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In vitro evaluation of push-out bond strength of fiber posts cemented using two different adhesive approaches

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Abstract

Introduction: Resin-based cements are commonly used for luting glass fibre posts into intraradicular dentin. A combination of the etch-and-rinse adhesive system and regular resin cement is the approach most often used in dental practice. In the past decade, self-adhesive resin cements were introduced to provide easier clinical application compared with regular resin cements.

Objective: To compare push-out bond strength of fiber-posts luted with two different adhesive approaches to root canal dentin

Materials and methods: Twenty mandibular first premolars were decoronated and endodontically treated. Specimens were randomly distributed into two groups (n = 10) and fiber-posts were inserted using two different luting materials: self-adhesive resin cements (RelyXUnicem, 3M Espe) in group one and a self-etch adhesive/ dual cure resin cement(Para Core , Coltene) in group two. The roots were sectioned into slices of 2mm thickness at the coronal third and middle third and after 24 hours push-out bond strength was investigated.

Conclusion

Within the limitations of this study the self-adhesive resin cement exhibited the least push-out bond strength values among the two groups, with best results in the coronal sections.

Keywords: Bonding Technique, Fiber Posts, Push-Out, Root Canal, Self-Adhesive Resin Cements

Introduction

For post-endodontic restorations various luting agents and adhesives systems, respectively, have been proposed to bond fiber-reinforced composite (FRC) posts to root canal dentin. Compared to conventional post cementation adhesive post luting offers less mikroleakage[1,2], improved retention [3,4] and load capability. Thus, a durable bond to root canal dentin to seal the endodontic environment is considered to be the major issue in longevity of postendodontic restoration.[5]

According to the way they interact with the smear layer current adhesives used in this study are attributed to the following bonding strategies/techniques [6]:

(1) self-etch adhesives include acidic monomers making the smear layer permeable without removing it

(2) self-adhesive resin cements, which show a different cement/dentin interface.

Current developments tend to adhesively restore the weakened endodontically treated teeth with fiberpost and composite core in a one-stage core-and-post procedure [7], whereas core build-up will immediately follow post cementation using the same composite material (core-and-post materials).

Recently, a new resin-based cement (RelyXUnicem Cement, 3M ESPE, Seefeld, Germany) has combined the use of adhesive and cement in one single application, eliminating the need for pretreatment of both tooth and restoration[8]

Such a procedure could reduce the technique sensitivity, hazards of possible incompatibility of different composites (interface between cement and core material) and the time necessary to complete the core-and-post treatment procedure. Also the the bond strength of fiber posts to root canal dentin may be varied in different regions of the root canal, which may be due to the difficulty of curing light to reach the more apical parts of the root canal and Difficulty of moisture control and adhesive application .[9,10]

Therefore the aim of this study was to compare and evaluate the the push-out bond strengths of fibre posts luted with a self adhesive resin cement(RelyxUnicem) and an dual cure resin(ParaCore)

Materials and methods

This *in-vitro* study was conducted in the Department of conservative dentistry and endodontics. Twenty single rooted mandibular first premolar human teeth extracted for orthodontic reasons were used in this study, which were collected from the Department of Oral and Maxillofacial Surgery.

Teeth were stored in 0.9% normal saline to prevent dehydration till the further period of study

Access cavity was prepared using an endodontic access bur. Root canals were cleared of pulp using barbed broaches. The samples were then decoronated at the level of CEJ using a diamond disk. Patency of apical foramen was determined by passing a No. 10 K-file into the root canal until the tip of file was visible at the apical foramen, and then 1 mm was subtracted from that length. The canals were prepared using hand protaper files and instrumented to a No. 30 size master apical file up to the apical foramen.

The smear layer was removed by irrigation with 10 ml sodium hypochlorite and 10 ml of 17% EDTA solution, each for 3 min. Final rinse was done with 10 ml of sterile water. All canals were dried with paper points They were obturated with vertical condensation of gutta-percha with AH Plus sealer. The samples were then stored in phosphate buffer solution for 24 hours .

The post space were prepared using a peesoreamer, leaving apical 4mm of guttapercha. Then teeth were randomly assigned to two groups containing 10 teeth each.

- Group 1: Posts will be luted with rely X Unicem.

- Group 2: Posts will be luted with ParaCore

All the roots were stored at 37°C in distilled water for 1-week and the roots were embedded in an acrylic block and sectioned perpendicular to the long axis with the diamond disc in low speed with water spray. Slices of 2.5 mm thickness were obtained, one from cervical third (approximately 1-mm below CEJ), one from middle third. For push out the test, specimens were mounted in a customized device fixed to the universal testing machine. The push out strength was performed at a speed of 0.5 mm/min until dislodgement of post. This was confirmed by the appearance of sharp drop along the load/time curve recorded by testing machine.Push out strength was calculated: using the following equation-Load at the debonding(N)/Area(A

Results

According to the results of the present study, the bond strength was significantly higher in paracore compared to self adhesive systems,with higher values shown by the coronal slices.

Discussion

Studies have shown that use of resin cement significantly increases retention and fracture resistance of tooth by providing adhesive bonding. The use of self-cure or dual cure resin cements is recommended because of limited penetration of light into depths of root canal.[8]

The results of this study support the first hypothesis by **Vichi et al** , stating that the that tubule density is greater in the coronal and the diameter of the tubules decreases in the apical direction , due to which there is increased adhesion of fibre post in the coronal third - in the presence of greater number of tubules , more will be the resin penetration and hence enhances the retention [8,11]

Self-etch resin cements uses an acidic primer which, without rinsing, can alter tooth structure before bonding; therefore, the clinical steps are simpler than those with total-etch cements[12].Another study by ***Lopes et al*** had reported that Self-etching primers, with no rinsing step, resulted in less aggressive demineralization [13].

For Rely X The adhesion mechanism is claimed to rely on both micromechanical retention and chemical interaction between monomer acidic groups and hydroxyapatite.[13,14]

The acid groups chelate the calcium ions of hydroxyapatite, promoting part of the chemical adhesion .In order to assure neutralization of initial acidity of this cement pH increase through reactions between phosphoric acid groups and alkaline fillers[5]

Water formed during this process is claimed to contribute to the cement's initial hydrophilicity, providing improved adaptation to dentin and moisture tolerance.

Subsequently, water is reused Such a reaction would finally results in a hydrophobic matrix[14,15]

Moreover, because of the relatively mild acidity of the functional monomer in Unicem, the depth of acid infiltration through the dentin would be decreased when a thick smear layer has built up as a result of RCT[16]

some studies suggest that self adhesive cements have limited capacity to diffuse and decalcify the underlying dentin effectively

Some reasons for this limitation are:

1) High viscosity, which may rapidly increase after acid base reactions

2) A neutralization effect that may occur during setting, resulting in the release of water and of alkaline filler that raises pH level and buffering components of the smear layer. Interfacial gaps are always found in bonded posts. Interfacial discontinuity is commonly attributed to resin shrinkage [7,11]

Rely X Unicem produces good marginal continuity, but due to its high viscosity, does not form an obvious dentin hybrid layer and thus achieves limited infiltration .Dual-

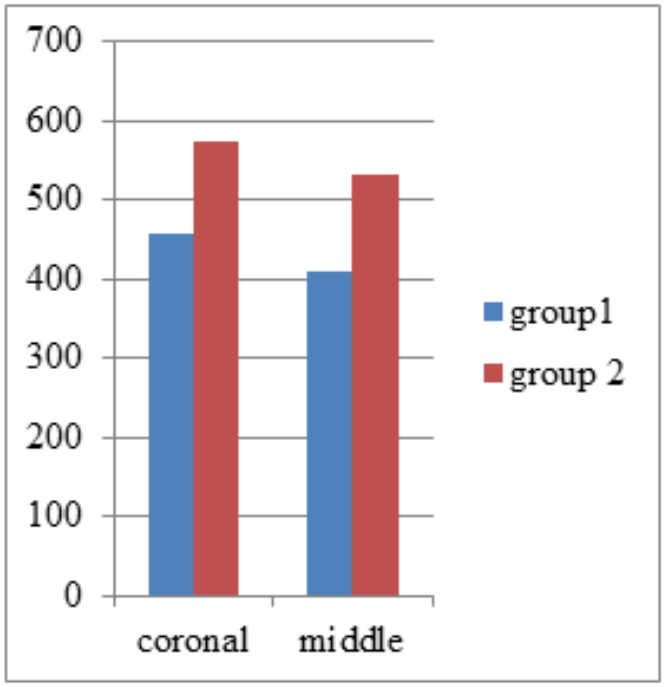
cure cements form a more continuous interface compared to their self-adhesive counterpart.

It was shown that the calcium salt produced by the chemical reaction between this monomer and HA was the most stable among tested self-etching primers[17,18]

Table 1

Group 1	Group 2
Coronal - 457.46	Coronal - 573.65
Middle - 407.81	Middle - 530.51

Graph 1



Conclusion

Within the limitations of this study the self-adhesive resin cement exhibited the least push-out bond strength values among the two groups, with best results in the coronal sections.

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