REVIEW ARTICLE

Recent Advancements in Posts

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ABSTRACT

The ultimate objective of dental treatment is preservation of the tooth in oral cavity. Endodontic treatment reduces the fracture resistance of tooth, thus making it more vulnerable to fracture. To reinforce the endodontically treated teeth and protect against fracture, some type of stabilization is required that will fasten the restoration to the remaining tooth structure. This is accomplished using a post. This article focuses in recent post systems and their application in dentistry.

Key words: Double taper post, everstick post, luminex light transmitting system, luscent anchor, ribbond, twin lucent, wuerzburg post

INTRODUCTION

Root canal therapy saves the tooth whereas restoration reinstates the tooth as a functional member of the masticatory system.[1] Endodontically treated teeth are often severely damaged by decay, excessive wear, or previous restorations, resulting in a lack of coronal tooth structure.[2] This loss makes the retention of subsequent restoration problematic and increases the likelihood of fracture during function; therefore, special techniques are needed to restore them.[3] When the remaining tooth structure is less, the retention of final restoration becomes a problem, then extra retentive features in the form of post need to be given to increase the retention.[4] An endodontically treated tooth undergoes coronal and radicular tissue loss due to prior pathology, endodontic treatment, and/or restorative procedures, posts are often necessary for providing sufficient retention for the core material.[5]

Various tooth-colored post systems made of either fiber-reinforced resin composites including glass fiber, quartz fiber, carbon and polyethylene fiber, or zirconia-based ceramics are available for restoring non-vital teeth.[6] Fiber posts can be used when ample coronal dentin remains and the crown is well supported by remaining tooth structure; otherwise, cast posts may be used when there is moderate-to-severe tooth loss. The bonding of a post to the tooth structure can improve the prognosis of the post-core restored tooth by increasing post retention and by reinforcing the tooth structure.[7]

Dallari, A. and Rovatti (1996) classified the posts into three generations:[8]

First-generation Posts: Self-retentive Metal Posts

The first group is comprised self-retentive posts which develop close contact to the endodontically prepared root canal walls such as self-threaded metal posts, screw posts, and serrated cast posts.

Second-generation Posts: Metal Posts with Passive Retention

The second group is comprised metal posts with passive retention and cast posts using different adhesive techniques for bonding, as proposed by Nathanson. These techniques eliminate direct contact between the post and the root canal wall, by creating a space which is filled with composite bonding material.

Third-generation Posts: Non-metal Posts with Passive retention

The third group is comprised non-metallic root canal post systems such as ceramic posts and fiber-reinforced posts with passive retention.

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Naumann *et al.* (2002) described the following classification devised on the basis of the remaining axial walls of prepared access cavity.[9]

Class I describes the access cavity preparation with all the four axial cavity walls remaining.

Class II describes the access cavity preparation in which loss of one cavity wall is there, for example, a mesioocclusal or a distoocclusal cavity.

Class III represents a MOD cavity with two remaining cavity walls.

Class IV describes the cavity with one remaining cavity wall. In most cases, it is the buccal or oral wall.

Class V describes a decorated tooth with no cavity wall remaining.

The minimal thickness of the cavity wall as a determining factor for the resistance to functional loads of crown-root complex is 1 mm and hard tissues below this thickness cannot be prepared for crowns without the loss of all the remaining substance, leaving no dental tissue. The minimal height of the cavity wall capable of providing a sufficient ferrule effect is 2 mm.

Bondable Reinforcement Fiber

It is available as the Ribbond and Ribbond THM (Thinner Higher Modulus). Ribbond-THM is made up of the thinner fibers with higher thread count and is almost half as thick as original Ribbond. This method of fabrication involves the utilization of a bondable reinforcement fiber, (Ribbond-Kerr), as the post material, a fourth-generation bonding agent (Optibond Kerr), a dual-cure hybrid composite (Nexus II-Kerr/Sybron) as the luting agent, and a dual-cure hybrid composite (CoreRestore2-Kerr/ Sybron) as a core build up. Ribbond consists of polyethylene fibers that are treated with cold gas plasma. Kerr, in 1992, introduced a new polyethylene braided fiber which is impregnated with resin and can be handled by fingers without the use of gloves.[10]

The fiber is transported to the base of the post space using a modified Luk's gutta-percha condenser. A dual-cure composite or resin cement is then injected into the canal. The remaining fiber is then reinserted by folding it over and over within the canal using the modified Luk's gutta-percha condenser and finally light cured for 60 s. After preparing and finishing of the reinforced resin fiber core, a 2 mm ferrule is placed on the tooth structure to aid in the mechanical retention and resistance of the endodontically treated tooth complex. Impression of the prepared tooth structure is taken and an extra coronal coverage is given.

Sirimai *et al.* compared PRF posts with metal posts in laboratory, the fiber reinforced posts reduced the incidence of vertical root fracture. The addition of small sized prefabricated post to the PFR post increased the strength of the post and core complex. However, the strength of the PFR post did not approach that of a cast metal post and core.[11]

Usumez *et al.* (2004) compared *in vitro* the microleakage of three esthetic, adhesively luted post systems with a conventional post systems. They found that the PRF posts and the glass fiber posts exhibited less microleakage compared with zirconia posts.[12]

Light Transmitting Post System

Double taper light post illusion

a. Double taper light post was developed by Dr. Pierre Boudrias and a Dr. Salam Sakkal at the University of Montreal as they decided to have a post that should actually adapt to the realistic contours of the prepared canal, rather than the traditional approach of adapting the canal to fit the post. The DT Light-Post Illusion post was recently launched into the market by RTD (St. Egreve, France). The resin matrix and the type of fiber which make up the posts correspond to those of the DT Light-Post, except for the addition of a small amount of special colorants, which impart a specific color to each post according to its diameter. The DT Light-Post Illusion is colored at room temperature, while retaining a certain translucency: # 0.5 – black, # 1 – red, # 2 – yellow, and # 3 – blue. However, at body temperature (37 C), all the posts become completely translucent almost immediately.[13] This post has fiber-optic construction and can be cemented with light cure and dual-cure materials and light transmission capacity of 9.1 mW/cm^2
b. The Luminex Light Transmitting System: The Luminex Light Transmitting System (Dentatus, New York, NY) is used to rehabilitate a root canal to an ideal size and shape. These radiolucent posts, homogeneously attached to the canal and core material, transmit the tooth color without being visible under most adverse

light conditions. The Luminex post allows the polymerizing light to pass down through light cured composites inside weak, debilitated root structures, to strengthen the root and to leave an ideal space for subsequent placement of prefabricated or custom cast posts and cores. They also provide a sound core-crown gingival interface radiating natural color through soft and hard tissues surrounding teeth.[14]

c. Luscent anchor post: This post system was introduced by Dentatus, is a fiber-glass clear resin post that is designed to refract and transmit natural tooth colors for esthetic post-and-core foundations.[15] The Luscent anchor is radiolucent and identified on radiographs by the surrounding resin cement. Designed to be placed passively in prepared canals, it is available in six sizes and diameter combinations ranging from 15 mm long and 1 mm diameter up to 19 mm long and 1.80 mm diameter. The Luscent anchor is easily removed, if required, for endodontic retreatment. The Luscent Anchor combines strong fiberglass rods encapsulated in a resin matrix that transmits light within the canal confines.[15] It creates a monoblock concept for exceptional strength and longevity. Also maintains the sound radicular and coronal structure and reinforces the thin walled roots through resin bonding internal root splinting.[16]
d. Twin luscent anchors: This post has been introduced by Dentatus in 2002 and claims to be an innovative design with an assurance against accidental debonding of adhesive and resin-core materials. The slim mid-section creates a physical choke. The vent groove eliminates air resin entrapment and prevents rotational dislocation. Due to its effective light transmitting capability, it effectively polymerizes composite within the deep confines of canals. It is very esthetic as it eliminates shadows at the gingival, root and crown interface, as well as through thin laminate composite restorations and reflects the surrounding colors and hues, compatible with natural esthetics. Mechanical resistance is seen in the anchor's midsection providing double retention against accidental debonding of resins and restorative materials along with its added monoblock strength. The anchors cone-shaped end can be placed in deeper and narrower canals without excess removal of dentin or canal wall. In addition, the vent groove creates an anti-rotational resistance in the surrounding polymerized resin material. It has a low modulus of elasticity of 20.1 GPa and a flexural strength of 579 MPa. This one-step procedure of simultaneously luting the anchor and building a monoblock core with dual-cure materials has been found to be economical and highly effective.[17]

Flexible Light Curable Directly Placed Fiber-Bundle Dowel System

The adhesive properties of tooth-colored FRC dowels have allowed for the development of more anatomic dowel designs. These dowels are usually prefabricated and require mechanical canal enlargement. In 2008, an innovative approach has been proposed by the manufacturer of a flexible light curable directly placed fiber-bundle dowel system (everStick; StickTech, Turku, Finland)

Everstick Post System

In this system, glass fibers are impregnated with a semi-interpenetrating polymer network (IPN). An IPN polymer may be defined as a polymer comprising two or more networks that are not covalently bonded to each other, while a semi-IPN comprises only one network and a linear polymer. In the everstick dowel, the matrix is a multiphase of bisphenol A diglycidylether methacrylate (Bis-GMA) monomer resin partially diffused into a linear phase of polymethyl methacrylate (PMMA).[18] Further, the fiber bundle is surrounded by a PMMA outer layer to improve the adhesive properties of the dowel. According to the manufacturer, when a light-curing bonding resin is applied for 5 min onto the surface of the fiber bundle pre-impregnated with PMMA, the latter will be partially dissolved. Consequently, grooves and undercuts are created on the surface to provide micromechanical bonding in addition to the chemical adhesion – surface reactivation. On polymerization, the monomers form a cross-linked semi-IPN polymer together with phases of linear polymer. The flexible dowel system is not based on a matching reamer and dowel approach. Instead, the most appropriate dowel size for the available canal space is advocated by the manufacturer.

One advantage of this dowel system is that it facilitates conservation of root tissue, which is an important contribution to the durability of the dowel and core restoration.[19] Another advantage is that it has the potential for use in curved and diverted root canals in which conventional prefabricated dowels may not be applicable.[20] This dowel system is not based on a matching reamer and dowel

approach. Instead, the most appropriate dowel size for the available canal space is advocated by the manufacturer. Such a method is clearly dependent on the luting cement to fill any remaining space between the restoration and canal walls.

Wuerzburg Post

The Wuerzburg Post, introduced in 2008, is a new post-and-core restoration system designed to eliminate the weak parts of post-and-core restorations and the associated problems, respectively. In contrast to conventional posts, the Wuerzburg Post is a short and thick post, which no longer relies on cementation or luting for retention in the root, but on stress-free positive locking, which it achieves by means of a post which can be spread into a predefined and form-congruent undercut cavity.[21] The second key feature is an annular groove which runs in the dentin ensuring regular force transmission and stress dissipation, as opposed to the classic ferrule design. There are two versions: One with a machined core which can be prepared like a classic build-up to support crowns and bridges, and another one with a 2.25 mm ball end to connect to common dies which can be integrated into removable prostheses.

As the system utilizes prefabricated parts made from Titanium, a precise fit is ensured, enabling the user to restore teeth quickly and easily. It is also important to note that if necessary, it is possible to remove the Wuerzburg Post in a reasonable time without extensive risk of destroying the remaining tooth. This involves destructive separation of the build-up or ball end with a diamond bur which separates the core from the spreadable lamella which remains in the cavity and can be removed individually. In particular, this feature is helpful when endodontic retreatment become necessary.

PARAPOST FIBER WHITE SYSTEM

The esthetic ParaPost has longitudinally arranged glass fibers. The post is essentially parallel and has white translucent color that minimizes shadowing. Parapost system is made metal free for esthetic purposes and is also indicated for patients with metal allergies. Flexural modulus measures closer to dentin than other post materials. Filled resin/unidirectional fiber matrix strengthens the structure of the post without compromising flexibility. It is passive, parallel-sided design mirrors the qualities of metal ParaPost®. This post system is specially fabricated to bond with resin cements and core materials. If endodontic treatment becomes necessary, this para post can be removed readily. The posts are color coded for use with existing ParaPost® drills.[15]

REFERENCES

1. Kokane VB, Patil SN. Post endodontic restoration: Are you serious? J Dent Med Sci 2012;3:4-7.
2. Kurt M, Güler AU, Duran I, Uludamar A, nan Ö. Effects of different surface treatments on the bond strength of glass fiber-reinforced composite root canal posts to composite core material. J Dent Sci 2012;7:20-5.
3. Gogna R, Jagadish S, Shashikala K, Prasad BS, Restoration of badly broken, endodontically treated posterior teeth. J Conserv Dent 2009;12:123-8.
4. Segovi S, Gali N, Davanzo A, Paveli B. Postendodontic tooth restoration - Part I: The aim and the plan of the procedure. Acta Stomat Croat 2004;38:81-6.
5. Kishen A. Mechanisms and risk factors for fracture predilection in endodontically treated teeth. Endod Top 2006;13:57-83.
6. Cekic-Nagas I, Sukuroglu E, Canay S, Does the surface treatment affect the bond strength of various fibre-post systems to resin-core materials? J Dent 2010;39:171-9.
7. Randow K, Glantz P. On cantilever loading of vital and non-vital teeth. An experimental clinical study. Acta Odontol Scand 1989;44:271-7.
8. Dallari A, Rovatti L. Six years of *in vitro*/*in vivo* experience with composipost. Compend Contin Educ Dent Suppl 1996;20:S57-63.
9. Peroz I, Naumann M. Restoring endodontically treated teeth with posts and cores--a review. Quintessence Int 2005;36:737-46.
10. Bayrak S, Tunc ES, Tuloglu N. Polyethylene fiber-reinforced composite resin used as a short post in severely decayed primary anterior teeth: A case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009;107:60-4.
11. Sirimai S, Riis DN, Morgano SM. An *in vitro* study of the fracture resistance and incidence of vertical root fracture of pulpless teeth restored with six post-and-core systems. J Prosthet Dent 1999;81:165-71.
12. Usumez A, Cobankara FK, Ozturk N, Eskitascioglu G, Belli S. Microleakage of endodontically treated teeth with different dowel systems. J Prosthet Dent 2004;92:163-9.
13. Cheleux N. Innovations in the fiber post field: The "Chameleon" post. Int Dent SA 2008;10:62-8.
14. Kivanç BH, Alaçam T, Ulusoy OI, Genç O, Görgül G. Fracture resistance of thin-walled roots restored with different post systems. Int Endod J 2009;42:997-1003.
15. Stewardson DA. Non-metal post systems. Dent Update 2001;28:326-36.
16. Strassler HE, Marchiori RH. Using luscent anchors to esthetically restore and reinforce flared root canals. Contemp Esthet Restor Pract 2001;8:86-9.
17. Available from: http//www.dentatus.com/twin-luscent.html. [Last accessed on 2014 Nov 30].

18. Vats A, Srivastava S, Kukreja M, Chhabra HS. High strength and bonding achieved with new flexible everstick posts: A case report. Endodontology 2016;28:188-91.
19. Beltagy TM. Fracture resistance of rehabilitated flared root canals with anatomically adjustable fiber post. Tanta Dent J 2017;14:96-103.
20. Chakmakchi M, Rasheed R, Suliman R. *In vitro* comparative assessment of fracture resistance of roots restored with everstick fiber reinforced composite post. J Oral Dent Res 2015;1:43-50.
21. Rottner K, Boldt J, Proff P, Spassov A, Gredes T, Mack F, *et al.* A novel post-and-core restoration system--results of three years of clinical application of the "Wuerzburg Post". J Physiol Pharmacol 2008;59:105-15.