Effect of post surface treatment on shear bond strength of cemented fiber posts

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بسم الله الرحمن الرحيم

يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ
وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ
وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ

صدق الله العظيم

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Dedication

*To my great **Parents**, who was the reason for where I am today, and without their support and encouragement*

*To my lovely brother **Khaled**, who was always supporting me*

*To my dear friend **Dr. Mohamed Taisser Sowwan** for his constant help and all my friends for their love and support*

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Introduction

The restoration of endodontically treated teeth has always been a debated topic. A tooth requires endodontic treatment as a result of caries, repeated restorative procedures or trauma. Many changes after root canal treatment occur including the physical and chemical properties of dentin due to loss of water content or absence of collagen fibers, resistance to fatigue and changes in the biomechanical behaviour.

Restoration of root-filled teeth may be carried out with or without using post because the primary reason for using a post is to retain a core and thus restoring the missing coronal tooth structure. To achieve optimum results, the materials that are used should have physical and mechanical properties that are similar to that of dentine. They should be able to bond to tooth structure and should be biocompatible in the oral environment.

Prefabricated post systems have become more popular because they can provide satisfactory results, saving time and reducing cost. However, prefabricated post should adequately adapt to the prepared root canal otherwise, a cast post and core should be used as its configuration is congruent with the root canal configuration and allow for optimal preservation of tooth structure especially in the apical region

Fiber posts were rapidly accepted by clinicians and provided a viable alternative to metal posts. They are classified according to

material into carbon, glass or quartz fiber posts. The major advantage of these posts is their similar elastic modulus to dentine, producing a stress field similar to that of natural teeth.

Loss of retention of a post is the most frequent mode of failure that is affected by the bonding of the post, the luting cement and the interaction between the post/core, post/cement and post/dentin. So many attempts have been made to enhance these interfaces in many ways by modifying the post design and surface treatment.

Several researches were performed to improve the retention of the post by surface treatment which may be chemical involving hydrogen peroxide, phosphoric acid, hydrofluoric acid and potassium permanganate or mechanical as sandblasting and silica coating.

The present study focused on the effect of post surface treatments on the bond strength of two types of fiber posts.

Review of literature

The restoration of endodontically treated teeth is a topic that is extensively studied and yet remains controversial from many perspectives. Usually, pulpless teeth have lost substantial coronal and radicular tooth structure from pre-existing restorations, dental caries, trauma and access cavity preparations. [1, 2]

Since the rehabilitation of the endodontically treated teeth require therapeutic and aesthetic considerations, so several studies showed the existence of differences between the vital and non vital teeth and this attributed to the changes in the physical properties and in the chemical composition. Moreover, changes in the morphology and in the biomechanical behavior of teeth that occur under stress. [2, 4]

Dentin after root canal treatment is considered more brittle due to loss of water content or reduction of the percentage of collagen fibers overtime after endodontic treatment. Which consequently affect the main physical properties of dentin as modulus of elasticity, tensile strength and the compressive strength. [2, 4]

For many years, the concept of using a post for the restoration of endodontically treated teeth was based upon the philosophy that the post would “reinforce” the tooth and

additional retention was needed for the core restoration. But, post dose not strengthen the tooth as has been advocated traditionally. On the contrary, post insertion should be avoided if adequate retention can be achieved from the coronal tooth structure [2, 5, 6 and 7].

Many authors agree that the placement of posts is directly related to the need for a retention and resistance form. This depends directly on the amount of sound tooth structure, tooth position, restorative choice and occlusal relationship. [7, 8]

Post types and designs

In the 1700s, a French dentist, Pierre Fauchard, also called “the father of modern dentistry”, inserted wooden dowels in the canals of teeth to aid in crown retention. The wooden dowels expanded with moisture and eventually fractured the root. Later, after introducing the so-called Richmond crown in 1878, a modification consisting of a one piece dowel and crown became common. [7]

Many attempts have been made to develop a post with appropriate characteristics for functioning as a homogenous and biomechanically suitable structure in an endodontically treated tooth. [8, 10]

The ideal post and core system should fulfill the physical properties such as modulus of elasticity, compressive strength, and coefficient of thermal expansion similar to dentin. Additionally, posts should demonstrate high retention, good biocompatibility, esthetics and retrievability. [8]

Posts and cores are often required for replacement of the missing coronal aspect of teeth. [5] Which affect the selection of an appropriate post system, the treatment should attempt to establish a stable post which transfers the stress of mastication throughout the radicular root and into the periodontal attachment uniformly without focusing the stress in function or create it during placement. [3]

Moreover, a stiff post system that resists deformation or permanent bending to protect the integrity of the crown margins and cement seal. Also, to provide optimal luting of the post to the radicular dentin. [3]

So, in order to perform a successful treatment, different types of post systems are available, post systems can be classified according to their different material [11], design and surface characteristics. [3]

The prefabricated posts designs may be parallel sided posts which have been reported that they are more retentive as it induce less stress into the root because of the lower wedging effect compared to tapered posts which form the natural shape of the root and more likely to cause root fractures. [3, 7, 12]

The surface characteristics may be in the form of smooth, serrated or threaded designs. The serrated post significantly increases the retention of the post as compared to a smooth post. While the threaded post produce stresses that may be induce local root fractures. [7]