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Bond Strength of Composite Resin Luting Cements to Fiber-reinforced Composite Root Canal Post

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Abstract

Aims: The aim of this study was to compare the attachment of different composite resin luting cements to a fiber-reinforced composite (FRC) post with a semi-interpenetrating polymer network polymer matrix.

Methods and Materials: Six different brands of composite resin luting cement stubs were applied on the surface of FRC post material and light-cured for 40 seconds. Shear bond strengths of luting cement stubs were measured using a universal testing machine.

Results: The differences in shear bond strengths between the cements were not statistically significant.

Conclusion: All of the tested composite resin luting cements provided acceptable attachment to the tested FRC post. The tested FRC post material is suitable to use with different composite resin luting cements.

Keywords: Fiber-reinforced composite, fiber-reinforced composite root canal post, bonding, composite resin luting cement

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Introduction

Luting between tooth structure and restorative materials plays an essential role in the clinical outcome of a fixed restoration. In post and core restorative systems the cement must provide a durable bond between the dentin and the post and core material. Fiber-reinforced composite (FRC) posts have been criticized regarding their poor adhesion to luting cements.[1] The polymer matrix between the fibers of prefabricated FRC posts today is highly cross-linked and, therefore, nonreactive. This makes it difficult to bond these posts with composite resin luting cements via radical polymerization or by dissolving the surface of the post. One brand of FRC post consists of glass fibers and a semi-interpenetrating polymer network (IPN) polymer resin matrix (Figure 1). This enables bonding of composite resin cement to the post by dissolving the surface and creation of IPN-based adhesion.[2-4]

Because composite resin cements of various brands have different bonding characteristics to dental ceramics, it was of interest in this study to compare the attachment of different composite resin luting cements to a FRC post with semi-IPN polymer matrix.

Methods and Materials

The six different composite resin luting cements tested in this study are shown in Table 1. The FRC post material used was an individually formed light-curing semi-IPN polymer matrix unidirectional E-glass FRC (everstick Post™, Stick Tech, Turku, Finland). The FRC post material was embedded horizontally as a flat surface on a mold of acrylic resin with the fibers placed along the surface of the mold. After light-polymerizing (Optilux 501, Danbury, CT, USA) for 40 seconds, the surface of the FRC was treated with light curing resin (Stick Resin™, Stick Tech, Turku, Finland) of bis-GMA-TEGDMA for five minutes to activate (dissolve) the semi-IPN polymer matrix of the FRC post material. Composite resin luting cement stubs with a diameter of 3.6 mm and a height of 3 mm of six different brands (n= 7/group) were applied to the surface of the FRC and light polymerized for 40 seconds. The samples were stored in +37°C for 20 hours. Shear bond strengths (MPa) of the luting cement stubs were measured using a custom-made jig with a cross-head speed of 1.0 mm/min (Lloyd LRX, Lloyd Instruments Ltd, Fareham, UK). The force (MPa) and corresponding stress required to debond the stubs from the post material was recorded. The direction of the fibers was the same as the direction of the load (Figure 2). The data was subjected initially to an analysis of variance (ANOVA) and subsequent comparisons between post groups were performed using the Dunnett T3 Post Hoc Test.

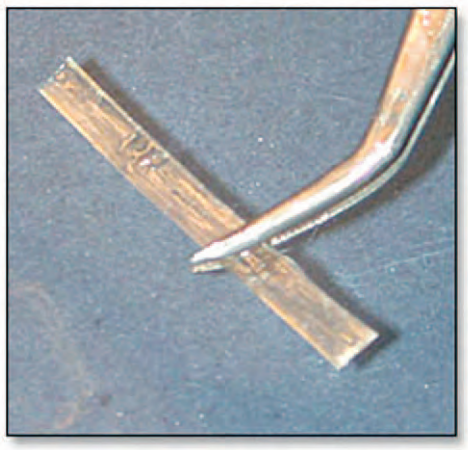

Figure 1. An individually formed glass FRC post with a semi-IPN polymer matrix.

Results

The highest shear bond strength was obtained with Panavia F (24.3 MPa) and the lowest with Bisfil 2B (18.5 MPa) (Figure 3). The differences in shear bond strength between the six cements were not statistically significant (ANOVA, p=0.54).

Discussion

The shear bond strength varied between 18.5 and 24.3 MPa which is in accordance with earlier results.[5] The results show that commonly used resin cements, including self-cure and dual-cure, are suitable for luting the tested FRC post with the semi-IPN polymer matrix. The acidic Panavia cement did not provide significantly better bonding to the FRC post although it has been shown to be superior with ceramics in other studies.

Conclusion

All of the tested composite resin luting cements can be considered suitable for luting because they adhered well to the tested FRC post material with semi-IPN polymer matrix. FRC posts with a semi-IPN polymer matrix are suitable to use with many different composite resin luting cements used by clinicians.

Table 1. Description of resin luting cements used.

Brand	Manufacturer	Type of cement
ParaPost Cement	Coltène Whaledent , Switzerland	Self-cure
Post Cement Hi-X	Bisco Inc., USA	Self-cure
Variolink II	Vivadent Ets , Liechtenstein	Dual-cure
Bisfil 2B	Bisco Inc., USA	Self-cure
Compolute Aplicap	Espe Dental AG, Germany	Dual-cure
Panavia F	Kuraray Co. Ltd., Japan	Dual-cure

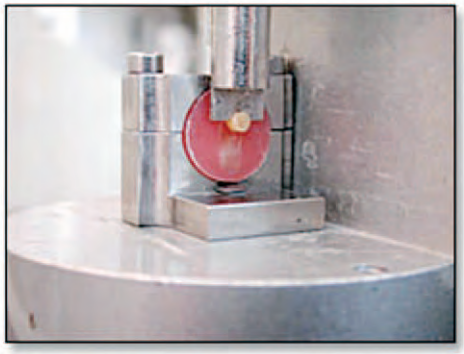

Figure 2. The test set-up (cross-head speed of 1.0 mm/min) for measuring the shear bond strength.

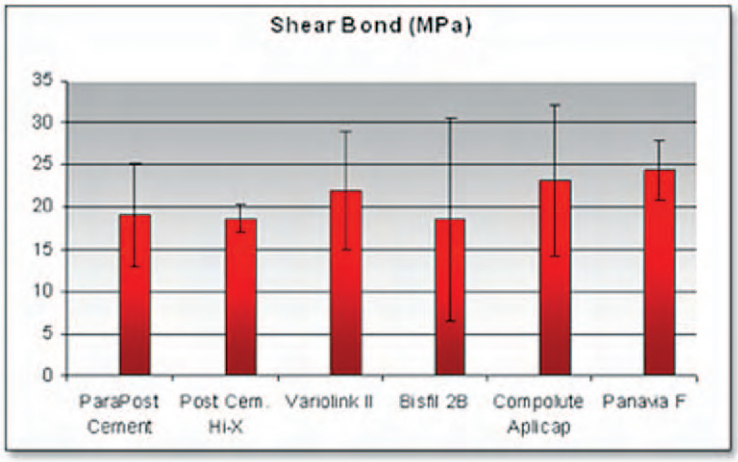

Figure 3. Mean shear bond strengths (Mpa) and standard deviations (SD) for the six tested composite resin luting cements.

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