

Impact of Different Endodontic Sealers on Retentive Strength of Fiber Posts – An *In Vitro* Study

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Abstract

Aim: The aim of the study was to evaluate the effect of two different root canal sealers in relation to the retention of the prefabricated fiber posts.

Materials and Methods: Twenty extracted single-rooted mandibular premolar teeth were prepared and randomly divided into two groups. In Group 1, eugenol-based sealer was used while in Group 2, a resin-based root canal sealer was used. Prefabricated fiber posts were luted into the prepared post-spaces with the same composite resin cement in both the groups. After calculating the pullout forces required for dislodgment of posts post-spaces, the data were recorded and statistically analyzed.

Results: The resin-based root canal sealer group had significantly greater retentive strengths for the posts as compared to eugenol-based sealers group ($P > 0.0001$).

Conclusion: The retentive strength for prefabricated fiber posts luted with resin cement was much more than those luted with eugenol-based sealers. This was attributed to the different chemical composition of the two sealers.

Key words: Endodontic sealer, Prefabricated Fiber Post, Retentive strength

INTRODUCTION

The retentive capacity of the post used for retention of core is critical for the long-term survival of the final restoration.^[1] Various factors such as shape, design, length, diameter, type of luting agent used to cement it, the coronal tooth preparation after cementation, and the endodontic obturation sealer have a bearing on the retention of the post.^[2-5] In recent times, fiber-reinforced endodontic posts have become more popular as they have better biocompatibility and physical properties.^[6] The role of dental cements on post-retention has already been established.^[7,8] Endodontic sealers play an important role in the retention of the post.^[9] Sealers based on epoxy

resin have good physical properties and adequate biological performance.^[9,10] Still, eugenol-based sealers remain the most commonly used root canal sealer.^[11] However, eugenol is thought to inhibit composite resin polymerization because of its radical scavenging properties.^[12-20] There is little agreement between studies on whether this interaction is clinically relevant.^[12,13,14] There is limited information in the literature about the effect of the various types of sealers the bond strength of endodontic posts luted with core build up materials. This *in vitro* study was undertaken to evaluate the influence of two chemically different sealers on the retention of the prefabricated fiber posts.

MATERIALS AND METHODS

Twenty extracted single-rooted, human permanent mandibular first premolars of approximately the same size having a straight single canal with closed apex radiographically were selected for this study. Teeth were sectioned 1 mm coronal to the midfacial cements/enamel junction using a low-speed diamond saw under copious water

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coolant. After removing the pulpal tissue, working length at 1 mm from the root apex was established. The canals were prepared, cleaned, and shaped with a rotary system according to the manufacturer's instructions following the crown-down technique. One milliliter of sodium hypochlorite (NaOCl; 5.25%) was reintroduced into each root canal after every instrument. Each tooth was irrigated with 2 ml of distilled water after preparation and the teeth were divided into two groups ($n = 10$). Obturation was done with laterally condensed gutta-percha with either a eugenol-based sealer or a resin-based sealer. After storing the obturated teeth in 100% relative humidity at 37°C for 10 days, gutta-percha was removed and post-spaces were prepared using a no. 5 Peeso Reamer at low speed to a depth of 9 mm such that 5 mm of the gutta-percha always remained in each tooth radiographically. Standardized post-spaces (1.5 mm diameter and 9 mm long) were prepared using a no. 6 ParaPost Drill at low speed and each post-space was irrigated with 2 ml of distilled water. Parallel sided, size 6 prefabricated fiber posts were checked for a passive fit in their respective canals before luting. Carbide burs were used to notch the roots. After canal irrigation with 5.25% NaOCl and then distilled water, the canals were dried with absorbent paper points. The posts were then luted with the selected composite resin cement. After acid etching of the root canal walls 37% phosphoric acid for 15 s, followed by thorough water rinsing and removal of excess surface moisture with paper points, corresponding bonding material was applied to the canal using a microbrush for 10 s, and excess adhesive was removed using paper points. The luting cement material was applied into the prepared post-space in the root canal and on each fiber post. Then, the fiber post was inserted into the canal using slight pressure. Excess cement was removed and then light polymerized for 40 s was carried out.

The specimens were stored in 100% relative humidity at 37°C for 24 h before testing. After securing each tooth in the universal testing machine, pneumatic grips that grasped the post head at its long axis were used to determine the force required to dislodge the post. A constant loading rate of 0.5 mm/min was applied until cement failure was achieved the point of bond failure was recorded in Newtons when the post - segment extruded from the specimen. The data were statistically analyzed using statistic package – SPSS version 23.

RESULTS

The means and standard deviations (SD) of the results are summarized in Table 1. The posts obturated with gutta-percha and resin bonder sealer (240.8 N) required higher force to dislodge the post than the group of eugenol-based sealer (94.2 N).

DISCUSSION

Better retention, less microleakage, and a higher resistance to tooth fracture can be achieved the cementation of fiber posts with an adhesive resin cement.^[14,20] The present study assessed the influence of eugenol- and resin-based root canal sealers on the retention of fiber posts composite resin designed for core buildup restorations of teeth and luting of fiber posts. Teeth with relatively equal dimensions and canal configuration were prepared for standardized post-space using a large ParaPost Drill (1.5 mm in diameter) and same size posts were inserted. Retention of cemented fiber posts into prepared root canals relies on the interface resistance.^[7,8] As per studies, resin-based root canal sealers are more effective in sealing root canals than the zinc oxide-eugenol-based sealers as they do not shrink during setting and adhere to dentin, ensuring a permanent seal.^[9] However, eugenol-based sealer used for obturation cause a significant reduction in the adhesive effectiveness or modify the polymerized resin's surface,^[16] resulting in decreased bond strength of the resin cement. Some studies demonstrated that eugenol could inhibit the polymerization process.^[5,16,17] Our study showed that higher mean bond strength values were needed for vertical dislodgment of the fiber posts luted after the resin sealer had previously been used as part of the root canal obturation compared with those canals eugenol-based sealers had previously been used as part of the root canal obturation. Carvalho *et al.*^[18] observed that a temporary sealing cement containing eugenol reduced the bond strength of adhesive systems. However, Hagge *et al.*^[14] concluded that the retention of posts cemented with resin cements was not significantly affected by the chemical formulation of endodontic sealers. Schwartz *et al.*^[4] reported no changes in the bond strength of posts luted with Panavia cement in canals filled with eugenol and previously treated with acid while Hagge *et al.*^[5] reported significant differences in groups treated with eugenol. The use of 37% phosphoric acid as the etching reportedly eliminates the contaminated smear layer and results in demineralization of dentin. Studies have demonstrated that etch-and-rinse systems allow more effective bonding to the eugenol contaminated dentin surfaces, compared to the self-etch approach, due to the non-removal of the sealer's debris entrapped within the smear layer. In our study, no special canal treatment was performed before post-cementation which might be the cause of reduced bond strength for the eugenol group. Tjan and Nemetz^[3] found that the presence of eugenol within the root canal resulted in significant loss of retention and that residual eugenol in the root canal could be removed without any effect on retention of the post by irrigating the canal with ethyl alcohol (ethanol) or etching with 37% phosphoric acid. Push-out tests lead to a shear stress, which is comparable to the stress under clinical conditions at the interface between dentin and luting cement, as well as between the post and luting cement.^[21]

Table 1: Mean and SD in forces applied

Group	n	1	2	3	4	5	6	7	8	9	10	Mean±SD
Group 1	Push-out force (n)	67.1	59.7	110.6	122.7	130.6	86.4	87.6	94.8	99.5	83.4	94.2±36.4
Group 2	Push-out force (n)	165.4	246.3	325.4	253.4	190.6	186.7	204.8	212.9	310.8	301.4	240.8±84.6

SD: Standard deviation

Goracci *et al.*^[22] noticed that the push-out test was a more reliable technique in the determination of bond strengths between fiber posts and post-space dentin due to the high number of premature failures occurring during specimen preparation. Non-uniform stress distribution is a disadvantage of the push-out test when it is performed on thick root sections.^[23] Therefore, this testing model was preferred for the present study. The pullout test has been used by several studies to determine the values required to remove the post from the root canal.^[3,23] In the current study, although teeth were selected with similar size and canal shapes and received standardized post preparations, a wide range of strengths and relatively large SD was obtained. However, comparison of the values reported in some earlier studies dealing with the retention of root canal posts that used extracted human teeth also revealed wide ranges in their measurements.^[2,23] One possible explanation is that the size and shape of the root canals differ and/or the texture and properties of the inner surfaces of the root canals differ among the teeth used. In addition, the diameter of the individual root canal preparation could affect how much of the canal was still covered with some eugenol-containing sealer. Our study indicates that type of root canal sealer affected the retention of a fiber post-cemented with resin cement. However, controlled prospective long-term clinical trials with a larger sample and *in vivo* studies are required to definitely comment on the results.

CONCLUSION

Within the limitations of this study, it was concluded that pre-fabricated fiber posts luted with composite resin in canals previously obturated with gutta-percha and eugenol based had significantly reduced bond strength compared to fiber posts luted with the resin-based sealers cement.

REFERENCES

- Bateman G, Ricketts DN, Saunders WP. Fiberbased post systems: A review. *Br Dent J* 2003;195:43-8.
- Qualtrough AJ, Chandler NP, Purton DG. A comparison of the retention of tooth-colored posts. *Quintessence Int* 2003;34:199-201.
- Tjan AH, Nemetz H. Effect of eugenol-containing endodontic sealer on retention of prefabricated posts luted with an adhesive composite resin cement. *Quintessence Int* 1992;23:839-4.
- Schwartz RS, Murchison DF, Walker WA. Effects of eugenol and noneugenol endodontic sealer cements on post retention. *J Endod* 1998;24:564-7.
- Hagge MS, Wong RD, Lindemuth JS. Effect of three root canal sealers on the retentive strength of endodontic posts luted with resin cement. *Int Endod J* 2002;35:372-8.
- Asmussen E, Peutzfeldt A, Heitmann T. Stiffness, elastic limit, and strength of newer types of endodontics posts. *J Dent* 1999;27:275-8.
- Bouillaguet S, Troesch S, Wataha JC, Krejci I, Meyer JM, Pashley DH. Microtensile bond strength between adhesive cements and root canal dentin. *Dent Mater* 2003;19:199-205.
- Ferrari M, Vichi A, Grandini M. Efficacy of different adhesive techniques on bonding to root canal walls: An SEM investigation. *Dent Mater* 2001;17:422-9.
- Wennberg A, Østravik D. Adhesion of root canal sealers to bovine dentine and gutta-percha. *Int Endod J* 1990;23:13-9.
- Lee KW, Williams MC, Camps JJ, Pashley DH. Adhesion of endodontic sealers to dentine and gutta-percha. *J Endod* 2002;28:684-8.
- Hagge MS, Wong RD, Lindemuth JS. Retention strengths of five luting cements on prefabricated dowels after root canal obturation with a zinc oxide/eugenol sealer: 1. Dowel space preparation/cementation at one week after obturation. *J Prosthodont* 2002;11:168-75.
- Al-Wazzan KA, Al-Harbi AA, Hammad IA. The effect of eugenol-containing temporary cement on the bond strength of two resin composite core materials to dentin. *J Prosthodont* 1997;6:37-42.
- Schwartz R, Davis R, Hilton TJ. Effect of temporary cements on the bond strength of a resin cement. *Am J Dent* 1992;5:147-50.
- Hagge MS, Wong RD, Lindemuth JS. Retention of posts luted with phosphate monomer-based composite cement in canals obturated using a eugenol sealer. *Am J Dent* 2002;15:378-82.
- Ganss C, Jung M. Effect of eugenol-containing temporary cements on bond strength of composite to dentin. *Oper Dent* 1998;23:55-62.
- Mayer T, Pioch T, Duscner H, Staehle HJ. Dentinal adhesion and histomorphology of two dentinal bonding agents under the influence of eugenol. *Quintessence Int* 1997;28:57-62.
- Dilts WE, Miller RC, Miranda FJ, Duncanson MG Jr. Effect of zinc oxide-eugenol on shear bond strengths of selected core/cement combinations. *J Prosthet Dent* 1986;55:206-8.
- Carvalho CN, Oliveira B Jr., Loguercio AD, Reis A. Effect of ZOE temporary restoration on resin-dentin bond strength using different adhesive strategies *J Esthet Restor Dent* 2007;9:137-41.
- Russo EM, Russo E, Carvalho RC, Santos MG, Braga SR. Effect of eugenol-containing endodontic sealer on retention of posts. *J Dent Res* 1999;78:389.
- Cheung W. A review of the management of endodontically treated teeth. *J Am Dent Assoc* 2005;136:611-9.
- Bitter K, Meyer-Lueckel H, Priehn K, Kanjuparambil JP, Neumann K, Kielbassa AM. Effects of luting agent and thermocycling on bond strengths to root canal dentine *Int Endod J* 2006;39:809-18.
- Goracci C, Tavares AU, Fabianelli A, Monticelli F, Raffaelli O, Cardoso PC. The adhesion between fibre posts and root canal walls: Comparison between microtensile and push-out bond strength measurements. *Eur J Oral Sci* 2004;112:353-61.
- Al-Harbi F, Nathanson D. *In vitro* assessment of retention of four esthetic dowels to resin core foundation and teeth. *J Prosthet Dent* 2003;90:547-55.

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