

# A Comparative Evaluation of Push-Out Bond Strength of Two Different Posts System To Root Dentin By Using Two Different Luting Cement -An In Vitro Study

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## Abstract:

**Background:** Posts that have been properly fitted can withstand torsion forces and so provide better retention. **Objectives:** The purpose of this in vitro study was to comparative evaluation of push-out bond strength of two different posts system to root dentin by using two different luting cement. **Materials and Method:** A total 25 single rooted mandibular incisors with fully developed apices and straight root canals were selected in the study. The samples were randomly divided into 5 groups of 5 teeth each. The crown down procedure was used to clean and shape the pulp area. A Tenax fiber post and rebilda glass fiber post was used by four groups. The first group is control group (n=5)-Teeth restored without post. Second group (n=5) - rebilda post with vocco (Bifix SE-Quickmix). Third group (n=5)-rebilda post with FC (Filtek Z 350 3M ESPE). Fourth group (n=5)-Tenax fibre post with vocco (Bifix SE-Quickmix). Fifth group (n=5) - Tenax fibre post with FC (Filtek Z 350 3M ESPE). The specimens were cross sectioned after 24 h. all specimens were cross-sectioned 4 mm thick into the coronal and middle parts by a sectioning machine. The strength of the bond between the luting cement and the posts was measured using push out bond strength testing.

**Results:** In coronal and middle region each, rebilda post with bifix SE group showed significantly higher push out bond strength as compared to other four groups.

**Conclusion:** Bifix SE with rebilda post mean push out bond strength score is less than other groups.

**Keywords:** Rebilda post, push out bond strength, bifix SE Quikmix, Tenax fiber post.

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## INTRODUCTION

The main clinical goal of using a post system is to provide additional support and retention to the coronal restoration in endodontically treated teeth with compromised crown structure. For that

purpose, different treatment modalities and materials have emerged to maximize the clinical outcomes of biomechanical stability, esthetics and longevity<sup>1</sup>. Multiple parameters concerning the intraradicular post influence the success of restored endodontically treated teeth. For instance, the adhesion of the post to

the intraradicular dentin and its retention within the radicular structure has an impact on restorative complex durability. Further factors include the amount of remaining tooth structure and post, as well as core and cement material properties.<sup>1</sup>

One of the main goal of posts presence is to ensure the dental materials' retention while the lost dental crown is being reconstructed. A post allows for the appropriate stress distribution in the root and may be used to support single crowns and bridges. However, according to numerous researchers, a post does not strengthen the tooth structure, it merely provides the appropriate retention for the material used to restore a crown foundation.<sup>2</sup>

The difficulty of restoring teeth that are endodontically treated has led to a wide range of base restorations. Loss of tooth structure due to endodontic access preparations, caries, and defective restorations makes restoring a pulpless tooth challenging. The length of a post, diameter, design, canal shape and preparation, luting agent, cementation procedure, and other factors all influence post retention. A good adaptation of the post to the root canal (RC) will remain for a long time and tolerate torsion forces. The resin adhesives in well-fitting canals provide good retention. The quality of luting cement is the main element in retention. Characteristics such as easy manipulation, a thinner film, extended working time with a fast set, and low solubility are ideal properties in luting cement. However, there have been fewer studies that provide evidence on the comparison of the bond strength of luting cement. Most studies have conflicting results on which of the luting types of cement have superior bond strength.<sup>3</sup>

Rebilda glass fiber post is highly translucent for excellent esthetics. High radiopacity (350% Al).Dentin-like elasticity for gentle root treatment and Dentin-like translucency for esthetic restorations with High retention rate for strong bond.Excellent light conduct and diffusion for use with dual-cured materials.it contains Glass fiber-reinforced resin post (Rebilda Post) contains 70% glass fiber, 10% inorganic filler, 20% UDMA matrix.

Tenax glass fiber post it is an excellent alternative to metal posts, if highly esthetic, metal free restorations are desired. This Post System is a high quality,

translucent fiber resin post system, that has a tapered (.04) design in the bottom third of the post. High strength, high bending strength, and resistance to shearing force have elastic modulus similar to that of dentin. It is translucent hence light can pass through it while using light cure. Fiber /Glass reinforcement 75% and Resin 25%.

Bifix SE flowable composite secure adhesion to tooth and restoration.Fast working: no etching, no bonding Odourless, Easy handling Long-term durability. Simple removal of excess material Minimal film thickness of 10 µm for precisely fitted luting without elevating the bite. Also suitable for zirconium dioxide. Catalyst: dimethacrylates, phosphoric acid, dimethacrylate ester, methacrylates, BPO, SiO<sub>2</sub>, BAS glass ceramic, BHT;Base: dimethacrylates, methacrylates, CQ, amine, SiO<sub>2</sub>, BAS glass ceramic, BHT; filler content: 66.3%.

Filtek flowable composite Low-viscosity, visible light-cured, radiopaque flowable nanocomposite. Bonding to the tooth structure is accomplished through the use of dental adhesive systems, either total-etch or self-etch, that are designed to be compatible with methacrylate composites. The resin contains bis-GMA, UDMA, TEGDMA, and bis-EMA resins. To moderate the shrinkage, PEGDMA has been substituted for a portion of the TEGDMA resin in Filtek Supreme XT restorative.

The purpose of this study was to evaluate of the push-out bond strength of two different posts system to root dentin by using two different luting cement - an in vitro study

Material and methods

Sample preparation: A total of Twenty five natural single rooted mandibular incisors were used in this study. Selected teeth were extracted due to periodontal problems and the structure of the tooth, i.e., with enamel and dentine intact, so that results can be generalized. Then teeth were cut at the cementoenamel junction, teeth were sectioned with a high-speed airtoror handpiece. The endodontic working lengths will be determined visually at 1.00 mm short of the apical foramen, using the 10 K-type files (Maillefer, Ballaigues, Switzerland).The pulp space was cleaned and shaped using the crown-down technique with a rotary protaper nickel-titanium file up to size F2. Irrigation with sodium

hypochlorite 2.5% solution, saline, and 17% Ethylenediaminetetraacetic acid (EDTA) was done at the same time. The RCs were dried with paper points after being irrigated with distilled water. All of the RCs were sealed with endodontic sealer and then gutta-percha was used to obturate them. The teeth were then stored in deionized water for 24 h to create post spaces. The RC walls of the specimen were individually enlarged using low-speed drill tips. The depth of the post space was 10 mm. The specimens were divided into 5 groups of 5 samples each at random.

The samples were randomly divided into 5 groups as follows.

- 1) Control group (n=5)-Teeth restored without post.
- 2) Group (n=5) - rebilda post with vocco (Bifix SE-Quickmix).
- 3) Group (n=5)-rebilda post with FC (Filtek Z 350 3M ESPE).
- 4) Group (n=5) - Tenax fibre post with vocco (Bifix SE-Quickmix).
- 5) Group (n=5) - Tenax fibre post with FC (Filtek Z 350 3M ESPE).

In control group-Teeth restored without post.

The RC walls of the specimen were individually enlarged using peeso reamer. The depth of the post space was 10 mm.

Group 2: The RCs were etched for 10s with 37% phosphoric acid, then rinsed with water and dried. A micro brush was used to apply the single-bond universal adhesive to the RCs. After that, the vocco rebilda post was luted with vocco Bifix SE-Quickmix and put into the RC, with the excess resin later removed. Then the components were light cured for 60 s.

Group 3: The RCs were etched for 10s with 37% phosphoric acid, then rinsed with water and dried. A micro brush was used to apply the single-bond universal adhesive to the RCs. After that, the vocco rebilda post was luted with FC (Filtek Z) and put into the RC, with the excess resin later removed. Then the components were light cured for 60 s.

Group 4: The RCs were prepared same like group 2 and Tenax fiber Trans Coltene whaletene post was luted with vocco Bifix SE-Quickmix.

Group 5: The RCs were prepared same like group 3 and Tenax fiber Trans Coltene whaletene post was coated with FC (Filtek Z).

All specimens were cross-sectioned 4 mm thick into the coronal and middle parts by a sectioning machine. The push test was used to calculate the bond strength between the luting cement and post. On the testing machine, the post was loaded with a 1 mm in diameter cylindrical plunger.

Statistical analysis

All Statistical analyses were carried out using spss software. Mean values and standard deviation (SD) were calculated. After normality testing using a one way ANOVA and Independent t test; was run to analyse the means of each group. The Post hoc Tukey test was to make multiple comparisons between all groups the significance level was set at  $\alpha < 0.05$ .

## PROGRESS OF TREATMENT

**Table- 1 Comparison of push-out bond strength among five groups**

Region	Group	Mean	SD	p-value
Coronal	Rebilda+Bifix	4.43	0.02	<0.001*
	Tenex+Bifix	4.19	0.02	
	Rebilda+Filtek C	4.10	0.02	
	Tenex+Filtek C	3.63	0.03	
	Control	0.92	0.02	
Middle	Rebilda+Bifix	4.33	0.03	<0.001*
	Tenex+Bifix	4.06	0.03	
	Rebilda+Filtek C	3.99	0.03	
	Tenex+Filtek C	3.49	0.03	
	Control	0.43	0.02	

One-way ANOVA test; \* indicates significant difference at  $p \leq 0.05$

Table- 2 Pairwise comparison of push-out bond strength among five groups

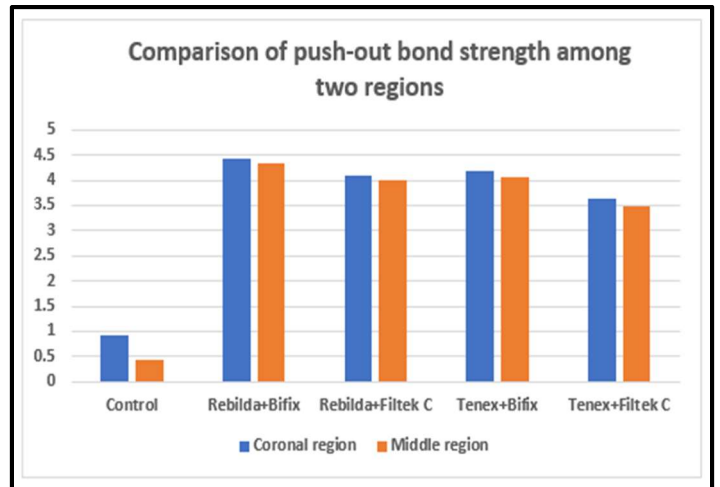
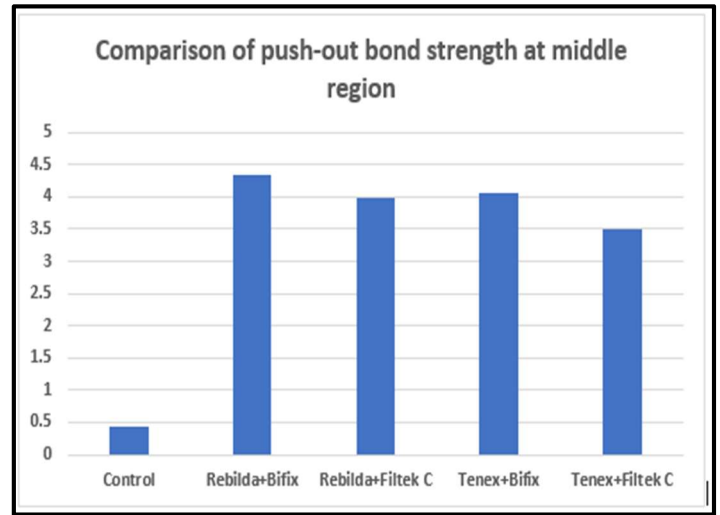
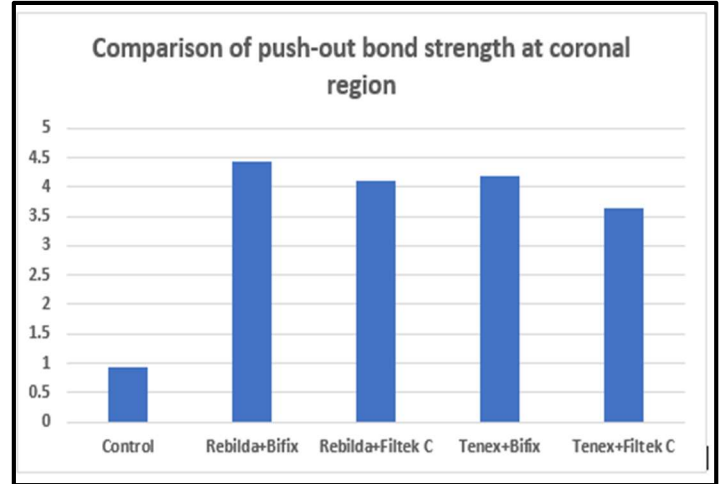
Group	Coronal	Middle
Rebilda+Bifix vs Tenex+Bifix	<0.001*	<0.001*
Rebilda+Bifix vs Rebilda+Filtek C	<0.001*	<0.001*
Rebilda+Bifix vs Tenex+Filtek C	<0.001*	<0.001*
Rebilda+Bifix vs Control	<0.001*	0.002*
Tenex+Bifix vs Rebilda+Filtek C	<0.001*	<0.001*
Tenex+Bifix vs Tenex+Filtek C	<0.001*	<0.001*
Tenex+Bifix vs Control	<0.001*	<0.001*
Rebilda+Filtek C vs Tenex+Filtek C	<0.001*	<0.001*
Rebilda+Filtek C vs Control	<0.001*	<0.001*
Tenex+Filtek C vs Control	<0.001*	<0.001*

Post hoc tukey test; \* indicates significant difference at  $p \leq 0.05$

Table- 3 Comparison of push-out bond strength among two regions

Group	Coronal		Middle		p value
	Mean	SD	Mean	SD	
Rebilda+Bifix	4.43	0.02	4.33	0.03	0.001*
Tenex+Bifix	4.19	0.02	4.06	0.03	<0.001*
Rebilda+Filtek C	4.10	0.02	3.99	0.03	<0.001*
Tenex+Filtek C	3.63	0.03	3.49	0.03	<0.001*
Control	0.92	0.02	0.43	0.02	<0.001*

Independent t test; \* indicates significant difference at  $p \leq 0.05$



## DISCUSSION

Tooth restoration following endodontic treatment is the main objective of dental prosthetics. It is recommended not to insert posts at the cost of the root dentin.(4) The research has shown that excessive preparation for a post not only weakens the tooth structure but may also lead to fractures and defects which could result in increasing the probability of tooth fractures or even tooth loss.(5,6)

Phebus et al. demonstrated that the teeth with a cemented fibre-reinforced composite post were significantly stronger than those which were endodontically treated without the use of a post.(9) In the present study, the push-out bonding test has been applied for measuring the bond strengths of posts to intra-radicular dentin. The push-out bonding test has been considered as a reliable method that provides a better estimation of the bond strength of posts than does the conventional shear test.

It has been applied in several recent studies assessing the influence of a range of factors on bond strength of different types of posts and luting agents. (10-11) Advantages of the push-out test, is that the fracture occurs parallel to the dentin-adhesive interface, which makes it a true shear test. Retention of adhesively luted fiber-reinforced posts relies on the strength of the bonding interface between dentinal root canal wall on one hand and the post surface on the other. It is important that the bond strength is sufficiently strong to withstand stresses during functional loading. (1)

The highest bond strength values of FRC posts in combination with other favorable in vitro physical and mechanical properties that have been demonstrated in recent studies supports their clinical use. Especially in teeth with extensive coronal destruction the clinical outcome advantages of fiber-reinforced composite post have been reported. (12)

Bond strength results that influence a performance of FRP in restorations of endodontically treated teeth provide valuable information to predict the clinical outcome and expect decreasing of debonding frequency due to appropriate selection of post type. Nevertheless, the in-vivo survival of FRC posts and debonding occurrence must be further investigated. (1)

In the present study, a statistically significant result was obtained between the Rebilida glass fiber post with Bifix SE and other glass fiber post with Filtek composite. Due to chemical cure there may be high shear bond strength in middle third compared to other dual cure as light penetration in middle third will be less.

When Bifix SE was used for the cementation of zirconium crowns, it was capable of presenting a higher level of retention after one year, with good mechanical properties even after being submitted to stress for a long period. Bifix SE is a cement that is more dependent on chemical activation than on light activation. (7)

With analysis of the Ca 2p peak components, a powerful method to quantify the chemical interaction to HAp was developed and adopted to analyze the reaction of composites with inorganic teeth components. Percentage of unreacted HAp calcium atoms were found and with Bifix 65 and 35%, respectively. (8)

In prefabricated fiber post systems, fiber content usually ranges from about 35% to 65%, with a higher fiber content post typically having greater strength and stiffness. The fibers are bound with resin such as epoxy or polyester resins and their advantages are metal free, aesthetic in nature, and can easily be retrieved in case of endodontic failure. While comparing Tenax and rebilda post both composition is almost same.

## CONCLUSION

Within the limitations of the present in-vitro study and based on the results, we can conclude that Bifix SE composite for luting is better than Filtek composite.

## REFERENCES

1. Kanzler Abdel Raouf V, Jockusch J, Al-Haj Husain N, Dydyk N, Özcan M. Push-Out Bond Strength Assessment of Different Post Systems at Different Radicular Levels of Endodontically Treated Teeth. *Materials (Basel)*. 2022 Jul 24; 15(15):5134.
2. Bialy M, Targonska S, Szust A, Wiglusz RJ, Dobrzynski M. In Vitro Fracture Resistance of Endodontically Treated Premolar Teeth Restored

- with Prefabricated and Custom-Made Fibre-Reinforced Composite Posts. *Materials*. 2021 Oct 19; 14 (20):6214.
3. Cheruvathoor JJ, Thomas LR, Thomas LA, Shivanna MM, Machani P, Naik S, Al Kheraif AA. Push-Out Bond Strength of Resin-Modified Glass Ionomer Cement and Flowable Composite Luting Systems on Glass Fiber Post of Root Canal. *Materials (Basel)*. 2021 Nov 16; 14 (22):6908.
  4. Dietschi, D.; Argente, A.; Krejci, I.; Mandikos, M. In vitro performance of class I and II composite restorations: A literature review on nondestructive laboratory trials-part II. *Oper. Dent.* 2013, 38, 182-200.
  5. Meyenberg, K. The ideal restoration of endodontically treated teeth-structural and esthetic considerations: A review of the literature and clinical guidelines for the restorative clinician. *Eur. J. Esthet. Dent.* 2013, 8, 238-268.
  6. Paolone, G.; Scolavino, S.; Gherlone, E.; Spagnuolo, G. Direct Esthetic Composite Restorations in Anterior Teeth: Managing Symmetry Strategies. *Symmetry* 2021, 13, 797.
  7. Lima DM, Linhares TS, Lima SNL, Carvalho EM, Loguercio AD, Bauer J, Carvalho CN. Effect of Sonic Application of Self-Adhesive Resin Cements on Push-Out Bond Strength of Glass Fiber Posts to Root Dentin. *Materials (Basel)*. 2019 Jun 14; 12(12):1930.
  8. Gerth HU, Dammaschke T, Züchner H, Schäfer E. Chemical analysis and bonding reaction of RelyX Unicem and Bifix composites--a comparative study. *Dent Mater.* 2006 Oct; 22(10):934-41.
  9. Phebus, J.G.; Owens, B.M.; de Rijk, W.; Davis, A.; Johnson, W.W. Fracture resistance of permanent anterior incisors using fiber-reinforced composite posts. *Gen. Dent.* 2014, 62, 37-42.
  10. Bouillaguet, S.; Schütt, A.; Alander, P.; Schwaller, P.; Buerki, G.; Michler, J.; Cattani-Lorente, M.; Vallitu, P.K.; Krejci, I. Hydrothermal and mechanical stresses degrade fiber-matrix interfacial bond strength in dental fiber-reinforced composites. *J. Biomed. Mater. Res. Part B Appl. Biomater.* 2006, 76, 98-105.
  11. Kremeier, K.; Fasen, L.; Klaiber, B.; Hofmann, N. Influence of endodontic post type (glass fiber, quartz fiber or gold) and luting material on push-out bond strength to dentin in vitro. *Dent. Mater.* 2008, 24, 660-666.
  12. Baba, N.Z.; Golden, G.; Goodacre, C.J. Nonmetallic prefabricated dowels: A review of compositions, properties, laboratory, and clinical test results. *J. Prosthodont.* 2009, 18, 527-536.