



Effect of different root dentin pretreatment protocols on the bond strength of fiber posts

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Dedication

I wish to dedicate this work to

My great parents, whom I could never have done this without their support, encouragement and sacrifices. Thank you for teaching me to believe in myself, in god, and in my dreams.

My brother, for always being by my side.

My lovely friends and colleagues

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Introduction

The restoration of endodontically treated teeth frequently posed a challenge for the clinician. In cases of considerable hard tissue loss posts are used as an element supporting core foundation when there is insufficient coronal tooth structure¹. The literature shows that there is no consensus regarding the ideal endodontic post and core system. Clinicians usually choose the post and core system that provides best retention, support, and reduces the possibility of root fracture².

Previously, posts were cast in a precious alloy, or prefabricated posts made of stainless steel, titanium, or precious alloy were used. Then several types of post material have been introduced to the dental community: These are zirconia, titanium specially treated to give adherence to a composite core, or resin reinforced with carbon fibers. These posts are intended to be adhesively cemented into the root canal³.

The introduction of fiber posts brought a revolution in the field of dentistry, providing a reliable substitute to metal posts. Fiber posts were developed as a result of advances in biomaterials, development in bonding and adhesive systems, and enhancement of aesthetic characteristics of dental restorations⁴. Fiber posts include carbon fiber, silica fiber, ribbon fiber, and light transmitting posts. fiber posts have superior aesthetics⁵, are biocompatible, more color stable, corrosion free, and some have similar stiffness to dental tissues thus improving stress distribution^{6,7}.

Various luting agents and corresponding adhesive systems have been proposed for bonding fiber posts to root canal dentin. These materials can be light polymerized or dual cured. These cements include conventional resin cement which require dentin pretreatment with an adhesive, self-adhesive resin cement that requires no dentin pretreatment and has a dual cure mechanism⁸. Unfortunately, there is controversy about the regional bond strength of fiber posts to root canal dentin luted with self-adhesive cement in comparison with conventional dual cure cement.

Some researchers have used core buildup material for fiber post cementation as a one stage post and core procedure for simplification of the steps and reduction of technique sensitivity. They claim that they have higher bond strength and mechanical properties than resin cements.

Some authors have reported important effects on post adhesion of the choice of luting cement, pretreatment of root dentin and pretreatment of post^{9,10}, others found no clinically relevant differences. Starting from this point, the question arises whether the time consuming clinical procedures of root bonding, post pretreatment, and post cementation are necessary or whether the procedure could be simplified. One possible means of substantially simplifying the procedure may be the use of core build-up resin for both, consecutive, treatment steps post cementation and subsequent core-build-up

Over the years, the trend has been to develop adhesive systems that are “simplified” or, in other words, that involve fewer steps with less procedure time⁹.some of these adhesives shows a certain degree of incompatibility

when used with chemical or dual cured adhesives. due to their acidic monomers content which can react with the basic catalytic components (aromatic tertiary amines) of self/dual-polymerizing composites and interfere with their polymerization¹⁰.

Therefore dual cured adhesive systems can be used in combination with dual cured cements to avoid this degree of incompatibility, as these adhesives include additional activator which buffer the effect of acidic monomers, also they can be cured by light or chemically which can overcome the problem of reduced light cure intensity in the apical third of the root.

The objective of this study was, therefore, to test the hypothesis that a specific core-build-up resin had acceptable push-out strength compared with luting cement and the efficacy of self adhesive resin cement. The effect of adhesive dentin pretreatment in different regions of the root was also evaluated.

Review of literature

Endodontically treated teeth are often excessively damaged by decay, wear or previous restorations, resulting in a lack in the coronal tooth structure. Cast metal posts and cores have traditionally been used in these clinical situations to provide the needed retention for the subsequent prosthesis¹¹. The clinical use of fiber posts has increased tremendously since they were introduced in the 1990s¹². They are currently perceived as promising alternatives to cast metal posts in the restoration of endodontically treated teeth¹³.

Prosthetic restorations of endodontically treated teeth have undergone a paradigm shift, from the traditional use of rigid materials (amalgam, gold alloys, etc.) to the gradual acceptance of materials with mechanical properties closer to dentin (resin composites and fiber posts), in order to reduce stress transmission to the remaining tooth structure¹⁴.

Effect of endodontic treatment on the tooth structure

The tooth structure that remains after endodontic treatment has been undermined and weakened which increases susceptibility to fracture, so it is important to understand the effect of endodontics on the tooth structure.

The belief that endodontically treated teeth are brittle was related to their reduced toughness due to desiccation or other physical changes in their dentine. However, despite the fact that endodontically treated teeth have reduced moisture content than vital teeth¹⁵ there is no experimental proof

that endodontically treated teeth are weaker or more brittle than vital teeth¹⁶. Laboratory testing demonstrated a comparable resistance to fracture between sound and endodontically treated anterior teeth¹⁷ but that does not mean occurrence of clinical fracture of endodontically treated. Hence, strengthening these teeth was done using metal posts. However, post placement requires the removal of additional tooth structure, and this will result in further weakening of the tooth structure and create an area of stress concentration at the terminus of the post channel¹⁸.

Endodontically treated teeth has a limited amount of remaining tooth structure as a result of trauma, caries, prior restoration and endodontic access procedures¹⁹. This might reduce their fracture resistance. Endodontic access in combination with the earlier loss of one or both marginal ridges leave the tooth at a high risk of fracture¹⁸. The amount of remaining tooth structure is the most important factor affecting clinical success.

Functions of endodontic posts:

Endodontically-treated teeth that have a minimal amount of remaining tooth structure, require the use of post and cores to improve the retention of the prosthesis . Metallic cast post and cores have been used for many years. However, they present poor aesthetic features and have much higher elastic moduli compared to dentin, causing catastrophic root fractures because of stress concentrations at the post end²⁰. Ideally, post and core materials should have physical properties similar to dentin, so they are able to bond to tooth structures and distribute torqueing forces to radicular dentin, protecting root integrity²¹. If post and core materials have similar elastic