

Aesthetic postmaterials

T. Shetty, G. Sudhakar Bhat, P. Shetty

Department of Prosthodontics and Maxillofacial Prosthetics, Manipal College of Dental Sciences, Mangalore, Manipal Academy of Higher Education, Karnataka, India

For correspondence

Department of Prosthodontics and Maxillofacial Prosthetics, Manipal College of Dental Sciences, Mangalore, Light House Hill Road, Mangalore - 575 001, Karnataka, India, E-mail: thilak@yahoo.com

Posts were designed to retain the coronal restoration when inadequate tooth structure remained, for reinforcing endodontically treated teeth. Metallic posts being more rigid than the tooth structure undermines its usage. Due to the forces there could be differential movements of the components and the tooth, resulting in their separation or fracture. The metallic posts have aesthetic shortcomings especially when the newer all ceramic materials are used for restoring the anterior teeth. The growing demand for esthetic restorations in dentistry has led to development of tooth-colored, metal free post systems like carbon fiber posts, zirconia posts, glass fiber posts [translucent quartz fiber] and woven fibers [polyethylene fibers] which are discussed in this article.

Key words: aesthetic, metal free posts, ceramics

INTRODUCTION

In the recent times demand for esthetic dentistry is growing both in urban and rural areas. Development in material science has reached near perfection in achieving the required results. A grossly destructed anterior tooth needs post and core for successful restoration of the tooth. There are many post and core system based on metal alloys. Though the metal posts are rigid and strong it can produce gray discoloration beneath translucent metal free ceramic crowns, limiting the esthetic potential especially when non precious alloys are used. The other disadvantages include potential for post and root fractures and a risk of corrosion.

Recently the use of esthetic or tooth colored posts have increased in the restoration of endodontically treated tooth or teeth with severe coronal destruction. The various non-metallic tooth colored posts used to enhance esthetics results are carbon fiber posts, zirconia posts, glass fiber posts [translucent quartz fiber] and woven fibers posts [polyethylene fibers]

These non-metallic tooth colored posts have their own advantage and disadvantages in the restoration of badly destructed anterior tooth. This article gives an overview to the various aspects of using variety of posts available for this purpose. Depending on the clinical situation, clinicians can now make their choice, for better esthetic results and prognosis.

DISCUSSION

A rapid development of ceramic technology is the contribution of metal-free restorations which provides increased esthetics and improved material strength. The different non-metallic tooth colored posts used to enhance esthetics of a grossly destructed tooth are, carbon fiber posts, zirconia posts, glass fiber posts, woven fiber posts. Each of these posts are discussed below.

CARBON FIBER POSTS

In 1990 Duret et al introduced a nonmetallic material for fabrication of posts based on the carbon fiber reinforcement principle. Carbon fiber posts consists of bundles of stretched carbon fibers embedded in an epoxy matrix. The original version was inherently black and unaesthetic. This was the first nonmetallic post to be introduced to dentistry. This endodontic post and core system is called composipost being used for 7 years in Europe and Canada and in U.S.A. since 2 years as C-post dowel^[1] [Figure 1]. The interface between the carbon filaments and the matrix is an organic composition. The carbon fibers by exerting uniform tension on the filaments, impart high strength to the posts. Composipost dowels are passive and are designed to be used with a bonding technique. The recommended core material is resilient composite, a BisGMA resin filled with short glass fiber and all bond 2.

Advantages

1. The clinical procedures for composipost dowels





- are less time consuming but expensive than conventional procedures for cast metal posts.
- 2. The carbon fiber post is strong but has significantly low stiffness and strength when compared to ceramic & metal posts.^[2]
- 3. Ease of its removal for re-treatment.

Disadvantages

- 1. The main disadvantage of carbon fiber posts is its black color and its radiolucency which makes it impossible to detect radiographically
- 2. Immersion in water reduced the strength and stiffness to about 60-70 %. The flexural strength of fiber posts was found to be similar to metal posts as long as contact with water was avoided. But the main concern related to the finding is that fiber posts do undergo degradation on repeated mechanical loading and moisture contamination, hence reducing the modulus of elasticity with an increased risk of debonding.

Common nonmetallic post systems available are:^[3]

Brand name	Type of post	Manufacturer
C-post	Carbon fiber	RTD/bisco
Cosmo post	Zirconium	Vivadent
Snow post	Zirconium	Danville
Fiberkor	Glass fiber	Jeneric/penetron
Lucent anchor	Glass fiber	Dentatus
Para post white	Glass fiber	Coltene/whaledent
Aestseti plus	Quartz fiber	RTD/bisco
DT light post	Quartz fiber	RTD/bisco

ZIRCONIA POSTS

In response to the need for a dowel post that possess good optical and biologic properties, compatible with an all ceramic crown these were developed in the late 1980s by Christel et al. These posts were made from fine grained tetragonal zirconium polycrystals(TZP)and is reported to possess high flexural strength and fracture toughness^[4,5] [Figure 2]. But ceramic materials are tough and have high compressive strength even though tensile strength is poor, hence when subjected to shear stresses ceramic posts itself fracture rather than root as in case of metals posts. By glass infiltration, dentin like shade is obtained of all-ceramic posts increasing the depth of translucency giving a natural appearance to final all ceramic restorations.

Advantages

- 1. For teeth with severe coronal destruction, composite restorative materials are known to lack the strength to resist deformation when used to support crowns. Hence zirconia dowels with zirconia enriched glass-ceramic cores are selected for adequate strength.
- 2. An alternative to composite cores bonded to Zirconia dowels, a new indirect technique allows the

addition of a heat pressed ceramic core to a Zirconia dowel to form an all ceramic tooth colored dowel and core. This will prevent the drawbacks of composite core buildup like high polymerization shrinkage, higher thermal expansion coefficient which will contribute to functional deformation and micro leakage

- 3. In-ceram alumina is an all ceramic post and core material having high biocompatibility, increased flexural strength and accurate fit.
- 4. The smaller zirconia posts (150050,090) might be used for an all ceramic post and core construction for narrower root canals where the other techniques are contraindicated.
- 5. The heat pressed technique is advantageous because of uniform all-ceramic post and core restoration is fabricated with a familiar technique that is followed for metal post and cores i.e, with pre-fabricated high precious metal posts. The combination of glass-ceramic and the zirconia ceramic material is used because of similarity of their thermal expansion coefficients which results in a corresponding shrinkage and a good fit after heat pressing procedure.

Disadvantage

- 1. Adhesion to tooth and composite is compromised which becomes a problem for retreatment.
- 2. Another disadvantage is that zirconia posts are brittle with inherently high modulus of elasticity, hence are not indicated for patients with bruxism.^[6]
- 3. Zirconia post when used with a direct resin composite buildup, large stress bearing composite buildups in combination with sub gingival margins should be avoided. As composite exhibit high polymerization shrinkage with a higher thermal expansion coefficient than the tooth which may contribute to micro leakage and under functional forces allow deformation.

GLASS FIBRE POSTS

The disadvantage of carbon fiber and other post system is overcome by replacing them with glass fiber. Glass fiber supported resin dowel systems were introduced in 1992. The dowels are composed of unidirectional glass fibers embedded in a resin matrix that strengthen the dowels without compromising the modulus of elasticity.^[7] [Figure 3]. Recently new quartz fiber post systems such as light- post DT (RTD) with tapered design are introduced to obtain better adaptation to the root canal preparation.^[8]

Advantages

- 1. The biggest advantage is that the modulus of elasticity is close to that of the dentin. Since these are made from resin, the bond strength of resin cement



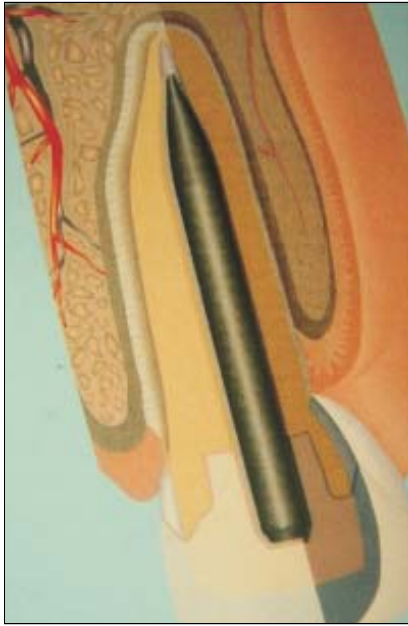


Figure 1: Carbon Fibre Post [Mirafit]



Figure 2: Zirconia Posts (Cosmo Post)

- is enhanced with esthetic advantage.
2. Another advantage of glass fiber is that they distribute stress over a broad surface area, increasing the load threshold.

Disadvantages

1. Variable radiopacity among brands.
Polyethelene woven fiber: These posts are suggested for use with composite to fabricate dowels and cores. Ribbond is polyethelene woven fiber which is commonly available, with the adhesive restorative materials [Figure 4]. Esthetic dowels and core foundation can be made more easily.
One of the study revealed polyethelene ribbon fibers^[9] is an alternative for restoring badly destroyed primary incisors. These fibers offer root and coronal retention along with stability and esthetics. This study analysed

the fracture resistance between non-pre-impregnated resin fibers (glasSpan) and pre-impregnated resin fibers (Splint-it) which had been used as post and core in the restoration of primary teeth. The observation of the study revealed that adhesive failures were noted among glasSpan type at junction between the fiber and its core to the interior wall of the root canal. But in Splint-it type fibers dislodged out of the canal and the core part of the canal remained intact. Hence, concluded that Splint-it offered a better fracture resistance when used as post in endodontically treated primary anterior teeth.

Advantages

1. The advantage of fiber dowel systems is a modulus of elasticity is close to that of a dentin thus reducing the incidence of root fracture and dis-



Figure 3: Para Post Fibre White



Figure 4: Ribbond - Thm (Fibre Splint Post And Core)





play higher survival rates than teeth restored with zirconia dowels.

Disadvantages

1. The disadvantage of fiber posts is that they undergo degradation on repeated mechanical loading and moisture contamination, hence reducing the modulus of elasticity with an increased risk of debonding.

CONCLUSION

There has been significant development in post systems in recent years with respect to post and core construction materials, Post shape and design, bonding systems and techniques for removal. Carbon fiber posts have generally been super ceded by quartz, silica and glass fiber reinforced materials. One advantage of fiber reinforced systems is that modulus of elasticity of the post is similar to tooth tissue hence post failure should occur before root fracture under conditions of stress. The flexural strength of fiber posts was found to be similar to metal posts as long as contact with water was avoided. But the main concern related to finding is that fiber posts do undergo degradation of repeated mechanical loading and moisture contamination. Hence, reducing the modulus of elasticity with an increased risk of debonding.

An all ceramic posts and cores cemented with adhesive technology with all ceramic crowns provide better light transmission and reflectance to simulate natural translucency with excellent bio compatibility. But disadvantage of these is the brittle nature of ceramic.

Hence a long term clinical evaluation has to be performed of different esthetic post materials so as to be recommended as an ideal and suitable material for post and core fabrication.

REFERENCES

1. Margareta Fredriksson, A retrospective study of 236 patients with teeth restored by carbon fiber-reinforced epoxy resin posts. *J Prosthet Dent* 1998;80:151-7
2. Rosensteil. *Contemporary of fixed Prosthodontics*; 3rd Edn. p. 295
3. Schwartz RS. Post placement and restoration of endodontically treated teeth-A literature review. *J Endodont* 2004;30:289-301
4. Akkayan B. An in vitro study evaluating the effect of ferrule length on fracture resistance of endodontically treated teeth restored with fiber – reinforced and zirconia dowel systems. *J Prosthet Dent* 2004;92:155-62
5. Kakehashi Y. A new all-ceramic post and core system: clinical, Technical and vitro results. *Int J Periodont Rest Dent* 1998;18:587-93.
6. Toksavul S. Esthetic enhancement of ceramic crowns with Zirconia dowels and cores – A clinical report. *J Prosthet Dent* 2004;92:116-9.
7. Usume A. Microleakage of endodontically treated teeth with different dowel systems. *J Prosthet Dent* 2004;92:163-9.
8. Qualtrough AJ. Tooth colored post system. *Rev Op Dentist* 2003;28:86-91.
9. Island G. Polyethylene ribbon fibers: A new alternative for restoring badly destroyed primary incisors. *J Clin Pediatric Dent* 2005;29:151-6.
10. Spi Roso. Koutayas. All ceramic post and cores; The state of the art. *Quintessence Int* 1999;30:383-92.

