Austin Journal of Clinical Case Reports

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Case Report

Esthetic and Functional Rehabilitation of Maxillary Anterior Tooth by Polyethylene Fibre Post

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Received: May 11, 2016; **Accepted:** August 31, 2016; **Published:** September 08, 2016

Abstract

The fracture resistance of endodontically treated tooth is highly dependent on the remaining dentine thickness around post and core systems. Flared root canals are more susceptible to fracture as the remaining walls are thin, and the restoration of these teeth requires techniques that will not compromise the integrity of the remaining radicular tooth structure. The introduction of materials that can bond to dentine has created an alternative option for the reconstruction and rehabilitation of root canals that have been severely damaged by caries, trauma, congenital disorders, or internal resorption. Ultra high molecular weight polyethylene (UHMWPE) fibre reinforcement systems are gaining in popularity. As bondable reinforcement fibres, they can be used to build up endodontic posts and cores; moreover, they adapt to the root canal walls without requiring additional enlargement of the root canal after endodontic treatment. This case report discusses the management of fractured non-vital anterior tooth using polyethylene fibre post-core.

Keywords: Esthetic; Rehabilitation; Polyethylene fibre

Introduction

The important role of anterior teeth in esthetics and function makes these teeth a significant component in dentition. Traumatic accidents are common in maxillary anterior teeth. Trauma and caries occurring before root completion can lead the tooth to a degenerative cycle which eventually causes necrosis and creation of large flared root canal. Root canal therapy (RCT) is often successfully done after apexification but compromised dentinal walls especially in cervical area, makes these teeth susceptible to fracture [1]. The fracture resistance of endodontically treated tooth is highly dependent on the remaining dentine thickness around post and core systems [2]. Flared root canals are more susceptible to fracture as the remaining walls are thin, and the restoration of these teeth requires techniques that will not compromise the integrity of the remaining radicular tooth structure.

As a rule, endodontically treated teeth are weaker than intact teeth due to loss of tooth structure, reduction in tooth flexural strength [3], change in the collagen cross-links and moisture content reduction and tooth dehydration [4]. Canal enlargement and cavity preparation can reduce the stiffness of the teeth [5] and brittleness could be a final result of a root canal treatment [6]. When most of the coronal structure of endodontically treated teeth has been lost, the use of post and core systems seems mandatory [7]. The decision regarding the treatment plan and post insertion should be based on three aspects: position of tooth in the arch [8], amount of remaining tooth structure [9] and esthetic requirements [10,11]. The main goal of the post insertion is to provide an optimum retention for the core which eventually supports the crown [12-14].

The introduction of materials that can bond to dentine has created an alternative option for the reconstruction and rehabilitation of root canals that have been severely damaged by caries, trauma, congenital disorders, or internal resorption [15-18]. In recent years, fibre reinforcement systems have been introduced in an attempt to increase resin-bonded composites durability and damage tolerance [19,20]. Ultra high molecular weight polyethylene (UHMWPE) fibre reinforcement systems are gaining in popularity. As bondable reinforcement fibres, they can be used to build up endodontic posts and cores; moreover, they adapt to the root canal walls without requiring additional enlargement of the root canal after endodontic treatment. These woven fibres have a modulus of elasticity similar to that of dentine and are supposed to create a mono-block dentine post- core system able to better distribute forces along the root [15,21,22]. Polyethylene fibres are used to improve the impact strength of composite materials, and they are nearly invisible in resinous matrices. For these reasons, polyethylene fibres seem to be the most appropriate and aesthetic strengtheners of composite materials [23,24].

Case Presentation

A sixteen years old male patient reported to the out-patient Department of Kothiwal Dental College and Research Centre with the chief complaint of broken tooth in the left upper front tooth region (Figure 1). On vitality testing, tooth 12 was found to be non-vital. Root canal treatment was completed in tooth 12 (Figure 2).

The tooth was isolated under rubber dam (Figure 3). The post space was prepared using number 5 & 6 peeso-reamers (Dentsply, Mallifier) maintaining a seal of 5 mm of apical plug of gutta-percha (Figure 4). Clinical examination of the root canal revealed oval shaped canal that was wide. So it was decided to restore and reinforce the root with ribbond (Poly ethylene fiber) and make a composite core. The post space length was measured. This measurement was doubled, estimated core length added and the necessary length of fibre decided. 3 mm wide ribbond fiber of about 20 mm length was taken and folded.

Citation: Singh S, Nagpal R, Singh P, Singh UP and Manuja N. Esthetic and Functional Rehabilitation of Maxillary Anterior Tooth by Polyethylene Fibre Post. Austin J Clin Case Rep. 2016; 3(3): 1094.

Figure 1: Fractured maxillary right lateral incisor.

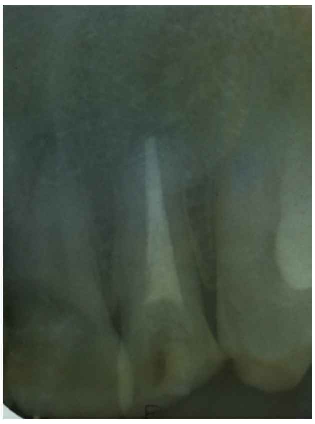

Figure 2: IOPAR showing obturation of the fractured maxillary right lateral incisor.

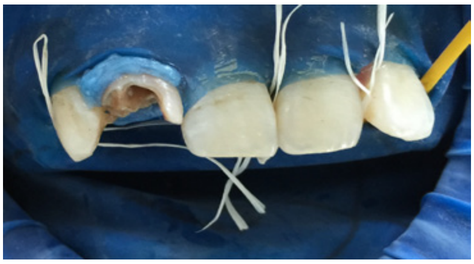

Figure 3: Rubber dam applied before post space preparation of tooth 12.

Figure 4: IOPAR showing the post space preparation.

The fibres were cut with the special scissors which are part of the set (Ribbond Starter Kit, Ribbond Inc, Seattle WA) It was moistened with

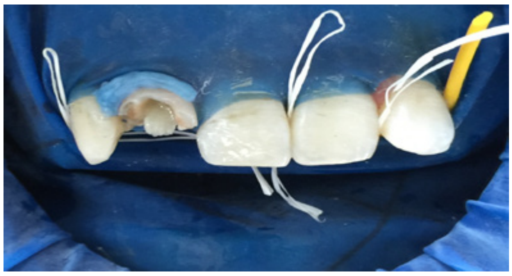

Figure 5: Ribbond condensed tightly into the canal space.

Figure 6: The core build up completed with a hybrid composite resin.

Figure 7: Post-operative view.

ribbond wetting agent, excess adhesive on the ribbond pieces was gently removed with a hand instrument moving in the direction of the fibres and was set aside in a light-protected container. The canal was etched with 37% phosphoric acid, bonded with Adper Single Bond Plus. (3M ESPE, St. Paul, MN, USA)Appropriate amount of cement Rely X ARC resin cement (Rely X Arc, 3M ESPE, St paul, USA) was dispensed onto a mixing pad, mixed for 10 seconds and flooded into the canal. The folded end was placed inside the canal, tightly condensed with an endodontic plugger and the free ends were placed coronally (Figure 5). The excess resin was removed. Light curing was done with high intensity LED light curing unit (Elipar, 3M ESPE) for 40 seconds to ensure complete polymerization of the composite. Core build-up was done with composite resin (Filtez Z-350) (Figure 6 & 7) IOPA radiograph was taken (Figure 8).

Discussion

The prognosis of endodontically treated teeth depends not only on the treatment itself but also the placement of coronal restorations. A restorative material should restore the decayed or defective tooth, provide an effective seal between the restoration and the tooth, and strengthen the tooth. A loss of dentine may result in tooth fracture after the final restoration. Therefore, intracoronal strengthening is

Figure 8: Post-operative IOPAR.

important in protecting the teeth against fracture [25,26]. The choice of fibre is dependent on the width of the root canal (Ribbond THM, Size 2,3 or 4 mm, Ribbond Inc., Seattle WA).

The use of polyethylene fibres to restore endodontically treated teeth has gained popularity as an alternative to cast or prefabricated metal posts. It is preferred by paediatric dentists, especially after apexfication procedures. This may be attributed to two important characteristics of fibre posts: their modulus of elasticity, which is similar to that of dentine, and their ability to be adhesively cemented [27,28]. It is believed that mono-block dentine-post-core systems with dentinal bonding enhance the distribution of forces along the route. Therefore, if excessive loads are applied to the tooth, the post would be able to absorb the stress, reducing the possibility of root fracture [15]. It is assumed that polyethylene fibres have a stress-modifying effect along the restoration and dentine interface. Original Ribbond is the first version of Ribbond fiber reinforcement ribbons which was introduced in 1991. It is 0.35 mm thick and is available in 2 mm, 3 mm, 4 mm and 9 mm widths. Ribbond THM which was introduced in 2001 is an excellent all-purpose fiber. It is 0.18 mm thick and is available in widths of 2 mm, 3 mm, 4 mm, 7 mm and 1 mm. Made using a traixial braid, Ribbond Triaxial achieves the highest strength and modulus of elasticity of any Ribbond product. It is thicker (0.50 mm thick) and more rope-like than the other leno woven Ribbond products. Introduced in 2013, Ribbond ULTRA is the premium dental fiber. It's the thinnest of all Ribbond fiber reinforcement ribbons, (0.12 mm thick), has the highest flexural modulus and has a greater peak load than the Ribbond THM and is more adaptable. It lays flatter against the teeth which creates a thinner bond line to the teeth. It is available in widths of 2 mm, 3 mm, 4 mm, and 1 mm.

Polyethylene fiber has shown to reinforce the weakened root structures. In this case pre-fabricated post was not selected because the canal anatomy was oval and irregular. Presences of weakened root structure contraindicate the use of custom cast post and core [9]. It is difficult to identify ribbond (Poly ethylene fiber) in radiograph because of their radio-lucent nature so care should be taken while placement. The core build-up was done with direct composite as it is compatible with ribbond fibers. The post length should not be shorter than the clinical crown as this would cause an increase in stress accumulation at the cervical region. On the other hand, the post length does not need to extend beyond 2/3 of the root because as the post length increases, so stress moves through the apical area. Preservation of radicular dentin is also an important factor. Teeth restored with larger diameter posts are reported to have the least resistance to fracture with a decrease in the width of the remaining dentin.

There are many factors influencing the clinical success of an adhesive post core system. The luting cement is one of these factors and it is particularly important when used in large quantities, especially in those cases where the canals are irregular and/or very wide compared to the pre-fabricated posts. A resin luting agent may create polymerization shrinkage stresses within the dowel space [29]. It has been shown that C factors in dowel spaces may be as high as 200 [30]. These stresses may also cause a leakage problem when used with prefabricated fibre or zirconia dowel systems [31]. In these cases, the resin supported Ribbond post core system has an advantage because of its polymerization shrinkage reducing effect. The bonding surface is also an important factor for the success of an adhesive post-core system. Therefore, root canal dentin was conditioned with 17% liquid EDTA to remove the smear layer before application of resin cement.

Impregnation of the fibres with resin before application is an important step for a successful restoration with UHMW polyethylene fibre Ribbond. Each fibre should come into contact with the resin. However, residual monomer may induce problems. These can be avoided by using pre-impregnated fibres. It is difficult to save UHMW polyethylene fibre after impregnation in the clinical situation. It is therefore advisable to wet the fibre shortly before restoration and to remove the excess resin over the fibre surfaces with a hand instrument in the direction of the fibre.

Conclusion

Restoration of teeth after endodontic treatment is becoming an integral part of the restorative practice in dentistry. Placement of ribbond fiber to reinforce the root and restore coronal tooth structure with resin composite seems to be ideal, less time consuming and more conservative treatment option in selected cases. Long term follow-up of more clinical cases is required to determine the ultimate success rate of the technique.

References

1. Katebzadeh N, Dalton BC, Trope M. Strengthening immature teeth during and after apexification. J Endod. 1998; 24: 256-259.
2. Marchi GM, Mitsui FH, Cavalcanti AN. Effect of remaining dentine structure and thermal-mechanical aging on the fracture resistance of bovine roots with different post and core systems. Int Endod J. 2008; 41: 969-976.
3. Michael MC, Husein A, Bakar WZ, Sulaimanb E. Fracture resistance of endodontically treated teeth: An *in vitro* study. Arch Orofac Sci. 2010; 5: 36-41.
4. Helfer AR, Melnick S, Schilder H. Determination of the moisture content of vital and pulpless teeth. Oral Surg Oral Med Oral Pathol. 1972; 34: 661-670.
5. Reeh ES, Messer HH, Douglas WH. Reduction in tooth stiffness as a result of endodontic and restorative procedures. J Endod. 1989; 15: 512-516.
6. Sedgley CM, Messer HH. Are endodontically treated teeth more brittle? J Endod. 1992; 18: 332-335.
7. Makade CS, Meshram GK, Warhadpande M, Patil PG. A comparative evaluation of fracture resistance of endodontically treated teeth restored with different post core systems-an *in vitro* study. J Adv Prosthodont. 2011; 3: 90-95.

8. Heydecke G, Butz F, Hussein A, Strub JR. Fracture strength after dynamic loading of endodontically treated teeth restored with different post-and-core systems. J Prosthet Dent. 2002; 87: 438-445.

9. Kimmel SS. Restoration of endodontically treated tooth containing wide or flared canal. N Y State Dent J. 2000; 66: 36-40.

10. Rosentritt M, Fürer C, Behr M, Lang R, Handel G. Comparison of *in vitro* fracture strength of metallic and tooth-coloured posts and cores. J Oral Rehabil. 2000; 27: 595-601.

11. Zalkind M, Hochman N. Direct core buildup using a preformed crown and prefabricated zirconium oxide post. J Prosthet Dent. 1998; 80: 730-732.

12. Belli S, Erdemir A, Ozcopur M, Eskitascioglu G. The effect of fibre insertion on fracture resistance of root filled molar teeth with MOD preparations restored with composite. Int Endod J. 2005; 38: 73-80.

13. Mannocci F, Ferrari M, Watson TF. Intermittent loading of teeth restored using quartz fiber, carbon-quartz fiber, and zirconium dioxide ceramic root canal posts. J Adhes Dent. 1999; 1: 153-158.

14. Boudrias P, Sakkal S, PetrovaY. Anatomical post design meets quartz fiber technology: Rationale and case report. Compend Contin Educ Dent. 2001; 22: 337.

15. Newman MP, Yaman P, Dennison J, Rafter M, Billy E. Fracture resistance of endodontically treated teeth restored with composite posts. J Prosthet Dent. 2003; 89: 360–367.

16. Katebzadeh N, Dalton BC, Trope M. Strengthening immature teeth during and after apexification. J Endod. 1998; 24: 256–259.

17. Hornbrook DS, Hastings JH. Use of bondable reinforcement fiber for post and core build-up in an endodontically treated tooth: maximizing strength and aesthetics. Pract Periodontics Aesthet Dent. 1995; 7: 33–42.

18. Kimmel SS. Restoration and reinforcement of endodontically treated teeth with a polyethylene Ribbond and prefabricated fiberglass post. Gen Dent. 2000; 48: 700–706.

19. Eskitascioglu G, Belli S. Use of bondable reinforcement fiber for post-and-core buildup in an endodontically treated tooth: a case report. Quintessence Int. 2002; 33: 549–551.

20. Terry DA, Triolo PT, Swift EJ. Fabrication of direct fiber-reinforced posts: a structural design concept. J Esthet Restor Dent. 2001; 13: 228–240.

21. Vitale MC, Caprioglio C, Martignone A, Marchesi U, Botticelli AR. Combined technique with polyethylene fibers and composite resins in restoration of traumatized anterior teeth. Dent Traumatol. 2004; 20: 172–177.

22. Ramos V, Runyan D, Christensen L. The effect of plasma-treated polyethylene fiber on the fracture strength of polymethyl methacrylate. J Prosthet Dent. 1996; 76: 94–96.

23. Smadzadeh A, Kugel G. Fracture strengths of provisional restorations reinforced with plasma treated woven polyethylene fiber. J Prosthet Dent. 1997; 78: 447–449.

24. Uzun G, Hersek N, Tincer T. Effect of five woven fiber reinforcements on the impact and transverse strength of a denture base resin. J Prosthet Dent. 1999; 81: 616–620.

25. Belli S, Erdemir A, Yıldırım C. Reinforcement effect of polyethylene fiber in root-filled teeth: comparison of two restoration techniques. Int Endodont J. 2006; 39: 136–142.

26. Trope M, Langer I, Maltz DO, Tronstad L. Resistance to fracture of restored endodontically treated premolars. Endod Dent Traumatol. 1986; 2: 35–38.

27. Perdiga˜o J, Monteiro P, Gomes G, Santos V. Restoring teeth with prefabricated fiber-reinforced resin posts. Pract Proced Aesthet Dent. 2007; 19: 359–364.

28. Ayna EC¸ elenk S. Use of an alternative pontic foundation technique for a fiber-reinforced composite fixed partial denture: A clinical report. J Prosthet Dent. 2005; 93: 412– 415.

29. Kwiatkowski S, Geller W. A preliminary consideration of the glass ceramic dowel post and core. Int J Prosthot. 1989; 2: 51-55.

30. Bouillaguet S, Troesch S, Wataha JC. Krejci I, Meyer JM, Pashley DH. Microtensile bond strength between adhesive cements and root canal dentin. Dent Mater. 2000; 19: 199-205.

31. Üümez A, Çobankara FK, Öztürk N, Eskitascioglu G, Belli S. Microleakage of endodontically treated teeth with different dowel systems. J Prosthet Dent. 2004; 92: 163-169.

Austin J Clin Case Rep - Volume 3 Issue 3 - 2016
ISSN : 2381-912X | www.austinpublishinggroup.com

Citation: Singh S, Nagpal R, Singh P, Singh UP and Manuja N. Esthetic and Functional Rehabilitation of Maxillary Anterior Tooth by Polyethylene Fibre Post. Austin J Clin Case Rep. 2016; 3(3): 1094.