Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublisher.com/sjams/

OPEN ACCESS

Endodontics

Effect of Different Cementation Techniques on Bond Strength of Fiber Posts: An in Vitro Study

Dr. Shahnaz Nabi[1*], Dr. Mohammad Arif Lone[2], Dr. Munaza Shafi[3], Dr. Ajaz Masoodi[4], Dr. Fayaz Ahmed[5], Dr. Aamir Rashid[6]

[1]Lecturer conservative dentistry and endodontics, govt dental college and hospital Srinagar, India
[2]Lecturer prosthodontics, govt dental college and hospital srinagar, India
[3]Senior resident skims soura srinagar, India
[4]Lecturer conservative dentistry and endodontics, govt dental college and hospital srinagar, India
[5]Assistant professor, conservative dentistry and endodontics, govt dental college and hospital srinagar, India
[6]Associate professor, conservative dentistry and endodontics, govt dental college and hospital srinagar, India

***Corresponding author:** Dr. Shahnaz Nabi
| **Received:** 14.04.2019 | **Accepted:** 24.04.2019 | **Published:** 30.04.2019
DOI: 10.21276/sjams.2019.7.4.44

Abstract — **Original Research Article**

Aim: to evaluate the effects of different cementation techniques on bond strength (BS), after fiber posts cementation. ***Methods and Materials:*** Thirty roots of human mandibular premolars prepared endodontically and divided according to the combination of adhesive application technique (manual passive, using lentulo-spiral instrument, applying the cement onto the post surface and the cementation system (Adper Single Bond 2/RelyX ARC Specimens were transversally sectioned into six 1-mm-thick serial slices, which were subjected to BS testing (n=7), Data were analyzed using two-way ANOVA and Bonferroni post-hoc test (α=5%). ***Results:*** Bond strength values significantly increased with using lentulo-spiral instrument (P<0.001). ***Conclusion:*** The study concluded that techniques with active application lentulo spiral resulted in higher bond strength values. The mode of adhesive application influences the results.

Keywords: Post; Push-out bond strength; Resin cement.

INTRODUCTION

The clinical success of a restorative procedure of endodontically treated teeth depends on the cementation used to create a link between the restoration and the tooth. The retention of a post is a major factor influencing the survival of the restoration. Fiber glass posts are used to provide support and adequate retention for restoration after endodontic treatment. Its elastic modulus is similar to dentin [1], which promotes better stress distribution, reduces the possibility of catastrophic failures [2] and provides resiliency and satisfactory adhesion between dentin and resin cement [3]. Adhesion between resin luting agent and dentin is still considered weaker than the cement/fiber glass post interface [4]. This may be attributed by products resulting from endodontic treatment before post cementation [5], type of the endodontic sealer [6, 7], smear layer removal, the high C-factor within the root canal, morphology of root dentin, incompatibility between some adhesive systems and resin-based cements, residual water and/or solvent [5, 8] and compromised micromechanical retention between the demineralized dentin matrix and the polymerized adhesive system [8]. The viscosity of resin cement and the application method used to place it into the post space seemed to be important factors that may affect the complete setting of fiber posts and, consequently, influence bond strength values of the post-adhesive cement complex. Therefore, the aim of this study was to evaluate the bond strengths of resin cement/fiber post systems to post space dentin by using different application methods of resin cement.

MATERIALS AND METHODS

Thirty single rooted premolars were used in this *in vitro* study. The inclusion criteria were absence of clinical signs of caries, radicular dilacerations, previous endodontic treatment, and at least 14 mm of radicular length, measured from the cement-enamel junction. Teeth were transversally sectioned immediately above the cement-enamel junction using a low-speed diamond saw (ISOMET 1000, Buehler and Lake Bluff, IL, USA) under constant irrigation. Canal exploration was performed by #10 K-files (Dentsply Maillefer, Ballaigues, Switzerland), up to #40 and the crown-down technique was made until #55 K-file. The

canals were irrigated with 1% sodium hypochlorite between each file. The canals were neutralized with saline solution and dried with paper points (Dentsply Maillefer, Ballaigues, Switzerland), and only 4 mm of the apical portion were sealed, by the warm vertical condensation technique, with gutta-percha points (Dentsply Maillefer, Ballaigues, Switzerland) and resin-based sealer (AH-Plus, Dentsply Maillefer, Ballaigues, Switzerland). The root access was temporarily filled with glass ionomer (GC, Japan), and the specimens were stored in distilled water for one week. Later, the post-spaces were prepared with low-speed burs Gates Glidden drills #2 to #4 (Dentsply Maillefer; Ballaigues, Switzerland) with apical enlargement to size 40/0.06, A post space was then prepared with size #2 Rely-X post drill (3M ESPE, St. Paul, MN, USA), and the same size of a tapered Rely-X glass fiber post (3M ESPE) were chosen. The root canal walls were etched with 37% phosphoric acid gel then washed for 10 sec. The fiber glass posts were cleaned with 70% alcohol for 30 sec. At this moment, the specimens were randomly divided in 3 groups (n=10), according to the cementation system: Adper Single Bond 2/RelyX ARC. Each group was then subdivided in 3 subgroups (n=10), according to the adhesive application technique: manual passive the adhesive system was just left on the root walls with a microbrush, without digital pressure (MP); using a #30 lentulo-spiral instrument (Dentsply Maillefer, Ballaigues, Switzerland) for 3 seconds before the post seating (group Lentulo), applying the cement onto the post surface (group Direct). the adhesive systems were applied according to the different application techniques previously described and light curing with a LED light-curing device (Dentsply, Switzerland) using a power density of 1200 mW/cm2, positioned at of the root for 20 sec. After cementation, all specimens were stored in distilled water for one week, and then embedded in acrylic resin inside polyvinyl chloride tubes. The specimens were transversally sectioned with a low-speed diamond saw .Slices of 1.0±0.1 mm were obtained, measured by a digital caliper with accuracy of 0.01 mm The push-out test was performed in a universal loading machine at a load of 50 kg and a crosshead speed of 0.5 mm/min. The load was applied in the apical-coronal direction until the post was dislodged. Care was taken to center the push-out pin on the center of the post surface without stressing the surrounding post space walls. The failure load was registered in Newtons (N), and the bond strength value, in MPa, was calculated with the surface equation, side of a truncated cone. The results of bond strength were analyzed by two-way ANOVA (comparing application technique, cementation system and root third) and Tukey's post-hoc (α=0.05).

RESULTS

Two-way ANOVA between application technique/ root region (P<0.001) were significant (Table 1). For the interaction between application technique/root region, a significant increase in BS values was observed with the lentulo spiral group in the cervical third (P<0.001), followed by direct group application in the same third.

Table-1: Mean push-out bond strength (MPa) and SD for groups

	Technique used		
	Lentulo spiral	Direct group	Manual passive
Coronal	8.27(2.13)	5.47(1.48)	4.96(1.83)
Middle	8.47(2.22)	6.34(2.30)	5.08(1.96)
Apical	9.82(2.46	7.56(2.92)	6.35(2.91)
Total	8.85(1.99)	6.45(1.78)	5.47(1.80)*

*statically significant difference

DISCUSSION

Several factors may account for the lower adhesion performance at the root canals, such as: the effect of operator experience [9] the brand of the material [10]. The variables of commercial adhesives occurs within a narrow range of moisture levels and depends on the solvent composition of the adhesive [11], it is most improbable that solvent evaporation occurs adequately in this region Goracci *et al*. revealed that a push-out test is a more reliable method for determining bond strengths between fiber posts and post-space dentin because of the high number of premature failures occurring during specimen preparation and large data distribution spread associated with microtensile testing [12]. The results of present study showed that the use of active application by lentulo spiral improves the BS compared to passive application in this study, the push-out bond strengths were statistically influenced by the root levels ($p < 0.05$). Present result confirmed previous studies [13, 14] that observed influence of root canal region on fiber post retention. Gaston *et al*. reported higher bond strengths in the apical third than in the parts of the root canal [9]. On the other hands, several studies have shown that the bond strength of resin cements to root canals is affective in the cervical third but weak in the apical third [15]. Regardless of the bond strength in apical regions, the frictional retention in these areas may contribute to the dislocation resistance of the fiber post [16, 17]. For dual-curing composite resin luting systems, the use of a lentulo-spiral drill is not recommended by the manufacturers, since the increased input energy may cause premature set of luting composite. Therefore, some manufacturers have been suggested, dual-cure resin cement should be taken into

the root canal by applying a thin layer of cement over the post before setting it in position. However, clinicians would have a difficulty to get a uniform cement application within the post space with only the direct application on the post surface. Furthermore the round cross section of a post also may have a difficulty to match the irregular canal area efficiently with the direct cement applying method. It is worth to mention that, as an *in vitro* study, active application was standardized which did not reproduce the clinical routine. Further clinical studies are required to better evaluate the long-term performance with other cementation systems and application modes.

CONCLUSION

The highest bond strength value was observed for the lentulo spiral technique, followed by the direct application technique at the same root region.

REFERENCES

1. Goracci C, Ferrari M. Current perspectives on post systems: a literature review. Australian Dental Journal. 2011 Jun;56:77-83.
2. Rosa R, Hwas A, Melo D, Valandro LF, Kaizer O. Fracture strength of endodontically treated teeth restored with different strategies after mechanical cycling. Gen Dent. 2012;60(2):e62-8.
3. Saraiva LO, Aguiar TR, Costa L, Correr-Sobrinho L, Muniz L, Mathias P. Effect of different adhesion strategies on fiber post cementation: Push-out test and scanning electron microscopy analysis. Contemp Clin Dent. 2013;4(4):443-7.
4. Ebrahimi SF, Shadman N, Nasery EB, Sadeghian F. Effect of polymerization mode of two adhesive systems on push-out bond strength of fiber post to different regions of root canal dentin. Dent Res J (Isfahan). 2014;11(1):32-8.
5. Daleprane B, Pereira CN, Bueno AC, Ferreira RC, and Moreira Magalhaes CS. Bond strength of fiber posts to the root canal: Effects of anatomic root levels and resin cements. J Prosthet Dent. 2016;116(3):416-24.
6. Dibaji F, Mohammadi E, Farid F, Mohammadian F, Sarraf P, Kharrazifard MJ. The Effect of BC Sealer, AH-Plus and Dorifill on Push-out Bond Strength of Fiber Post. Iran Endod J. 2017;12(4):443-8.
7. Ahmad M, Roy RA, Kamarudin AG, Safar M. The vibratory pattern of ultrasonic files driven piezoelectrically. Int Endod J. 1993;26(2):120-4.
8. Zarpellon DC, Szesz AL, Loguercio AD, Arrais CA. Effect of Sonic Application of Universal Adhesive Systems on Bond Strength of Fiber Posts to Root Canal. J Adhes Dent. 2016;18(6):493-9.
9. Hass V, Luque-Martinez I, Sabino NB, Loguercio AD, Reis A. Prolonged exposure times of one-step self-etch adhesives on adhesive properties and durability of dentine bonds. J Dent. 2012;40(12):1090-102.
10. Gomes GM, Gomes OM, Reis A, Gomes JC, Loguercio AD, Calixto AL. Effect of operator experience on the outcome of fiber post cementation with different resin cements. Oper Dent. 2013;38(5):555-64.
11. Breschi L, Mazzoni A, Ruggeri A, Cadenaro M, Di Lenarda R, De Stefano Dorigo E. Dental adhesion review: aging and stability of the bonded interface. Dent Mater. 2008;24(1):90-101.
12. Goracci C, Tavares AU, Fabianelli A, Monticelli F, Raffaelli O, Cardoso PC, Tay F, Ferrari M. The adhesion between fiber posts and root canal walls: comparison between microtensile and push-out bond strength measurements. European Journal of Oral Sciences. 2004 Aug;112(4):353-61.
13. Foxton RM, Nakajima M, Tagami J, Miura H. Adhesion to root canal dentine using one and two-step adhesives with dual-cure composite core materials. J Oral Rehabil 2005;32:97-104.
14. Gaston BA, West LA, Liewehr FR, Fernandes C, Pashley DH. Evaluation of regional bond strength of resin cement to endodontic surfaces. J Endod. 2001;27: 321-324
15. D'Arcangelo C, Cinelli M, De Angelis F, D'Amario M. The effect of resin cement film thickness on the pullout strength of a fiber-reinforced post system. The Journal of prosthetic dentistry. 2007 Sep 1;98(3):193-8.
16. Goracci C, Fabianelli A, Sadek FT, Papacchini F, Tay FR, Ferrari M. The contribution of friction to the dislocation resistance of bonded fiber posts. Journal of Endodontics. 2005 Aug 1;31(8):608-12.
17. Faria-e-Silva AL, Reis AF, Martins LR. The effects of different luting procedures in the push-out bond strength of fibre posts to the root canal. Braz J Oral Sci. 2008;27:1653-1666.