USING FIBER POSTS

to reinforce and restore traumatically fractured incisors

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Upon completion of this course, the participant will be able to:

- List the criteria for selection of a bondable, fiber post
- List the indications for a fiber post
- Describe the technique and materials for placing a bondable, fiber post

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CONVENIENCE—Review the latest information on fiber posts and related materials in a concise and consolidated format.

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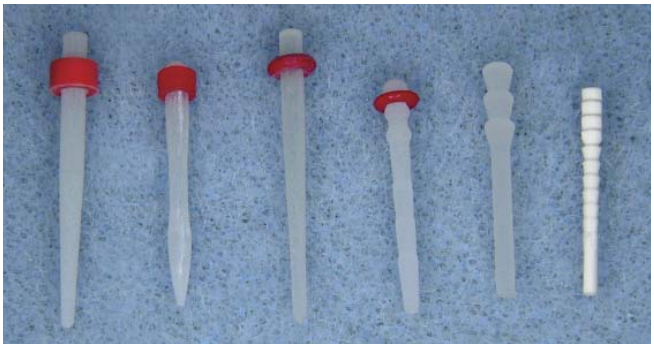
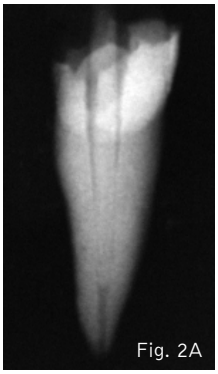


Fig. 1: Examples of fiber posts. Note the differences in shape, opacity and translucency. (L-R: RelyX Fiber Post, 3M ESPE; UniCore, UltraDent; Twin Luscent, Dentatus; DT Light Post, Bisco; Parapost Taper Lux, Coltene-Whaledent; CoreTEC Post, Benco Dental; Peerless Post, Kerr)

Dental injuries that occur during athletic activities have been estimated by the National Youth Sports Foundation to affect 15 million Americans annually. [1] For any teenager playing sports, there is a 1-in-10 chance of suffering a facial dental injury during a single athletic season. It has been estimated that the maxillary central incisors are at the greatest risk of a traumatic injury. While such injuries are preventable by wearing a protective athletic mouthguard,[2] children with this type of injury require immediate attention.[3] Children's anterior teeth must be restored in a timely manner without compromising the continuing development and eruption of the tooth in the arch while at the same time maintaining its esthetic appearance.

When teeth are traumatized, fractured or luxated, there are important guidelines for an appropriate treatment plan and treatment that should be followed to maintain these teeth in the oral cavity.[4] For a very young child with early eruption of the maxillary incisors, the most frequently encountered problem is the interruption in the apical closure and root development when these teeth are traumatized or fractured and their pulp subsequently becomes non-vital. This leads to an enlarged root canal and in some cases to an open periapical root canal apex. While the process of apical closure can be managed with adjunctive endodontic therapy using calcium hydroxide and then completed with conventional endodontic therapy, the root canal will maintain its immature size and remains more flared, especially in the CEJ area.[5] Other techniques of apical closure include the placement of MTA (6) These thin-walled teeth can have a guarded prognosis.[7] Restoration with a cast metal post and core is contraindicated because this closely adapting rigid post can lead to undesirable wedging effects leading to vertical root fracture.[8]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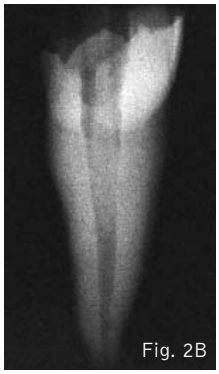
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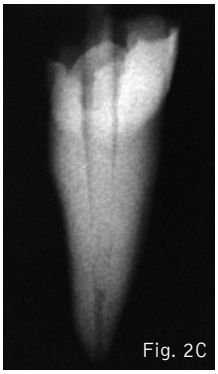
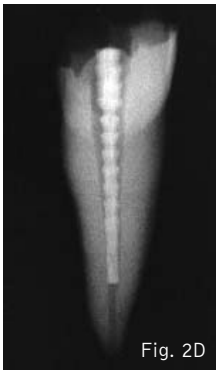


Fig. 2C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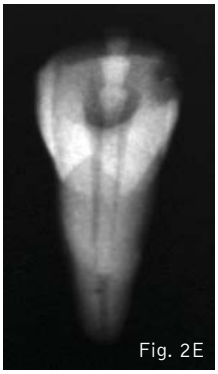


Fig. 2E

Fig. 2: Examples of differences in radiolucency with fiber posts
A. DT Light post (Bisco)
B. Twin Luscent Anchor (Dentatus)
C. RelyX Fiber Post (3M-ESPE)
D. Peerless Post (Kerr)
E. CoreTEC Post (Benco)

Until recently, the only way to combat the problem of vertical root fracture was to restore the pulpless tooth using a ferrule design with a cast post and core and cast crown.[9] Research has shown that thin-walled, endodontically-treated teeth can be restored and reinforced using dental adhesives with composite resin in the root canal.[10-14] One technique to restore a tooth in this manner is to use a Luminex Light Transmitting Post (Dentatus, New York, NY) which allows the practitioner to use light cure adhesives and composite resin to restore structurally compromised teeth.[15] After light curing the Luminex Smooth Light Transmitting, the post is removed, creating a new centered "canal" surrounded by composite resin that is intimately adapted and bonded to the dentin of the root canal. This provides for root strengthening and reinforcement.[12, 14] After the dentin has been replaced with bonded composite resin within the root canal and a new more narrow new root canal has been fabricated with this technique, a post can be placed. Either a metal post or a bondable fiber post can be placed depending on the needs of the tooth. While this is an effective technique, in the anterior esthetic zone, a translucent fiber post may be a better choice if the tooth is being restored with translucent, esthetic restorative materials—composite resin, porcelain veneers, or an all-ceramic crown.[16] In fact, metal posts in proximity to the gingival interface frequently create shadows and discolored gingival tissues due to shine-through that can adversely effect esthetic results. Even if not immediately apparent, shine-through can eventually become more obvious with changing heights of the gingival margin over time.[8, 9, 16, 17] Because of the esthetic problems associated with metal posts, the bondable, tooth-colored resin fiber esthetic posts were developed.

Fiber-reinforced posts are not as rigid as metal or ceramic posts. Some of the focus with fiber reinforced posts has been their ability to flex like the tooth. While it has been demonstrated that there is flexion of teeth in function, the definitive restoration of any tooth should create an integrally sealed element that does not yield, bend or flex. A number of studies have focused on functional stresses

to the tooth crown when it is restored with a post and bonded composite resin versus restoring with an integral cast metal post and core. The results of these studies have demonstrated that failure occurs at the interface between the restorative material and the tooth.[18, 19] The thinner the root, the greater the flexion which results in an increase in microleakage at the restorative material-tooth interface. In fact, Reeh and coworkers evaluated reduction in tooth stiffness as a result of endodontic and restorative procedures.[20] They found that the tooth was inherently stiff and resistant to flexion. Once a tooth was prepared, the rigidity of the tooth was reduced. An occlusal cavity preparation reduced tooth stiffness by 20% and loss of marginal ridge integrity with an MOD preparation reduced cuspal stiffness by 63%. In comparison, an endodontic access preparation reduced relative tooth stiffness by a mere 5%. Flexion of the post should not be the issue. Instead, the focus should be on the ability of a post to dissipate the energy of function and trauma.

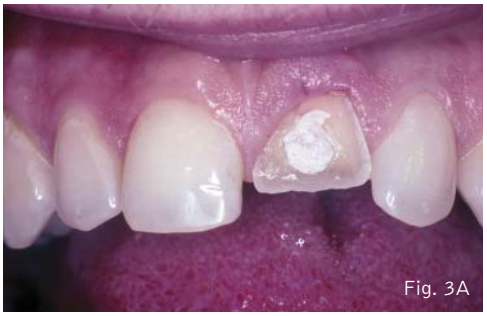


Fig. 3A

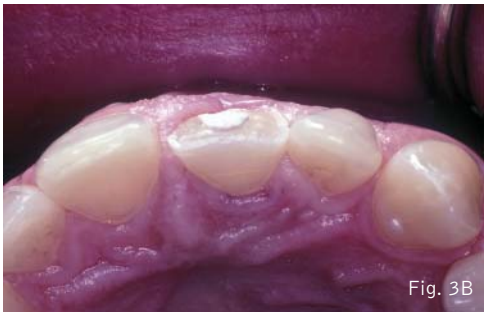


Fig. 3B

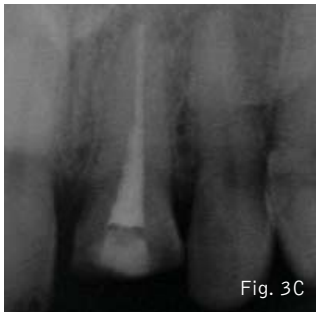


Fig. 3C

Fig. 3: Traumatic fracture of the maxillary central incisor
A. facial view
B. lingual view
C. radiographic view

While metal posts both custom and prefabricated have been the standard for many years, there has been the introduction of non-metallic posts to address the need for a more esthetic material in the anterior region. In the last several years, there have been significant advances in the development of bondable, fiber-reinforced, esthetic posts to reinforce endodontically treated teeth.[21-24] Fiber posts are improvements on other types of esthetic posts used in the past. The specific needs of light translucent composite resins and ceramics to mimic natural tooth requires the use of translucent posts to replace metal posts in the esthetic zone of the oral cavity.

Clinical trials with fiber posts have demonstrated clinical success. Over a 7-11 year period with the placement of 985 fiber posts, there was a 92% survival rate.[26] Recent articles have supported the use of fiber posts to restore endodontically treated teeth.[27-29] In a study evaluating post retention, it was found that serrated parallel-sided stainless steel posts were no more retentive than parallel-sided or tapered tooth-colored fiber posts.[30] When a fiber reinforced post is bonded within the root canal, it dissipates functional and parafunctional forces reducing the stress on the root.[25, 31] When a catastrophic force is placed on the crown of the tooth, the post or crown will fracture instead of the post transmitting the energy of force down the root creating a vertical root fracture.[32-35] Nicholls described an engineering approach when restoring endodontically treated teeth by using a design that includes a failsafe system that should prevent irreparable damage to the root when failure (fracture) occurs.[36] Nicholls further stated that when restoring the tooth, all remaining dentin – even the slivers – be maintained so that the tooth can be restored with an adhesive technique from within the root canal to the core for the crown. Consequently, the criteria when selecting a post system should be one that is able to dissipate or absorb the function of energy and even overcome moderate trauma. Fiber-reinforced posts have demonstrated the ability to fracture at the coronal portion of a tooth restoration with the presence of catastrophic forces without fear of root fracture.[37] This may be the single most compelling reason for their use. Also, research has demonstrated the ability of resin bonding with the root canal to reinforce endodonntically-treated teeth.[38, 39]

Further, to assure clinical success, at least one-quarter of the crown structure should remain for tooth preparation. Less tooth structure will contribute to flexion of the crown and potential post fracture.[19, 22]. Also, having at least one-quarter of the crown remaining will allow for the development of at least 1.5-2.0 mm of ferrule. (A ferrule refers to the development of a preparation margin that has a width apical from the tooth with the margin extending 360 degrees circumferentially around the tooth.) The influence of the remaining coronal tooth structure increases the fracture resistance of the restored endodontically treated tooth, especially in the anterior region. This amount of ferrule when preparing teeth will assure clinical success. [40-44]

How does one select what type of fiber-reinforced esthetic post to use? An esthetic post should be translucent similar to tooth structure so that it will transmit light similar to that of tooth structure. The post and restorative material should minimize esthetic failure by maximizing light transmission through an all-ceramic crown, porcelain veneer or composite resin. Even when a porcelain metal crown is to be used, root shadowing of metal posts can cause a "graying out" phenomenon. When a composite resin is being used either as a definitive restoration or as a foundation core for a crown, the post should bond to the composite resin, thereby creating a unified structure.(45) Because the post is to be bonded to the dentin within the root canal, post length need only be the same length as the height of the tooth (clinical) crown or at leastone-half the length of the root canal. The post should also be chemically integrated into the color and translucency of the composite resin surrounding it.

The post should be easy to work with. Preparation of the canal, surface preparation of the post, adaptation of the post to the root canal and cementation should involve a minimal number of steps to achieve the greatest clinical success. The post selected to restore the tooth should match the diameter of the root canal and not exceed one-half the diameter of the root. Guttman outlined criteria for anatomic and biologic considerations when restoring endodontically-treated teeth.(32) He stated that thin tapering roots and anatomic irregularities and tooth thinness can contribute to perforation and root weakening during root canal preparation for post placement. Parallel-sided posts, when chosen, should be sized so that additional tooth root preparation is not required to remove tooth structure where the tooth root is thinnest, at the apical third of the root.

When choosing an esthetic post system, there are a number of criteria that the post must fulfill to guarantee clinical success.(46) These include:

1. light transmission to eliminate shadowing of the post within the tooth to maximize esthetics of the final restoration;
2. ability to be bondable within the root canal for root reinforcement;
3. when the root canal is tapered: ability to be placed without having to remove additional dentin within the root canal at the apical region of the root that can compromise the prognosis of the tooth;
4. chemical properties and surface characteristics that increase retention (e.g., a resin matrix with glass fibers that are bondable to resin cement, serrations or a retentive design of the post and for the core, a retentive head design may be indicated);
5. impact absorption and dissipation if the coronal portion of the tooth crown is traumatized;
6. ease of removal with an atraumatic technique if the post breaks or endodontic retreatment is necessary;
7. multiple sizes to fit different root canal diameters.
8. radiopacity

With the current generation of fiber-reinforced composite posts, many different systems will fulfill these criteria. (Fig. 1)

Translucent fiber posts have been demonstrated to transmit light to eliminate shadowing of the soft tissue adjacent to root surfaces which can adversely effect an esthetic result.(17, 22, 46-49) Adhesion of the fiber post within the root canal has been shown to be clinically acceptable and root reinforcing.(33, 50-53) These posts have been shown to have a failsafe design where the post will fracture before the root will.(31-35, 51) A concern has been expressed that since the posts are fabricated from fiber-reinforced composite resin, removal will be difficult. In the case of a metal post, the technique for removal has been exposing the post, applying ultrasonic forces to break the cement/post interface and then grasping the post with a post-pulling instrument for removal.(54) Several evaluations of removal techniques have shown that the use of endodontic rotary instruments within the root canal can effectively and efficiently remove fiber posts essentially by hollowing them out of the root canal.(55, 56) Radiopacity of fiber

Fig. 4: Luscent canal reamer (Dentatus) verifying length needed for Twin Luscent Anchor placement.

Fig. 5: Twin Luscent Anchor (Dentatus) was fitted to the root canal.

Fig. 6: Excess etchanol was removed from the root canal using a paper point.

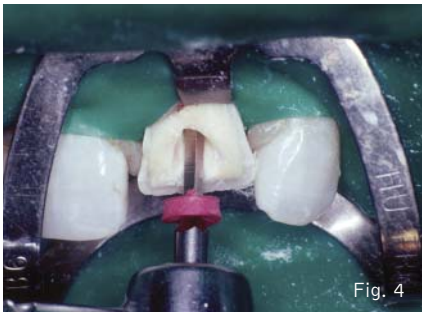
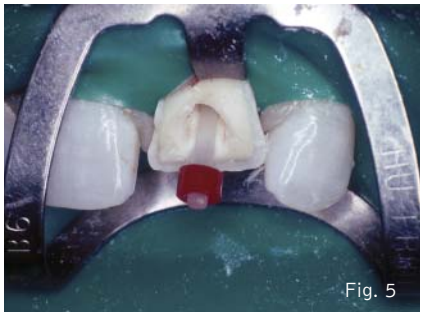


Fig. 4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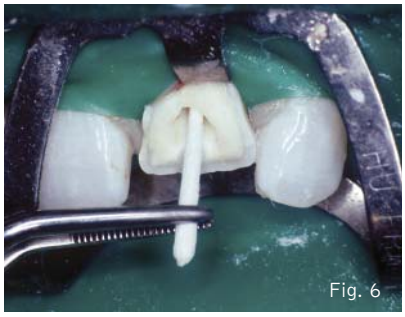
Fig. 6

posts has a great variability.[48, 57-59] Unlike metal posts that are very radiopaque and easily visible in radiographs, most fiber posts are similar to the radiopacity of dentin.(Fig. 2) Currently, the kits provided by manufacturers have a variety of diameters and designs to meet the requirements of post placement within a root canal when restoring an endodontically-treated tooth.

CASE REPORT

A 16-year-old boy was treated at the dental school as a result of the fracture of a maxillary central incisor while playing basketball without wearing a protective mouthguard. An elbow hit the child's mandible, forcing the mandibular incisors into the incisal edge of the maxillary incisor, cleaving the facial enamel from the tooth, resulting in pulp exposure. Radiographs were made of the maxillary and mandibular incisors. They revealed no evidence of root fractures. The maxillary central incisor was treated endodontically. (Fig. 3) After eight weeks, an additional endodontic evaluation of the other maxillary and mandibular incisors revealed normal pulpal vitality. Because of the patient's age, it was decided to restore the tooth with a bondable, fiber-reinforced esthetic post with a direct composite resin veneer until the child was old enough to receive a more definitive restoration.

CLINICAL TECHNIQUE

Canal preparation and post try-in

After rubber dam placement, the glass ionomer temporary endodontic stopping (Fuji Triage, GC America, Alsip, IL) was removed from the access opening with a 330 bur (SS White, Lakewood, NJ) in a high-speed handpiece with water spray. A glass ionomer was used as the provisional seal for the access opening due to its adhesion to the tooth combined with its fluoride release. The post space was made based upon the post-obturation radiograph to have a length of at least half the length of the root. The gutta percha was removed from the canal using a Touch n' Heat instrument (SybronEndo, Orange, CA) but a heated endodontic instrument can also be used to remove the gutta percha.

Rotary instrumentation within a root canal should be used judiciously to avoid root canal perforation. During the initial endodontic treatment, the root canal instrumentation should be made to accommodate the post diameter desired. For this case, the canal was not enlarged from the original root canal filling. It is important to make a radiograph after determining the length of the final canal preparation and removal of the endodontic filling. This is done prior to post placement in order to verify gutta percha and endodontic sealer removal while maintaining at least a 4-5 mm apical seal. Failure to remove the gutta percha and/or cement sealer from the canal walls can interfere with the bonding of the resin cement and the potential for root reinforcement within the root canal.

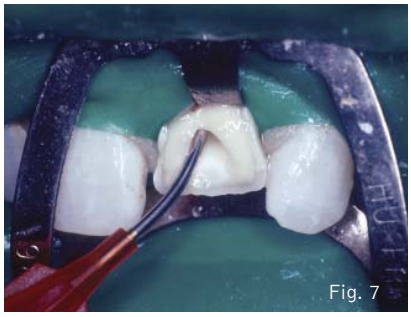
Fig. 7

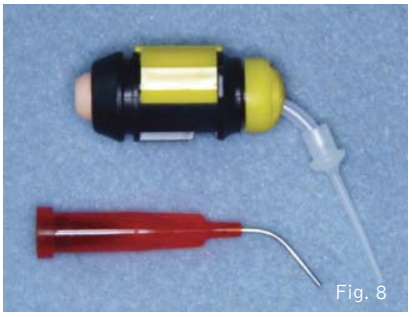
Fig. 8

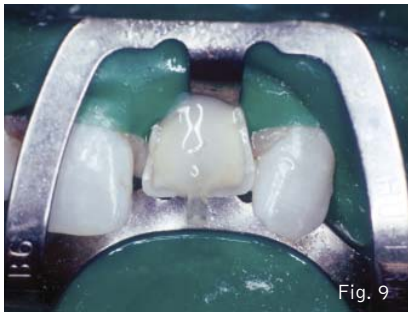
Fig. 9

Fig. 7: The universal self-adhesive composite resin cement, RelyX UniCem (3M ESPE), was injected into the root canal using an AccuDose NeedleTube (Centrix).

Fig. 8: Top, RelyX UniCem capsule with extended obturator tip (3M ESPE). Bottom, AccuDose NeedleTube (Centrix).

Fig. 9: The Twin Luscent Anchor was gently seated into the root canal. Excess cement was removed before light curing.

It was decided to reinforce the root canal with a Twin Luscent Anchor (Dentatus, New York, NY). The Twin Luscent not only fulfills the aforementioned basic criteria but it also has an hourglass shape that enhances retention.[60] Today, the cement of choice with any bondable fiber-resin post is a self-adhesive universal composite resin cement. These cements offer an alternative to multiple steps and potential contamination due to insufficient irrigation of a phosphoric acid etchant within the root canal and inadequate light curing of an adhesive within the root canal. This family of universal resin luting agents have a self-adhesive capability and eliminate the need for separate etching, rinsing and drying, primer and adhesive steps.[61, 62]

The root canal was sized for selection of the Twin Luscent Anchor using the canal reamer. (Fig. 4) The depth of the canal preparation was cross-verified by placing a matching size of Twin Luscent Anchor into the canal with the length verified using a red stopper (Fig. 5). This stopper is also useful when cutting the Twin Luscent Anchor to length. It can be placed to length desired and used as a guide before cutting the post to the length desired. For any fiber post, if it needs to be shortened, the post should be cut to length using either a diamond bur in a high speed handpiece with water spray or with a straight nosecone, slow-speed handpiece using a separating disk. Never use a fluted bur to cut a fiber post. A fluted bur will cause a shattering and separation of the fibers within the resin post.

Intraradicular dentin bonding and root-reinforcement

The canal was irrigated and flushed of all debris created during the canal preparation. At this point, the root canal was ready for the cementation of the fiber post. In many cases, the practitioner may not know what type of sealer was used within the root canal. Reported studies have implicated eugenol provisional cements with reduction in retention of restorations cemented with resin luting agents.(63, 64) Tjan and Nemetz investigated the effect of eugenol-containing endodontic sealer on retention of prefabricated posts cemented with an adhesive resin technique.(65) They found that the presence of eugenol within the root canal resulted in a significant loss of retention of the post. However, they also found the residual eugenol remaining in the root canal could be removed without any effect on the retention of the post when using a resin adhesive technique by irrigating the root canal with ethyl alcohol (ethanol). The excess alcohol must be removed from the root canal and the root canal dried using paper points and an endodontic root canal canula tip aspirator with the high speed suction tip (Micro Aspirator, Centrix, Shelton, CT) that places a needle tip within the canal. For non-eugenol endodontic sealers, these additional steps are not necessary.

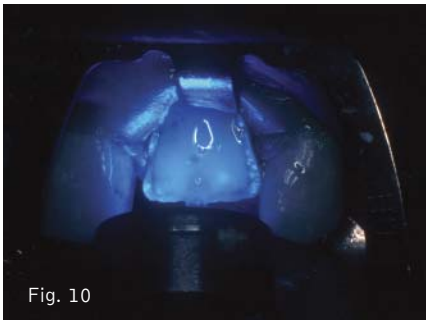
Fig. 10

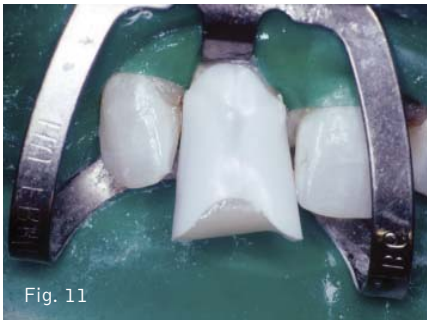
Fig. 11

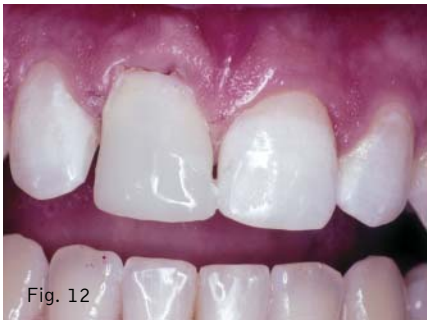
Fig. 12

Fig. 10: The dual-cure cement was light cured for 1 minute with an LED curing unit with the light curing probe touching the translucent Twin Luscent Anchor so that the light transmits down into the canal.

Fig. 11: Composite resin (Point 4, Kerr) was placed to restore tooth with a Crown Form (Dentatus) and then light cured for 30 seconds.

Fig. 12: Facial view of the completed composite resin restoration (Point 4, Kerr).

It was known for this case that a eugenol-containing endodontic sealer was used. After preparation of the root canal for the post with verification of the fitting of the post, the root canal was irrigated with an endodontic irrigation syringe filled with ethyl alcohol. The canal was irrigated with ethanol two times to assure that all residual eugenol had been cleansed from the canal and dried of excess ethanol using paper points (Fig. 6) and suction evacuation using the aforementioned Micro Aspirator.

The canal was now ready for placement of the universal self-adhesive cement (UniCem, 3M ESPE). UniCem is specially formulated to be self-adherent and moisture tolerant, eliminating the need for separate etching, priming or bonding steps. This saves time and greatly reduces the potential for patient sensitivity compared to other resin cement systems that require etching and bonding. Also, UniCem is available in two different packaging modes. UniCem is available in pre-dose capsules (chosen for this case) and in a new, easy to use, accurate dispensing clicker dispenser. (Fig. 7) The cement was applied into the root canal using an AccuDose NeedleTube (Centrix, Shelton, CT) (Fig. 8). Using a Needle Tube will assure complete filling of the canal with cement. A lentulo spiral will leave the canal incompletely filled.(66) Recently, a special tip was introduced for use with the UniCem capsule to improve the application of the cement into the root canal. This elongation tip attaches to the end of the tip of the UniCem capsule and is similar to the AccuDose NeedleTube in its diameter and extension. (Fig. 8)

UniCem cement was also placed on the Twin Luscent Anchor, which was gently seated into the cement filled canal and the excess cement was cleared away before curing (Fig. 9). Using an LED light curing unit, the light curing probe was placed at right angles to the tooth, touching the translucent fiber post and the entire complex was light cured for one minute. (Fig. 10).

Restoration placement

After light curing, the tooth was prepared to roughen the dentin and enamel remaining and with an intra-enamel chamfer on the lingual surface that was half the thickness of enamel. The tooth was etched for 15 seconds, rinsed and dried. An adhesive resin was placed and the facial surface crown was restored with a nanofilled micromatrix hybrid composite resin, Point 4 (Kerr, Orange, CA) using a Crown Former matrix (Dentatus, New York, NY) (Fig. 11). The restoration was finished and polished.

From a facial view, it can be seen that the translucent Twin Luscent Anchor blends in with the shade of the composite resin. (Fig. 12) Unlike a metal post, there is no shadowing of the composite resin restoration. Because of the patient's age (sixteen years old), it was

decided to restore the tooth with a bondable, fiber-reinforced esthetic post using a direct composite resin veneer until the child was old enough to receive a more definitive restoration. In the future, when the child matures, this tooth can be restored with an all-ceramic crown without the need for post replacement. The fiber post placed will provide the support necessary for the full-coverage crown after the dentition matures. Also, an impression was made and a custom athletic mouthguard was made for this teenager to use when playing sports to protect the dentition from trauma.

Conclusion

For the case presented, a fiber post met both the esthetic and restorative needs for the clinical situation. Essential to the treatment planning for this case and in light of this child's history of sports participation and trauma, the patient must have a custom athletic mouthguard. After restoration placement, the patient had a protective athletic mouthguard fabricated to be worn during athletic activities Also, given his past history of trauma, there is high likelihood that the restored tooth will be traumatized again. To avoid disastrous consequences of root fracture and tooth loss, the fiber reinforced resin post, offers a safer alternative to metal or ceramic posts-

Partial listing of Universal self-adhesive resin luting cements

RelyX Unicem	3M-ESPE
Multilink Automix	Ivoclar
G-Cem	GC America
Infinity	Den-Mat
Embrace Wetbond Universal	Pulpdent
Breeze	Pentron Clinical Technologies
Monocem	Shofu

Fiber reinforced posts are energy dissipating when compared to the energy transmittance of more rigid metal and ceramics that might be used as post materials that would put the tooth root at risk.

Fiber posts have a definite place in a restorative dentist's armamentarium. When restoring an endodontically treated tooth, treatment planning for the use of a fiber post should be based upon the clinical needs of the case. Also, to achieve good clinical success, the clinician must choose compatible materials and techniques for cementation when using a fiber post, and be assured that the crown preparation for the tooth have an adequate ferrule. By understanding the concepts for clinical success with fiber posts as described in this article, the clinician will provide their patients with esthetic, long lasting, successful restorations.

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SELF-TEST

1. Of the 15 million Americans injured in athletic activities, the chance of a facial dental injury is:
A. 1 in 2
B. 1 in 3
C. 1 in 5
D. 1 in 10

2. Injuries to the teeth during sports activities can be prevented by:
A. wearing a helmet
B. wearing an athletic mouthguard
C. splinting the maxillary and mandibular anterior teeth
D. playing less vigorously

3. Young, immature teeth that become non-vital due to trauma that have wide root canals and open apicies should be treated with:
A. extraction
B. restoration with a cast metal post and core
C. an apical closure technique either an apexification procedure with calcium hydroxide or root end sealing with MTA and then conventional endodontic therapy
D. no treatment until the tooth matures on its own.

4. Tooth stiffness is important to success in restorative dentistry. A whole tooth is inherently stiff and resistant to flexion. If a molar tooth has an MOD cavity preparation, the cuspal stiffness is reduced by:
A. 10%
B. 20%
C. 35%
D. 63%

5. When only an endodontic access is accomplished, tooth stiffness is reduced by:
A. 5%
B. 25%
C. 50%
D. 75%

6. A bonded fiber post has a failsafe design. This means that if a catastrophic force is placed on the crown of a tooth that is restored with a fiber post:
A. the root will fracture apical to the post before the crown does
B. microbiologic infection of the root canal will occur before root fracture
C. the crown will fracture and not the root
D. force is transmitted down the post to the apical end of the root and the force is absorbed by the PDL

7. TRUE or FALSE: When treatment planning for use of a fiber post, there needs to be at least one-quarter of the crown remaining so that a ferrule design to the preparation of 1.5-2.0 mm can be developed 360 degrees circumferentially around the tooth preparation margin.
A. True
B. False

8. The need for a fiber post is many times based upon the final esthetic restoration. When placing a composite resin, all-ceramic crown and porcelain veneer on an endodontically treated tooth, the selection of fiber post is based upon:
A. its structural stiffness
B. its ability to transmit light to avoid shadowing of the tooth and gingival that metal posts can create
C. the price of the post
D. what the insurance plan will reimburse for treatment

9. The criteria for a bondable fiber post include all the following EXCEPT:
A. multiple sized diameters to fit different root canal diameters
B. longitudinal conglomerations to enhance retention
C. bondable within the root canal for root reinforcement
D. transmit light to maximize esthetics

10. Surface characteristics that fiber posts have to increase retention include all the following EXCEPT:
A. retentive head design
B. serrations
C. split in the post to lock within the canal
D. a resin matrix with glass fibers that are bondable to resin cement.

11. When placing a bondable fiber post, the cement of choice is a:
A. zinc phosphate cement
B. resin reinforced glass ionomer cement
C. composite resin cement
D. zinc oxide and eugenol cement

SELF-TEST

12. There has been concern that fiber posts will be difficult to remove from the root if there is a need for endodontic re-treatment of the tooth or replacement of the post due to fracture. Removal of fiber posts is easily accomplished by:

A. pulling the post out with a post puller
B. fiber posts can not be removed, the tooth must be extracted
C. using rotary endodontic files hollowing out the post within the root canal
D. dissolving the post with ethanol

13. When removing the gutta percha to create the post space, a safe method to use is:

A. a #8 round bur in a high speed handpiece
B. a heated endodontic instrument
C. a round diamond in a high speed handpiece
D. there is no need to remove the gutta percha, just heat the post and insert it into the gutta percha

14. When creating a post space, it is important that a radiograph be made to verify that the post space is:

A. at least ¾ the length of the root
B. at least ½ the length of the root
C. free of gutta percha on the lateral walls of the canal that could interfere with bonding of the composite resin cement.
D. both B and C are correct

15. Eugenol can have a negative effect when using an adhesive in the root canal during cementation. If you are not sure which endodontic sealer was used with the gutta percha or you know that the endodontic sealer contained eugenol, after removing the gutta percha from the canal and creating the post space, the canal should be:

A. irrigated with distilled water twice, drying the canal between each irrigation step
B. irrigated with ethyl alcohol using an endodontic irrigation syringe and then removing the alcohol using specialized endodontic aspirating tips or endodontic paper points
C. left alone because no special technique is required; the canal is clean enough with only the post preparation
D. primed with dentin primer using a micro applicator and then air dried

16. If a fiber post must be cut to shorten its length, the method of choice is:

A. wire cutter
B. diamond abrasive with a high speed handpiece with water spray
C. laboratory saw
D. the post is never too long

17. A simplified technique for cementation of fiber posts is to use:

A. a 4th-generation adhesive by etching the root canal, rinsing and drying, applying the primer, applying the adhesive, light curing, then placing the cement on the pot
B. a self-adhesive, self-etching universal resin cement
C. a conventional glass ionomer cement
D. a resin modified glass ionomer cement

18. The optimal method for placing a composite resin cement into a root canal for post cementation is:

A. using a micro applicator brush to paint the root canal
B. placing the cement on the post only
C. placing the cement in an AccuDose NeedleTube and syringing the cement into the root canal
D. using a conventional brush and paint the root canal walls

19. According to this article, if you are using UniCem universal, self-adhesive resin cement: After mixing it in its pre-dose capsule for cementing a fiber post, the cement can be applied within the root canal using:

A. an Accudose NeedleTube after placing the cement in the tube
B. a special elongation tip that is placed on the UniCem capsule tip
C. an endodontic file with cement placed on it and then twirled around
D. A and B are correct answers as described in this article

20. Due to the age of the patient in the case report, (16 years old), the decision was made after restoring the tooth with composite resin to:

A. proceed with an all-ceramic crown preparation
B. splint the tooth to the adjacent teeth for additional support
C. make an impression and fabricate a custom athletic mouthguard to prevent injury to the teeth
D. wait for the dentition to mature before fabricating a full coverage crown
E. C and D

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