BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, December 2016. Vol. **13**(4), 2313-2316

The Effect of Canal Etching on the Tensile Bond Strength of Casting Posts Cemented with Xeno Cement

Zahra Mirzaei[1], Ali Hafezqoran[2], Ehsan Khashabi[1] and Roodabeh Koodaryan[3]*

[1]Assistant Professor, Dental and Periodontal Research Center,
Faculty of Dentistry, University of Medical Sciences, Urmia, Iran.
[2]Associate Professor, Dental and Periodontal Research Center, Faculty of Dentistry,
University of Medical Sciences, Tabriz, Iran.
[3]Assistant Professor, Department of Prosthodontics, Faculty of Dentistry,
University of Medical Sciences, Tabriz, Iran.

http://dx.doi.org/10.13005/bbra/2399

(Received: 24 July 2016; accepted: 19 September 2016)

The longevity of casting posts cemented to root canal is directly related to the bonding quality of resin cements to dental tissues. Surface treatment has an important role in optimizing bonding strength. The purpose of this study was to examine the effect of acid etching on the tensile bond strength of casting posts cemented with self-etch resin cement. The crowns of 32 canine teeth were cut from CEJ region. After root canal therapy and preparation for receiving casting posts, Duraley impressions were made and cast. Teeth were randomly divided into two groups. Root canals of test specimen were etched with 37% phosphoric acid for 10 seconds and for the control group, saline solution was used instead. After cementation with Xeno resin cemet, tensile bond strength was measured using universal testing machine. Data were analyzed using independent t-test method (á=5%). Mean ± SD tensile bond strength of casting posts in test and control groups were 105.8 ±20.5 and 55.6 ±21.2 respectively. Etching with 37% phosphoric acid produced significantly higher tensile bond strength in cemented posts (P<0.001). Etching dentine surfaces before cementation significantly increases bond strength in casting posts cemented with Xeno.

Key words: Casting post, Acid etching, Tensile bond strength, Resin cement

Post and cores are frequently used in endodontically treated teeth with excessive loss of coronal tooth structure. Cementation of a post is used to provide retention for the final restoration in the mentioned occasions [1].

However, there are reports of tooth loss due to fracture of weakened canal wall as a result of post preparation [2, 3].

The rationale behind resin cements applications are get both retention and reinforcement of prepared tooth structure [4].

Polymerization shrinkage and contraction stresses induced during polymerization are main problems of resin cements [5, 6]. Contraction stresses created by polymerization depend on the type of resin cement, geometry of the cavity and the thickness of the resin layer [6, 9]. Nonetheless resin cements are the materials of choice for cementation of posts into the canals [1].

There are a variety of bonding options using different luting agents making the bonding choice a challenge for clinician.

To improve adhesion, the use of phosphoric acid before the application of no rinsed adhesives or self-adhesive cements has been suggested [10, 11-16]. But the efficacy of dentin pretreatment with acid has been debated [17-21].

Therefore, the objective of this study was to evaluate phosphoric acid etching pretreatment on the tensile bond strength of Xeno resin cement to root canal dentin, applied according to manufacturers' instructions.

The null hypothesis was that the additional acid etching procedure would not affect

* To whom all correspondence should be addressed.
Tel.: +98 4133355965;
E-mail: koodaryan@gmail.com

the tensile bond strength of self etching resin cement.

MATERIALS AND METHODS

Thirty-two intact human maxillary canines, extracted for periodontal reasons were stored in 0.1% thymol solution (Symrise GmbH, Holzminden, Germany) at 4°C. The length of all selected teeth was 28-32 mm.

After disinfection and removal of soft tissues, teeth were sterilized in an autoclave at 121^{oC} [22]. Using a diamond saw, crowns of the teeth were separated from CEJ region. The root of each tooth was vertically imbedded in an individual polymeric tube filled with auto-polymerizing acrylic resin (Unifast II, GC Corp, Tokyo, Japan) 3 mm below CEJ.

Root canals were cleaned and shaped and obturated with lateral condensation method using sodium hypochlorite 0.525% as irrigating solution and AH-26 as sealer (GC America, Alsip, IL, USA). Gutta percha was removed using piezo reamer No 3 (Dentsply, Tokyo, Japan) in order to create 8 mm coronal length for inserting post.The post and core patterns were fabricated using duralay self curing (Asiateb, Tehran, Iran,) and a loop was attached on top of all patterns. The teeth were randomly divided into two groups.

Patterns were invested with phosphate bonded investment (Hinrivest-ernst, Hinricks, Berlin, Germany) and cast with Verabond2 base metal alloy (Albadene co, NY, USA). Cast posts were observed carefully with a magnifier for possible nodules and then seated into canals.

Specimens in the test group were etched with 37% phosphoric acid (Kuraray co, Okayama, Japan) for 10 seconds. In control group 0.9% saline was used instead of phosphoric acid. Then specimens in both groups were irrigated with saline for 15 seconds and desiccated with paper cones. Posts were cemented using Xeno type IV self etching resin cement (Dentsply, DE, USA) according to manufacturers' instructions.

After filling the root canals by using cement utilizing lentulo spiral filler (Dentsply, Tokyo, Japan) and smearing posts surface with cement, casting post were seated with finger pressure. Cement excess was removed with an explorer, and light cured from three directions for 30 seconds.

Samples were stored in water bath at 37°C for 72 hours and then thermocycled between 5°-55° for 1000 cycles, then the samples were mounted on the universal testing machine (H5KS, housefield test equipment, Surrey, UK) and the tensile bond strength was applied with cross head speed of 0.5 mm/min. Maximum loads were recorded in newton and analyzed using independent t-test (á=5%).

RESULTS

Mean tensile bond strength (N) and standard deviation values of casting posts in test and control groups were 105.8 ± 20.5 and 55.6 ± 21.2 respectively (Table 1).

The retentive strength values of cast post in test group were significantly higher than control group (P<0.001).

Table 1. Mean, standard deviation, minimum and maximum of posts retention in newton

Groups	Mean(±SD)	Min	Max
Test	105.8(±20.5)	78.6	140.9
control	55.6(±21.2)	34.5	109.1
Total	80.7(±32.7)	34.5	140.9

DISCUSSION

Resin cements have shown more retention and less micro leakage in comparison of common zinc phosphate cements. Chemical bonding of resin cements with root canal is cited as an explanation of above findings as the additional adhesion compared to mere mechanical retention promotes above parameters[25, 26].

Different preparation procedures have been recommended for post cementation with different resin cements [29, 31, 34]. However their effect on cement bond strength to root canal surface have not been studied widely [32, 33].

Frequently, use of a preparation method before utilization of cements are recommended, but some companies suggest no treatment. It seems that efficacy of surface treatment on the retention of resin cements depends on the type of cement [40].

Altunsoy *et al.* reported that acid etching of dentin structure improves the bond strength of resin-modified glass ionomer cement [42].

Xuan *et al.* investigated the effect of acid etching on bond strength of four self-adhesive resin cements to dentin. Acid etching decreased the bond strength of G-Cem, Clearfil SA Cement and Unicem cements, while there was no significant effect on the bond strength of BisCem cement [43].

Schmage *et al.* showed that conditioning the root canal (etching with 37% phosphoric acid or etching + bonding agent application) had no effect on the retention of Compolute Aplicap, Flexi-Flow Cem and Twinlook cements. But primer applications for surface treatment improved the tensile bond strength of Panavia 21 EX cement [26].

According to the results of the current study, canal etching with 37% phosphoric acid for 10 seconds increases bond strength of cast posts cemented with Xeno self etching resin cement.

Acid etching removes smear layer from dentinal tubules and demineralizes root canal dentin, enabling bonding agents to penetrate into dentinal tubules thus creating a hybrid layer [22].

Mahdan *et al.* demonstrated that presence of thick smear layer adversely affected the tensile bond strength of HEMA-free adhesives (2-hydroxyethyl-methacrylate). Thick porous smear layer would retain larger amounts of water, leading to higher water contamination on adhesive surface [41]. Since Xeno contains HEMA-free adhesives, this can explain the reason why removing of smear layer with acid etching before cementation procedure increased the bond strength of Xeno cement.

CONCLUSIONS

Etching root canal with 37% phosphoric acid for 10 seconds produced significantly higher tensile bond strength in casting posts cemented with Xeno self-etching resin cement.

REFERENCES

1. Lamichhane A, Xu C, Zhang FQ. Dental fiber-post resin base material: a review. *J Adv Prosthodont.* 2014; **6**:60-5.
2. Creugers NH, Mentink AJ, Kayser AF. An analysis of durability data on post and core retentions.*J dent*1993;**21**:281-4.
3. Stockton LW. Factors affecting retention of posts systems: a literature review. *J Prosthet* 1999; **81**:380-5.
4. Duncan JP, Pameijer CH. Retention of parallel-sided titanium posts cemented with six luting agents: in vitro study. *J Prosthet Dent* 1998; **80**:423-8.
5. Davidson CL, de Gee AJ, Failzer A. The competition between the composite-dentine bond strength and the polymerization contraction stress *J Dent Res* 1984; **63**:1396-90.
6. Feilzer A, de Gee AJ, Davidson CL. Setting stress in composite resin in relation to configuration of the restoration. *J Dent Res*1987; **66**:1936-90.
7. Wiskott HW, Belser UC, Scherrer SS. The effect of film thickness and surface texture on the resistance of cemented extracoronal restorations to lateral fatigue loading. *Int J Prosthodont.* 1999; **12**:255-62.
8. Prithviraj DR, Soni R, Ramaswamy S, Shruthi DP. Evaluation of the effect of different surface treatments on the retention of posts: a laboratory study. *Indian J Dent Res.* 2010; **21**:201-6.
9. Alster D, Feilzer AJ, de Gee AJ, Davidson CL. Polymerization contraction stress in thin resin composite layer as a function of layer thickness. *Dent Mater* 1997; **13**:146-50.
10. De Munck J, Vargas M, Van Landuyt K, Hikita K, Lambrechts P, Van Meerbeek B.Bonding of an auto-adhesive luting material to enamel and dentin. *Dent Mater* 2004; **20**:963-71.
11. Van Meerbeek B, Kanumilli P, De Munck J,Van Landuyt K, Lambrechts P, Peumans M.A randomized controlled study evaluating the effectiveness of a two-step self-etch adhesive with and without selective phosphoric-acid etching of enamel. *Dent Mater* 2005; **21**:375-83.
12. Peumans M, De Munck J, Van Landuyt K, Lambrechts P, Van Meerbeek B. Five-year clinical effectiveness of a two-step self-etching adhesive. *J Adhes Dent* 2007; **9**:7-10.
13. Van Meerbeek B, Van Landuyt K, De Munck J, Hashimoto M, Peumans M, Lambrechts P, et al. Technique-sensitivity of contemporary adhesives. *Dent Mater J* 2005; **24**:1-13.
14. Van Landuyt KL, Kanumilli P, De Munck J, Peumans M, Lambrechts P, Van Meerbeek B. Bond strength of a mild self-etch adhesive with and without prior acid-etching. J Dent 2006; **34**:77-85.
15. Van Landuyt KL, Peumans M, De Munck J, Lambrechts P, Van Meerbeek B. Extension of a one-step self-etch adhesive into a multi-step adhesive. *Dent Mater* 2006; **22**:533-44.
16. Carvalho RM, Pegoraro TA, Tay FR, Pegoraro LF, Silva NR, Pashley DH. Adhesive

permeability affects coupling of resin cements that utilise self-etching primers to dentine. *J Dent* 2004; **32**:55-65.

17. Behr M, Rosentritt M, Regnet T, Lang R, Handel G. Marginal adaptation in dentin of a self-adhesive universal resin cement compared with well-tried systems. Dent Mater 2004; **20**:191-7.
18. Perdigão J, Anauate-Netto C, Carmo AR, Lewgoy HR, Cordeiro HJ, Dutra-Correa M, et al. Influence of acid etching and enamel beveling on the 6-month clinical performance of a self-etch dentin adhesive. *Compend Contin Educ Dent* 2004; **25(**33-4): 36-8.
19. Perdigão J, Carmo AR, Anauate-Netto C, Amore R, Lewgoy HR, Cordeiro HJ, et al. Clinical performance of a self-etching adhesive at 18 months. *Am J Dent* 2005; **18**:135- 40.
20. Shinchi MJ, Soma K, Nakabayashi N. The effect of phosphoric acid concentration on resin tag length and bond strength of a photo-cured resin to acid-etched enamel. *Dent Mater* 2000; **16**: 324-9.
21. Sanares AM, Itthagarun A, King NM, Tay FR, Pashley DH. Adverse surface interactions between one-bottle light-cured adhesives and chemical-cured composites. *Dent Mater* 2001; **17**:542-56.
22. Mayhew JT,windchy AM,goldsmith LJ.gettleman.effect of root canal sealers and irrigation agents on retention of preformed posts luted with a resin cement. *JOE*.2000;**26**: 341-4.
23. Esrsu B,canay S. An alternative post-and-core method for patients with limited interarch space.*JADA*.2007;**138**: 1464-7.
24. Rosenstiel SF,land MF,fujimoto J.contemporary fixed prosthodonticsa.4th ed.2006;Mosby,477-79.
25. Wu H,hayashi M,okamura K,Koytchev EV,imazato S,tanaka S,et al. Effects of light penetration and smear layer removal on adhesion on post to root canal dentine by self-etching adhesive.*Dent Mater.*2009; **25**; 1484-92.
26. Schmage P, Sohn J,nergiz.ozcan M. Various conditioning methods for root canals influencing the tensile strength of titanium posts.*J Oral Rehab.*2004;**31**: 890-4.
27. Colley IT,harnpson EL,Lehman JL.Retention of post crowns an assessment of the relative efficiency of posts of different shapes and sizes. Br Dent J;1993;**124**: 63-9.
28. Tjan AHL,miller GD.comparision of retentive properties of dowel forms after application of intermittent torsional forces. *J Prosthet Dent*, 1984;**52**: 23-8.
29. Christensen GJ. Posts, core and patient care. JDJA,1993;**124**: 86-90.
30. Wiskott HW,belser UC,scherrere SS. The effect of film thickness and surface texture on the resistance of cemented extraoral restorations to lateral fatigue loading.*int J prosthodont.*1999; **12**: 255-62.
31. Chaves Camilo RD, Passo SP,Camargo FP,bottino MA,balducci I. Bond strength durability of self etching adhesive and resin cements to dentine. *J applral sci*. 2009; **17**: 155-60.
32. Prithviraj DR,soni R,ramaswamy S,shruthi DP.evaluation of the effect of different surface treatments on the retention of posts:a laboratory study. *Indian J dent res.*2010; **21**: 201-6.
33. Dietschi D,romelli M,goretti A.adaptation of adhesive posts and cores to dentin after fatigue testing. *Int J prosthodont.*1997;**10**: 497-507.
34. Goldman M,devitre R,pier M.effect of dentine smeared layer on tensile strength of cemented posts. *J Prosthe Dent* .1984; **52**: 485-8.
35. Breeding LC,Dixon DL,bogacki MT,tietge JD.use of luting agents with an implant system:part1.*J Prosthot Dent.*1997;**68**: 737-41.
36. Sturdevant CM,Roberson TM,Heyyman HO. The art and science of operative dentistry;3th ed.st Louis, *Mosby.*2002;118-125.
37. Kubulit, liu C-F, Fusayama Mechanism of differential staining in carious dentine, *J Dent Res*. 1983; **62**: 713-4.
38. Van Dijken JW, Horstedt P. Marginal adaptation of enamel of a polyacid-modified.it in composite (compomer) and a resin modified glass inomer cement, *Clin Oral Investing*.1997; **1**: 185-90.
39. Van Meerbeek B, Vanherle G, Lambrechts P, Braem M.Dentin- and enamel-bonding agents.*Curr Opin Dent*. 1992; **2**:117-27.
40. Chaves P, Giannini M, Ambrosano GM. Influence of smear layer pretreatments on bond strength to dentin. *J Adhes Dent.* 2002; **4**:191-6.
41. Mahdan MH, Nakajima M, Foxton RM, Tagami J. Combined effect of smear layer characteristics and hydrostatic pulpal pressure on dentine bond strength of HEMA-free and HEMA-containing adhesives. *J Dent.* 2013; **41**:861-71.
42. Altunsoy M, Botsali MS, Korkut E, Kucukyilmaz E, Sener Y. Effect of different surface treatments on the shear and microtensile bond strength of resin-modified glass ionomer cement to dentin. *Acta Odontol Scand*. 2014; **72**:874-9.
43. Xuan GH, Wang HH. The effect of acid etching on bond strength of different self-adhesive resin cements to dentin. *Shanghai Kou Qiang Yi Xue*. 2015; **24**:302-6.