p=0.044$ ) (Table 1).

**Table 1:** The mean bond strength of the Ca(OH)<sub>2</sub>, CHX and control groups in MPa

Medicament	Number	Minimum	Maximum	Mean	Stanadrd deviation
CHX gel	12	1.33	5.08	2.44	1.19
Ca(OH) <sub>2</sub>	12	0.64	12.33	4.45	3.21
Control	12	0.97	5.19	2.47	1.44

Table 2 shows the results of the comparison of bond strength among the three groups. The mean bond strength in the Ca(OH)<sub>2</sub> group was significantly higher than that in the CHX ( $p=0.029$ ) and control ( $p=0.031$ ) groups. The 2% CHX and control groups were not significantly different in terms of the mean bond strength ( $p=0.974$ ). In general, the mean bond strength of the Ca(OH)<sub>2</sub> group was significantly higher than that of the other two groups.

**Table 2:** Comparison of bond strengths of Ca(OH)<sub>2</sub>, CHX and control groups in MPa

Medicament	Groups	Mean	P value
Ca(OH) <sub>2</sub>	CHX	2	0.029
	Control	1.97	0.031
CHX gel	Ca(OH) <sub>2</sub>	-2	0.029
	Control	-0.02	0.974
Control	CHX	0.28	0.974
	Ca(OH) <sub>2</sub>	-1.97	0.031

## Discussion

Structure and chemical composition of dentin can significantly affect the micromechanical retention and resin bond to dentin when tooth-colored restorative materials or transparent posts are used. [2] Irrigating solutions, intracanal medicaments, and endodontic sealers may significantly alter the structure of dentin. [3, 10] Since the use of irrigants and different intracanal medicaments is inevitable during endodontic treatment for elimination of microorganisms, debris, and the smear layer, it is especially important to assess the effects of these agents on bond strength of posts to root dentin. [10-11]

In the current study, AH26 sealer was used since it

possesses almost all the properties of an ideal sealer. [12-13] Also, tooth-colored posts were used due to their high resistance to corrosion, biocompatibility, easy retrievability, optimal mechanical properties, radiopacity and favorable esthetics. [14] Panavia F2 cement was used for cementation of posts due to its extensive use for luting of fiber posts in the clinical setting as in previous studies. [15-16] We employed push-out test regarding the similar study reported by Armstrong *et al.* [17] Moreover, the push-out test distributes the stress more evenly and shows less variability in the results of mechanical tests. Therefore, this test is recommended for assessment of fiber post bond strength to root dentin. [18]

The current study results showed that use of CHX as an intracanal medicament had no statistically significant effect on bond strength of fiber post to root dentin; whereas, use of  $\text{Ca}(\text{OH})_2$  significantly increased the bond strength. In contrast, some previous studies have shown that use of  $\text{Ca}(\text{OH})_2$  as an intracanal medicament significantly decreased the retention of fiber posts. [2, 7, 19] However, the results of the current study regarding the increased bond strength of post to root dentin following the use of  $\text{Ca}(\text{OH})_2$  were in line with the findings of Carvalho *et al.*, [20] and Barbizam *et al.*, [8] Such an increase in bond strength following the use of  $\text{Ca}(\text{OH})_2$  may be explained by the fact that the saline solution was efficient in elimination of  $\text{Ca}(\text{OH})_2$  from the root canal walls compared to CHX and consequently, the adhesive was capable of well penetrating into the root dentinal tubules and subsequently yielded higher bond strength. [21] However, the saline solution was not capable of completely cleaning the CHX off the walls and the residual gel at the dentinal tubule openings prevented adequate infiltration of adhesive; thus, the bond strength did not increase in the CHX group. Barbizam *et al.* [8] also emphasized on methods to efficiently remove the medicaments and irrigants from the root canal walls. The difference between our findings and those of previous studies may be due to the methodology, method of elimination of  $\text{Ca}(\text{OH})_2$  from the root canal, and the type (brand) of materials used. Moreover, some previous studies measured the bond strength of resin sealers to root canal walls following the use of  $\text{Ca}(\text{OH})_2$  while in the current study; bond strength of fiber post to root

dentin was assessed. [8, 19-20]

In contrast to what was expected of CHX to be useful for the preservation of dentin bond strength, [22] the current study results revealed that use of 2% CHX gel as an intracanal medicament did not affect the bond strength of fiber post to root dentin (instead of increasing it); these findings are in contrast to those of da Silveira Bueno *et al.*, [23] Cecchin *et al.*, [24] and Liu *et al.*, [25] Manfro *et al.*, [26] and Ercan *et al.* [9] Such controversy in results may be attributed to the concentration and purpose of use of materials; because for instance, Cecchin *et al.*, [24] and Liu *et al.*, [25] used 2% CHX as an irrigant while we used 2% CHX as an intracanal medicament and thus, root dentin was exposed to this material for a longer period of time in our study. The obtained results in bond strength following the use of CHX in our study may be attributed to the use of a self-etch system for bonding of fiber post. Moreover, some studies have shown that use of CHX before acid etching does not increase the bond strength. [9] It should be noted that although the previous literature cited in the current study does not include all the research on the effect of CHX gel on bond strength, evidence shows that use of CHX gel for the purpose of disinfection of dentin and root canal prevents the penetration of other materials into the dentinal tubules and therefore, application of CHX in gel form does not increase the bond strength. [9]

### Conclusion

The results showed that use of  $\text{Ca}(\text{OH})_2$  as an intracanal medicament increased the bond strength of fiber post to root dentin while 2% CHX gel as an intracanal medicament did not enhance the bond strength.

### Conflict of Interest

None to declare.

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