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

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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 cement, tensile bond strength was measured using universal testing machine. Data were analyzed using independent t-test method (α=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...
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 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 using phosphate bonded investment (Hirinvest-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 (α=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>
<thead>
<tr>
<th>Groups</th>
<th>Mean(±SD)</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>105.8(±20.5)</td>
<td>78.6</td>
<td>140.9</td>
</tr>
<tr>
<td>control</td>
<td>55.6(±21.2)</td>
<td>34.5</td>
<td>109.1</td>
</tr>
<tr>
<td>Total</td>
<td>80.7(±32.7)</td>
<td>34.5</td>
<td>140.9</td>
</tr>
</tbody>
</table>

**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.

Different preparation procedures have been recommended for post cementation with different resin cements. However their effect on cement bond strength to root canal surface have not been studied widely.

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.

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

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.

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.

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. 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.

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