

## Review Article

# Recent Advances in Post Systems: A Review

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### ABSTRACT

Preservation of natural tooth in dental arch is ultimate objective of dental treatment. After endodontic treatment, tooth becomes brittle and prone to fracture which results in reduction of strength of crown causing fracture of cusp or sometimes weakness of the roots. In order to strengthen crown some anchorage within teeth has to be made and that anchorage and support is gained by rigid structure which is known as post. This article focuses on recent advances in post systems and their application, merits and demerits in endodontics..

### Introduction

The longevity of endodontically involved teeth has been greatly enhanced by continuing developments made in endodontic and restorative procedures.<sup>1,2</sup> Endodontic treatment saves the tooth from extraction, but only adequate restoration is essential for its durability. The endodontically treated tooth must be restored in such a way that it will withstand masticatory forces acting in vertical and lateral direction without being prone to fracture. To reinforce the treated tooth and protect against vertical fracture, some type of stabilization is required that will fasten the restoration to the remaining

tooth structure. This is accomplished by using a post (also referred to as a dowel), preferably with a core or coping and a crown or onlay as superstructure to give coronal-radicular stabilization.

A variety of materials have been used for posts ranging from wooden posts of the 18th-century to metal posts and, more recently, carbon fiber, glass fiber and ceramic posts.<sup>3,4</sup> With a variety of post systems available and by the fact that new posts are introduced before existing ones are fully evaluated in laboratory and clinical studies; it becomes often difficult to decide which one to use.<sup>5,6</sup> Newer post systems are continuously being

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introduced into the market. The general trend is towards more aesthetic dentistry and a keen interest to achieve good appearance and translucency due to which the restoration should mimic that of a natural tooth.

### Classification

Since past, cast or prefabricated metal posts have been used exclusively as foundations for indirect restorations. But with the emphasis on aesthetic outlook, posts and core with composite and ceramic materials having dual function and double taper have been introduced as alternatives.

Posts can be classified in a number of different ways:

- 1) Active or Passive
- 2) Parallel or Tapered
- 3) By their material composition<sup>7</sup>

1) Depending on how retention is achieved, posts can be divided into two main subgroups-

- Active posts
- Passive posts

Active posts derive their primary retention directly from the root dentine by the use of threads whereas Passive posts gain retention as their name suggests by passively seating in close proximity to the post hole walls, and rely primarily on the luting cement for their retention.<sup>5</sup>

2) According to its general shape, each post can be divided into either

- Tapered or
- Parallel sided

In general, active posts are more retentive than passive posts of a similar method of configuration, and parallel-sided posts are more retentive than tapered posts.<sup>5</sup>

### Based on composition

Other classification of posts is based on composition.

- Composite Materials
- Ceramics<sup>7</sup>

### Based on composite materials

Composite materials are composed of fibers of

- CARBON
- SILICA

These fibers are surrounded by a matrix of polymer resin, usually an epoxy resin. They also include light transmitting posts & ribbon fibre post.<sup>8</sup>

The various types of composite materials post can be grouped as:

#### • Silica Fibre Post<sup>8</sup>

- Aestheti Post
- Aestheti Plus
- Para Post
- Snow Post

#### Light Transmitting Post<sup>8</sup>

- Double Taper Light Post
- Luscent Anchor Post
- Twin Luscent Anchor Post

#### Ribbon Fibre Post<sup>8</sup>

- Ribbond

#### Based on Ceramics<sup>8</sup>

- Cosmopost

### Fiber-Reinforced Resin Post Systems

Fibre-based post systems have been the subject of a recent systematic review by Bateman et al 2003.<sup>9</sup> These posts are made of carbon, quartz or glass fibres,

embedded in a matrix of epoxy or methacrylate resin. The adhesion between quartz or glass fibres and resin matrix is enhanced by fibre silanization prior to embedding.<sup>5</sup> The main advantage of these posts is that by flexing slightly under load, they distribute stresses to the root dentine in a more favorable manner than metal posts.<sup>5</sup> The addition of fibers to a polymer matrix; have enhanced mechanical properties like strength, fracture toughness stiffness and fatigue resistance.

### CARBON FIBRE POST

Carbon Fibre posts have been successfully used by dentists because of their strength and relative flexibility, ease of placement or ease of removal, if necessary, for endodontic retreatment. The black colour of carbon posts alter the aesthetic effect and hence they cannot be used in clinical situations in which subsequent non-metal and translucent crowns are planned.<sup>10</sup>

### SILICA FIBRE POST

Glass fibre has physical properties similar to those of carbon fibre posts and now have been substituted to overcome the limitation of these above mentioned posts.<sup>10</sup>

### Aestheti Post

It retains a core of carbon fibre bundle surrounded by quartz fibres similarly arranged longitudinally.<sup>10</sup>

### Aestheti Plus

It is also composed entirely of Quartz Fibres. The traditional posts include white or clear quartz fibers.<sup>10</sup>

### Para Post X Post System

This system includes prefabricated parallel side serrated posts. Each of the four posts incorporates a raised diamond retention pattern which provides increased retention and resistance to torque and oblique forces. Two passive posts, Parapost XP and Parapost XH are available. Parapost XH provides extra retention and safety especially in conditions requiring mechanical retention. Parapost XP casting kit has calibrated components in widely flared canals. All Para Post X systems can be used with standard Para Post drills and the depth is now marked at 7mm, 9mm and 11mm from the apical end to help maintain proper post space depth. Figure 1 shows ParaPost XP System<sup>12</sup>

### Parapost Fiber White System

To enhance the features of the existing Para Post system, Fiber White has longitudinally arranged glass fibres. The post is essentially parallel and has small steps for



FIGURE 1 : PARAPOST X SYSTEM

mechanical retention of the luting cement. The post has white translucent color that minimizes shadowing. It is metal free and the fiber matrix strengthens the structure without compromising flexibility. The head of the Fiber

White post is antirotational and has two rounded sections to help in retention of the core material. It is available in diameters of 1.14 mm, 1.25mm, 1.4 mm and 1.5 mm. Each post has a removable color-coded ring around the head for identification. Figure 2 shows ParaPost Fibre White System.<sup>11</sup>



FIGURE 2 : PARA POST FIBRE WHITE SYSTEM

### Snowpost

Professor Bois and his colleagues at Lyon, developed Snowpost by originally researching on carbon fibres. Snowpost is composed of 60% longitudinally arranged silica zirconium glass fibres in an epoxy resin matrix. Its shape is cylindrical and has a 3° tapered apex. Four diameters of sizes 1 mm, 1.2 mm, 1.4 mm and 1.6mm – are contained in the complete kit, together with matching burs. The tapered end is 4 to 6 mm long.<sup>11</sup>

### LIGHT TRANSMITTING POST

Innovative systems have recently been developed for reconstituting roots with overly flared canals caused by caries or excessive endodontic preparation and to rehabilitate aesthetically and structurally weakened teeth. These include the light transmitting posts and their main purpose is to achieve union between the remaining dentine and a light-cured composite to restore the lost bulk and original strength of the root thereby functioning as a dentin replacement and structural reinforcement.<sup>11,13</sup>



FIGURE 3: SNOWPOST

### Double Taper Light Post

The capacity of different types of post-and-core to protect the prosthetic restoration from biomechanical failures varies greatly. The new DT- Post system (DT for double taper) was designed with the purpose of providing close canal adaptation with minimal tooth structure removal by providing a subtle taper. The DT

light post system has fibre optic construction and can be cemented with light cure or dual cure materials.

It has translucent shade and a light transmission capacity of  $9.1 \text{ mW/cm}^2$ . It is radiopaque and is available in various sizes of 1.25mm, 1.5mm, 1.8mm and 2.2mm. It is tapered, made up of quartz fibre and has passive insertion. The translucency allows the post to be used under all restorations without opaquers and radiopacity allows the post to be seen clearly in radiograph. Figure 4 shows Double Taper Light Post System.<sup>14</sup>

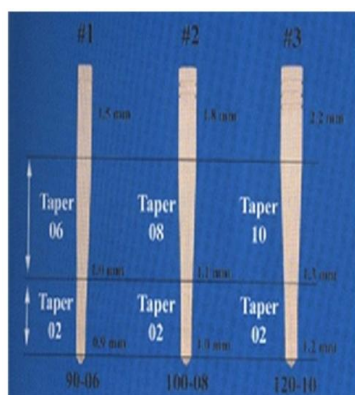


FIGURE 4: DOUBLE TAPER LIGHT POST

### Luscent Anchor Post System

The Luscent Anchor post (Dentatus) is a fiber-glass, clear resin post that is designed to refract and transmit natural tooth colors for esthetic post-and-core foundations. It is formed from glass fibres embedded in resin matrix.<sup>11</sup> They bond to the composite core crown complex and offer benefits in transilluminating light, radiolucency, retention and superb aesthetics. They are offered in 6 sizes and diameter combinations, ranging from 15 mm long and 1 mm diameter up to 19 mm long and 1.80 mm diameter. Whenever required for endodontic retreatment, the Luscent Anchor can be easily removed.<sup>15</sup>

Luscent Anchors posts can homogeneously attach to the canal and core material, creating a monobloc for exceptional strength and longevity. The resulting post and core is retentive and anti-rotational because sound radicular and coronal structure is maintained.<sup>15</sup> They reinforce thin walled roots through resin bonding internal root splinting.<sup>16</sup> The integral bonding of Luscent Anchor to composite core/crown complex provides durable support with natural background hues for esthetic restorations. Figure 5 shows Luscent Anchor Post system<sup>15</sup>



FIGURE 5: LUSCENT ANCHOR POST

### Twin Luscent Anchors Light Transmitting posts

*Twice the Invention, Twice the Retention!*

Tapered, light-transmitting, fiber glass-reinforced resin posts with a unique groove that starts near the apical end, stops around mid-post, and then starts again. This causes the post to have an hour-glass-like profile, with subtle bulges in the apical and coronal sections and a narrow area midpost. This innovative design is visible assurance against accidental debonding of adhesive and resin-core

materials. The slim mid-section creates a “physical choke”. By eliminating air resin entrapment, the vent groove prevents rotational dislocation. It all adds up to a great combination of light transmission, attractive esthetics and twice the retention.<sup>17</sup>

It has the following features:

- 1) Aesthetic
- 2) Provides monobloc strength
- 3) Narrow midradial section which provides double retention
- 4) Longitudinal vent groove providing anti rotational resistance
- 5) Convenient and fast to use

The posts are available in four colors and sizes:

- 1) White is extra small with size of 1.26 mm
- 2) Yellow is small with size of 1.40 mm
- 3) Red is medium with size of 1.54 mm
- 4) Blue is large with size of 1.68 mm

It has a low modulus of elasticity of 20.1 GPa and a flexural strength of 579 MPa. It has a light transmission capacity of 11.9 Mw/cm. Figure 6 shows Twin Luscent Anchor Light Transmitting Post.<sup>17</sup>



FIGURE 6: TWIN LUSCENT ANCHOR POST

## BONDABLE REINFORCEMENT FIBER POST (RIBBON FIBRE POST)

This method uses a bondable reinforcement fiber, a fourth-generation bonding agent and a dual-cure hybrid composite as the core build-up. The reinforcement material used for the post consists of polyethylene woven fibers that are treated with a cold-gas plasma. The use of cold gas plasma treated polyethylene woven fibers embedded in conventional resin composite has been advocated for corono-radicular stabilization of pulp-less teeth. For this technique to work well, there should be sufficient light to reach the depth of the post space.<sup>18</sup>

Ribbon Inc. suggest that their woven polyethylene fibre can also be used to construct a directly placed composite post and core.<sup>8</sup>

Ribbon maintains the natural strength of the tooth and eliminates the possibility of root perforation. It conforms to the natural contours and undercuts of the canal and provides additional mechanical retention. There are no stress concentrations at the tooth-post interface. The Ribbon post and core is passive and highly retentive<sup>18</sup>. Figure 7 shows Ribbon Fiber Post.

## CERAMIC POST AND CORE

The primary ability of ceramic materials to mimic the appearance of tooth structure has been combined with improvements in strength and durability and has



FIGURE 7: RIBBON FIBRE POST

permitted the use of all-ceramic restorations in situations, where previously only metal-reinforced restorations would have been placed. The use of ceramic to provide a core and post retention continues the idea of using a tough but aesthetic material to support all ceramic units without affecting their optical properties. The introduction of zirconium oxide ceramics has provided a material with over twice the flexural strength of aluminous ceramic systems, which is therefore able to be used to construct posts of realistic diameters.<sup>11</sup>

Zirconia ceramics have been shown to be biocompatible. Building a core of ceramic directly onto the zirconia posts has not been possible owing to the different coefficients of thermal expansion of the core and post materials, which would result in fracture of the core.<sup>11</sup>

Zirconium root canal posts have been shown to be more rigid than stainless steel posts. Aesthetic zirconium ceramic posts are available in traditional shapes and can be used in round root cross sections. They are radiopaque, biocompatible and mechanically rigid and can be bonded to variety of ceramics using resin luting materials as well as composites.<sup>13</sup>

### Cosmopost

It is a ceramic post system and is indicated mostly in aesthetically important anterior region of maxilla and mandible. Cylindrically shaped with a conical tip, the Cosmopost is available in two relatively wide diameters (1.4 mm and 1.7 mm).<sup>11,19</sup> The 1.4mm post is generally indicated in the anterior region: only for the lateral incisors and in the mandible for the central and lateral incisors whereas the 1.7mm Cosmopost is used for which the diameter of the coronal part of the root or the coronal endodontium clinically indicates a 1.7-mm root canal post. These teeth are usually the four canines and the central incisors in the maxilla.

Depending on the clinical situation, both the 1.7-mm and 1.4-mm Cosmopost can be used in the posterior region. Generally, the 1.4-mm post is used for maxillary and mandibular premolars, while the 1.7-mm post is used for molars (distal canal in the mandible, palatal canal in maxilla).

The posts, as manufactured, have a relatively smooth surface and are subsequently treated to roughen the surface, which increases the bond strength between the post and core, whether heat pressed or luted. Figure 8 shows Cosmopost Ceramic post system.



FIGURE 8: COSMOPOST

## Summary

Various posts systems have been introduced in the market and the research indicates that they can be safely included in the clinical practice. The selected post and core technique must be conservative, morphologic, retentive, aesthetic and resist radicular failure. The available laboratory and clinical evidence validates the utilization of fibre posts as an alternative to metal posts and preferably to other tooth-colored posts, such as zirconia dowels, in post-retained restorations. Each clinical situation will dictate to some degree what post system will be used and for those situations where there is choice, personal preference, familiarity and cost will influence the final decision.

However, clinicians are advised to follow guidelines and recommendations for post selection and core fabrication followed by crown design.

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