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Post, Way of Restorations of Endodontically Treated Tooth

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Abstract

After endodontically treatment, the tooth needs to be restored. There is a lot of variety in material, shape, retention etc. of the post, fabricated now days. After a review in some different dental journals, we select some studies, which were based in the different ways of restoring an endodontically treated tooth. Some posts had better properties than some others, and some where specifically indicated to be used in some cases compare with the others post. Length, shape, material, force resistance, type of tooth etc. has a high responsibility to increase the longevity of the restored tooth. The type of post, retention, mechanical and esthetical properties, must be choosing based on the clinical indication.

Keywords: Posts; Review; Properties; Restorations; Endodontically treated

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Introduction

The large number of post designs and materials available on the market reflects the absence of consensus in that field. Based on what manufacturers or clinicians consider the most important properties, posts can be fabricated from metal (gold, titanium, stainless steel), ceramic, or fiber-reinforced resins. As a general rule, a post needs retention and resistance. Whereas post retention refers to the ability of a post to resist vertical forces, resistance refers to the ability of the tooth/post combination to withstand lateral and rotational forces. Resistance is influenced by the presence of a ferrule, the post's length and rigidity, and the presence of anti rotational features. A restoration lacking resistance form is not likely to be a long-term success, regardless of the retentiveness of the post.

Prefabricated metallic posts

Prefabricated metallic posts are frequently used for the fabrication of a direct foundation restoration. These posts are classified several ways, including by alloy composition, retention mode, and shape.

Materials used to fabricate metallic posts include gold alloys, stainless steel, or titanium alloys. Metallic posts are very strong and, with the exception of the titanium alloys, very rigid [1]. The retention of prefabricated posts inside the root canal is also essential for successful restorations.

Two basic concepts have been used to promote the retention of endodontic posts: active posts and passive posts. Active posts derive their primary retention directly from the root dentin by the use of threads. Most active posts are threaded and are intended to be screwed into the walls of the root canal. Passive posts are passively placed in close contact to the dentin walls, and their retention primarily relies on the luting cement used for cementation. The shape of a passive post may be either tapered or parallel [2]. Unfortunately, modern techniques for root canal preparation use tapered nickel-titanium (NiTi) rotary shaping files, which result in a very wide tapered and unretentive canal exhibiting a significant divergence from apical to coronal [3]. Longer posts are often necessary to accommodate this problem and offer adequate retention; adequate length in the root canal is considered to be greater than 6 mm.

Fiber posts

A fiber post consists of reinforcing fibers embedded in a resin polymerized matrix. Monomers used to form the resin matrix are typically bifunctional methacrylates (Bis-GMA, UDMA, TEGDMA), but epoxies have also been used. Common fibers in today's fiber posts are made of carbon, glass, silica, or quartz but the type, volume content, and uniformity of the fibers and the matrix are proprietary and vary among fiber post systems. These differences in the manufacturing process may reflect the large variations observed among different types of fiber posts subjected to a fatigue-resistance test [4].

Fibers are commonly 7 to 20 μm in diameter and are used in

a number of configurations, including braided, woven, and longitudinal. The original fiber posts consisted of carbon fibers embedded in epoxy resin, but quartz-fiber posts are currently preferred for their favourable mechanical properties, aesthetic qualities, and ability to chemically bond to the polymer matrix [5]. A well-adapted adhesively cemented fiber post is considered the most retentive with the least stress generated on the canal walls.

Zirconia posts are composed of zirconium dioxide (ZrO_2) partially stabilized with yttrium oxide and exhibit a high flexural strength. Zirconia posts are aesthetic, partially adhesive, rigid, but also brittle. Controversies exist about the efficiency of airborne particle abrasion at establishing a durable resin bond to zirconia posts treated or not treated with a coupling agent [6,7]. Overall, there are concerns about the rigidity of zirconia posts, which tends to make those posts too brittle.

Methods

In this current study we search on some Dental Journals, published in different years, exactly as in the **Table 1.** From those journals editions, we selected only the studies that after reading the name of them, then the abstract and then all the study, was conducted that they had necessary information about restoration an endodontically treated tooth with post.

Results

In the **Table 2** are summarized the total number of article, carried out from each Dental Journal. After reading the abstract, the total number of article which was used in our current study, are shown also in this table.

Discussions

One study indicates that the flexural strength of stainless steel posts is about 1430 MPa and that flexural modulus approximates 110 GPa. On the other hand, titanium posts are less rigid (66 GPa) but exhibit a flexural strength (1280 MPa) similar to stainless steel.

A major concern about threaded posts has been the potential for vertical root fracture during placement. As the post is screwed into place, it introduces great stresses within the root, causing a wedging effect [8]. Therefore, it is generally accepted that

Table 1. Names of each Journals and the year of publication for each of them.

Name of Journals	Year of publications
Journal of Oral Rehabilitation	1982, 1997
Journal of Dental Materials	2002, 2004, 2005, 2007
Journal of Prosthetic Dental	2000, 2001, 2003, 2006, 2008, 2009
Brazilian Dental Journal	2005
International Journal of Prosthodontics	1992, 1997, 1999, 2001
Journal of Endodontic	2003, 2004, 2005, 2007
American Journal Dental	2000
Journal Dental	2009
Journal of Adhesive Dentistry	2006

Table 2. Names of each study according to the corresponding Journal.

Name of journals	Name of each study
Journal of Oral Rehabilitation	• Mechanical properties of endodontic posts [1]. • The Dentatus screw: comparative stress analysis with other endodontic dowel designs [8].
Journal of Dental Materials	• Flexural properties of endodontic posts and human root dentin [9]. • Fatigue resistance and structural characteristics of fiber posts: three-point bending test and SEM evaluation [4]. • The effect of a translucent post on resin composite depth of cure [10]. • Adhesive postendodontic restorations with fiber posts: push-out tests and SEM observations [11].
Journal of Prosthetic Dental	• The use of reinforced composite resin cement as compensation for reduced post length [12]. • Ferrule design and fracture resistance of endodontically treated teeth [13]. • Retention of a core material supported by three post head designs [14]. • Effect of surface treatment on retention of glass-fiber endodontic posts [15]. • Resin-ceramic bonding: a review of the literature [16]. • Influence of different surface treatments on the short-term bond strength and durability between a zirconia post and a composite resin core material [6]. • An in vitro evaluation of the long-term resin bond to a new densely sintered high-purity zirconium-oxide ceramic surface [7].
Brasilian Dental Journal	• Post and core systems, refinements to tooth preparation and cementation [2].
International Journal of Prosthodontices	• Intermittent loading of teeth with tapered, individually cast or prefabricated, parallel-sided posts [17]. • Survival rate and fracture strength of endodontically treated maxillary incisors with moderate defects restored with different post-and-core systems: an in vitro study [18]. • Adaptation of adhesive posts and cores to dentin after fatigue testing [19]. • The influence of post length and crown ferrule length on the resistance to cyclic loading of bovine teeth with prefabricated titanium posts [20].
Journal of Endodontic	• Post placement and restoration of endodontically treated teeth: a literature review [21]. • Nickel-titanium rotary instruments: current concepts for preparing the root canal system [3]. • Influence of surface treatments on the flexural properties of fiber posts [22]. • Microhardness of composites in simulated root canals occured with light transmitting posts and glass-fiber reinforced composite posts [23].
American Journal Dental	• Retrospective study of the clinical performance of fiber posts [24].
Journal Dental	• Long-term survival of endodontically treated, maxillary anterior teeth restored with either tapered or parallel- sided glass-fiber posts and full-ceramic crown coverage [25].
Journal of Adhesive Dentistry	• Adaptation of adhesive post and cores to dentin after in-vitro occlusal loading: evaluation of post material influence [26].

the use of threaded posts, or active post should be avoided. Furthermore, the improved retention once offered by threaded posts can now be achieved with adhesive luting cements [9-12]. A parallel passive post is more retentive than a tapered post but also requires removal of more root dentin during the preparation of the post space. Parallel posts are reported to be less likely to cause root fractures than tapered posts, although they are less conforming to the original shape of the root [13-21].

When teeth are protected by crowns with an adequate ferrule, longer posts do not further increase fracture resistance [20]. Posts designed with mechanical locking features in the heads and roughened surface texture can show better retention of the core [14].

One study indicates that the flexural strength of glass-, silica-, or quartz-fiber posts approximates 1000 MPa and that flexural modulus is about 23 GPa [22]. Current fiber posts are radiopaque and may also conduct the light for polymerization of resin-based luting cements. A light-transmitting post results in better polymerization of resin composites in the apical area of simulated root canals, as measured by hardness values [10,23]. To enhance bonding at the post/core/cement interfaces, several physicochemical pre-treatments such as silanization or sand blasting of the post surface have been described. One research indicates that silanization, hydrofluoric etching, and sandblasting (with 30 to 50 µm Al2O3) do not modify the mechanical properties of different glass, silica-, or quartz-fiber posts [15]. It is generally accepted that bonding fiber posts to root canal dentin can improve the distribution of forces applied along the root, thereby decreasing the risk of root fracture and contributing to the reinforcement of the remaining tooth structure [11,18]. In a retrospective study that evaluated three types of bonded fiber posts, investigators reported a 3.2% failure of 1306 fiber posts in recalls of 1 to 6 years [24]. More recently, another study reported survival rates of 98.6% and 96.8% for parallel-sided and tapered fiber posts, respectively, placed in anterior teeth covered with full-ceramic crowns after a mean observation period of 5.3 years [25].

Zirconia posts cannot be etched, and available literature suggests that bonding resins to these materials is less predictable and requires substantially different bonding methods than conventional ceramics [16]. When a composite core is built on a zirconia post, core retention may also be a problem. Other reports indicate that the rigidity of zirconia posts negatively affects the quality of the interface between the resin core material and dentin when subjected to fatigue testing [19,26].

Conclusion

There are a variety ways and materials how an endodontically treated tooth can be restored. During the restoration, the doctor must select carefully the type of post, based on clinical indication, patient, type of tooth etc. Resin reinforce posts are preferable to use in esthetical area, when a resin composite core will be build and because after the cementation, those post can be one body with the tooth. Active metallic and parallel posts are not preferable, because they may cause stress in the walls of the root and may increase the risk of fractures. Due to lower masticator forces resistance point, zirconia posts are not recommended to be used in high load forces areas. Zirconia posts are not also preferable to be used when composite resin core is going to be used.

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