بسم الله الرحمن الرحيم

(قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ)

صدق الله العظيم

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Assessment of newly introduced fiber-reinforced posts on fracture resistance of endodontically compromised teeth

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Introduction

With the advent of endodontic therapy, the challenges have been increased for restorative dentistry. The endodontic therapy has reduced the rate of tooth loss, however the prognosis of success is highly dependent on the proper restoration of these treated teeth [(1, 2)].

Root filled teeth have a higher risk of biomechanical failure than teeth with vital pulps [(3)]. Post and core systems are commonly used for the restoration of endodontically treated teeth to retain coronal restorations when inadequate tooth structure remained. For decades, restorative modalities for root filled teeth have been the main concern of much research, with the aim of identifying the adequate methods that make the complex root, post and core unit more resistant to the stresses of masticatory loads[(4)].

Loosening of the post and core or fracture of the remaining tooth structure is the most frequent problem observed. This failure is related to many factors such as, post length, diameter, material and post design which can influence the biomechanical behavior of endodontically treated teeth by modifying the pattern of stress distribution[(4)].

With the increasing esthetic demands, tooth colored post and core restorations have become popular for restoring endodontically treated teeth especially in the anterior region. The combination of tooth colored posts with all ceramic restorations has overcomed the disadvantages of metal posts with their inherent opacity that adversely affects the color of the final restoration [(5)].

Highlighting the effect of post design on the biomechanical performance of the restored teeth under different conditions might be of value to the clinician for proper post selection.

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 [6, 7].

Effect of root canal treatment on tooth structure

Root filled teeth are weaker than intact ones due to decreased dentin moisture, loss of dental structure and root canal preparation which will limit tooth deformation capacity under loading, thus increasing the potential for tooth fracture[8].

It is generally believed that the dentin in endodontically treated teeth is substantially more brittle than dentin in teeth with vital pulps, probably because of water loss and loss of collagen cross-linking [9]. Despite these findings, more recent studies were conducted in this aspect. A comparison of the physical and mechanical properties of dentin specimens from teeth with and without endodontic treatment at different levels of hydration was studied by **Huang et al** in **(1991)** [10]. They concluded that neither dehydration nor endodontic treatment caused degradation of the physical or mechanical properties of dentin. On the other hand, **Gutman** in **(1992)** [11] found that root canal treatment changed the actual composition of the remaining tooth structure.

Sedgley and **Messer (1992)** [12] tested the biomechanical properties of dentin from twenty three endodontically treated teeth with an average of ten years of post treatment. They compared them to their contralateral vital pairs. Aside from a slight difference in hardness, the properties were comparable. The study did not support the conclusion that endodontically treated teeth are more brittle. It was claimed that the loss of structural integrity associated with the access preparation rather than changes in the dentin that lead to a higher occurrence of fractures in endodontically treated teeth compared with vital teeth. Access preparations result in increased cuspal deflection during function and increase the possibility of cusp fracture and microleakage at the margins of restorations.

An earlier study by **Randow** and **Glantz** in **(1986)** [13] reported that teeth have a protective feedback mechanism that is lost when the pulp is removed, which also may contribute to tooth fracture.

The high success rate of modern-day endodontics has resulted in an increased demand for clinically convenient post core systems to help restore the lost tooth structure [14]. There is a considerable controversy surrounding the need for using coronal-radicular restoration and the strengthening role of posts. There are three basic philosophies. The first group advocate posts in each tooth after root canal treatment because posts supposedly strengthen the tooth against occlusal forces. The second group discourages the use of posts claiming that the tooth preparation of the root canal and the insertion of the post results in substantial weakening of the tooth. A third group believes that there is no appreciable improvement in fracture resistance of the tooth to occlusal forces [15].

In **(1994)**, **Assif et al** [15] pointed out that posts should be used only for retention of a core within remaining tooth structure when there are no other alternatives. Appropriate retentive features can be selected to retain the core as restorations that use parapulpal retentive pins in dentin or an intra-radicular post requiring removal of a minimal amount of tooth structure. They further added that increasing the length and diameter of the metal post to improve its radicular retention compromises the prognosis of the restored tooth. Finally they concluded that the use of a post to strengthen pulpless tooth aiming to resist occlusal forces, is hardly justified and possibly detrimental.

Post Types and Designs

In general, the decision whether to use a post in any clinical situation must be made judiciously. The posts should be used only when there is insufficient tooth substance remaining to support the final restoration. In other words, the main function of a post is the retention of a core to support the coronal restoration [16, 17].

Generally, posts and cores can be classified into two groups, custom-made and prefabricated. Custom-made post and core can be cast from a direct pattern fabricated in the patient's mouth, or an indirect pattern can be fabricated in the dental laboratory. A direct technique with autopolymerizing or light-polymerized resin is recommended for single canals with good clinical access, whereas an indirect procedure is more appropriate for multiple canals or when access is more problematic [18, 19].