Fracture Resistance of Wide Canalled Endodontically Treated Teeth Restored with Different Fiber Post Systems with & without Accessories

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

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Aisha Milad Mohammad Ben Ramadan

Dedication

This work is dedicated to

The soul of my father, my mother, my sisters, and my brothers

The light that leads my way

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Introduction

Reconstruction of endodontically treated teeth is a great challenge in restorative dentistry since the tooth crown is usually totally or partially lost due to caries, erosion, abrasion, previous restorations, trauma or endodontic access. When more than half of the coronal structure has been lost, a root canal post is required to provide retention for the restoration [(1)].

The survival of endodontically involved teeth has been greatly enhanced by continuing developments in endodontic therapy and restorative procedures. ***Turner (1982)***[(2)] reported that a large number of endodontically treated teeth are restored to their original function with many options. These options vary from a conventional custom cast post and core to one-visit techniques, using commercially available prefabricated post systems.[(3,4)] In the last few decades, various prefabricated post systems have been developed. The selection of post design is important, because it may have an influence on the longevity of the tooth.[(5)]

To achieve optimum results, the material used for the post should have physical properties similar to that of dentin, direct bonding to the tooth structure, and bio compatibly to the oral environment.[(6)] Traditionally, posts made of metal alloys were used. Recently, nonmetallic posts have been introduced, these are made of fiber-reinforced composites combining highly resistant

element (carbon fibers, glass, quartz or polyethylene) to resin matrices. [7, 8]

Wide root canals (due to carious lesions, utilization of large posts, iatrogenic problems, incomplete development, internal resorption or developmental anomalies) are very challenging [9]. One of the recent options for wide root canals is the development of prefabricated fiber posts with fiber strips added for filling empty spaces in the root canal caused by poor adaptation of the post, allowing a reduction in cement thickness. Another recent proposal, is the insertion of small accessory posts around the main glass fiber post[10]. ***Braz et al (2005)*** [11] restored roots with wide canals using a main glass fiber post and three accessory posts, which provided higher strength than other reconstruction options investigated.

In contemporary restorative dentistry, post-root canal adaptation always represents an important role in successful and long-lasting treatment for the restoration of endodontically treated teeth. In some cases posts have to be placed in wide oval-formed root canal spaces. However, the impact of the treatment outcome of the increasing non-uniform cement thickness around the posts has not yet reached a consensus. The purpose of this research is to assess the fracture resistance of post systems with four different post systems, customized and prefabricated with/without accessory posts as an alternative technique in the wide root canals. [12]

Review of Literature

The successful restoration of an endodontically treated tooth can pose a difficult challenge to the restorative dentist. A tooth which has lost significant coronal and radicular structure due to caries, endodontic procedures or trauma must be reestablished as a fully functioning member of the dental arch.

Effect of root canal treatment on tooth structure:

The loss of structural integrity is the main reason behind the vulnerability of endodontically treated teeth and their reduced resistance to fracture according to ***Peroz et al. (2005)*** [13] Most endodontically treated teeth suffer massive reduction in their structural stability because of the great loss of coronal dental structure caused by caries, fractures, and access preparations. ***Tang et al. (2010)*** [14] summarized the risks that increased the potential of tooth fracture after endodontic treatment. The risks included loss of tooth structure, stresses attributed to endodontic and restorative procedures, and inappropriate selection of tooth abutments for prostheses.

Mireku et al. (2010)[15] reported that the vertical root fractures of endodontically treated teeth prepared to receive endodontic posts were more frequent in the teeth of older patients

and when dentin thickness was reduced. ***Dietschi et al. (2007)*** [16] concluded that changes in tooth biomechanical behavior, tissue composition, and moisture after the loss of tooth vitality and proper endodontic treatment were limited and negligible. However, they found that teeth became weaker as they lost more coronal tissue because of caries or restorative procedures.

Akkayan et al. (2010)[17] reported that root fractures have been cited as the most common cause of failure in endodontically treated teeth restored with posts. Cross-sectional surveys of failed posts have shown that most failures are due to post decementation followed by caries and post fracture.

Ree and Schwartz (2010) [18] reported that the long-term success of endodontic treatment is highly dependent on the restorative treatment that follows. Once restored, the tooth must be structurally sound and the disinfected status of the root canal system must be maintained. Radicular and coronal tooth structure should also be preserved to the greatest possible extent during endodontic procedures and post space preparations within the root canals as it weakens the root.

Also ***Assif et al. (1993)*** [19] demonstrated that the section of a dowel should be based on a system that preserved the most tooth structure and possesses suitable retention of a core for restoration of the tooth. They reported that if the anatomic crown

is sufficiently preserved and core retention can be achieved from within the natural crown, or if completion of the coronal surface is unnecessary, dowel-core systems are not required.

Post material:

To achieve optimum results, the material used for the post should have physical properties similar to that of dentin, and should be bonded to the tooth structure, and biocompatible in the oral environment.[6] Post material should also act as a shock absorber by transmitting only limited stress to the residual tooth structure.[20] Unfortunately, the materials used for post and cores, as well as luting agents, have distinct physical properties different from dentin and exhibit fundamentally different fatigue behavior.[21]

Prefabricated posts have been introduced into the market with different materials. Metallic posts such as gold or titanium alloy or stainless steel. Nonmetallic posts such as ceramic, composite, and carbon fiber, quartz fiber, glass fiber and polyethylene fiber posts. Glass fiber being considered to be the most accepted by some authors.[22]

Zirconium ceramic, which is presently used for posts, has a high modulus of elasticity, and therefore the forces are assumed to be transmitted directly from the post to the tooth interface