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Original research article

Comparative Evaluation of Removal of Fibre Post Using Different Techniques

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Abstract

Introduction: Endodontically treated teeth often have a significant coronal and radicular compromise of tooth structure because of extensive caries, fracture, trauma to the tooth, iatrogenic causes and pulppathology

Materials and methods: Sixty extracted, single-rooted teeth with complete root development, mature apex, visible canal space and patent apical foramen were selected for this study. All teeth were free of caries lesions and fractures as evaluated under a microscope and radiographically.

Results: The mean and standard deviations of time to remove the fiber posts for the 4 subgroups, measured in seconds, are given in Table 1 (Graph 1). Table 2 (Graph 2) shows the mean time to remove fiber posts for the 3 fiber post removalsystem subgroups. The 3 subgroups did not differ significantly in average removal time. There was no significant difference between two removal kits and diamond bur/Peeso reamer combination in terms of efficiency for removal of fiber posts.

Conclusion: Within the limitations of the present study, it can be concluded that There was no differencebetween the three post removal systems i.e., DT Removal drill kit, Kodex Twist drill/ Parapost removal drill kit

Keywords: Pulp, Teeth, Extraction

Introduction

Endodontically treated teeth often have a significant coronal and radicular compromise oftooth structure because of extensive caries, fracture, trauma to the tooth, iatrogenic causes and pulp pathology etc[1]. Restorations of such weakened teeth are accomplished using varied intraradicularrestorations and posts to reinforce the tooth.The restoration of the endodontically treated tooth is a subject that has been evaluated anddiscussed widely in dental literature. It has

been a controversial topic often approached empiricallyand is based on assumptions rather than scientific evidence.[2] In cases where tooth structure is relatively intact, conservative approaches such as composite restorations for anterior teeth and full coverage restorations for posterior teeth are satisfactory.But, as most teeth have significant loss of coronal tooth structure, utilization of posts, pins,cores and final restorations are required to achieve proper form and function. In such teeth placement of post is required. The main function of the post is to anchor the post and core within the radicular portion of the remaining tooth.[3]Restorative success of endodontically treated tooth is directly related to the quality and bulk of the remaining tooth structure.[4,5] For many years, metal posts were used which caused concentration of wedging forces at the weakened coronal portion of the root canal.[6] Its use decreased with the introduction of prefabricated metal post systems[7]. An elastic modulus mismatch seen in cast metal and prefabricated metal posts is well known to be the source for stress concentration possibly resulting in post separation and failure[8,9].Over the past few years, fiber posts have gained popularity. Since the development of carbon fiber post in 1990, demands for better esthetics have lead to the development of tooth colored glass fiber and quartz fiber posts. In terms of structure, they are made of fibers (e.g., Carbon, quartz, silica, zirconia or glass) that are embedded in an epoxy resin matrix. As for physical properties, the elastic modulus of fiber posts, similar to that of radicular dentin.[10,11,12] Fiber posts have the ability to form monoblock.[13]Thus, restoring endodontically treated teeth without compromising the esthetics is the primary aim of every clinician.On occasion, a post must be removed to allow nonsurgical retreatment when endodontic treatment is failing or to improve the design, mechanics, or esthetics of a new restoration.[13] The ability to remove an existing post depends on the type of material that it is fabricated from. In mostfiber post removal situations, the clinician is generally confronted with a fiber post of unknown origin. In these instances, most removal kits would be ineffective because they are specifically designed by manufacturers for their respective post systems. A universal fiber post removal systemwould be beneficial to allow removal of any fiber post system.[19] Thus the aim of present study was done to evaluate the efficiency and effectiveness of fiberpost removal using 3 techniques i.e., with Parapost fiber removal drill kit, D.T.Light removal kit and combination of diamond bur/Peeso reamer.

Materials and methods

Sixty extracted, single-rooted teeth with complete root development, mature apex, visible canal space and patent apical foramen were selected for this study. All teeth were free of caries lesions and fractures as evaluated under a microscope and radiographically. The teeth were immersed in 3% Sodium hypochlorite solution for 15 minutes to remove the surface soft tissue and debris, and then washed under tap water. Any remaining tissue was mechanically removed using an ultrasonic scaler with attention not to damage the root surface andwere stored in 0.1% thymol solution until use. The samples were decoronated 3mm above the cementoenamel junction using a water cooled safe sided diamond disc. The roots were standardized to 14mm length to serve as a stable and equivocal reference for all measurements.

CANAL PREPARATION: Working length was established by introducing an ISO size 10 stainless K-file into the canal until visible at the apex and was determined by deducting 1mm fromlength recorded. Chemomechanical preparation was done with Protaper Universal System in 16:1 gear reduction torque controlled Endomotor (Rotary Master J Morita, USA) according to manufacturer's instructions till F4 size. A consistent irrigation, lubrication, and recapitulation regimen was followed using 3% NaOCl(Vishal Dental Products), RC-Prep(Premier Dental Products). After completion of instrumentation the root canals were finally rinsed with 10ml of 17% EDTA (Ammdent Dental Products, India), followed by 10ml of 3% sodium hypochlorite solution to remove the smear layer. Following this, 10ml of distilled

water was used to remove any residue ofsodium hypochlorite.The root canals were dried with paper points and then obturated with protaper gutta-perchapoints and AH Plus sealer. After the obturation, the teeth were sealed with temporary restoration and placed in saline at 37^0C in the individual vial for one week in an incubator. After completion of this procedure, the teeth were divided randomly into 2groups:

Group 1: Teeth receiving DT Light fiber post No 1

Group 2: Teeth receiving Parapost fiber post No 5.

All the teeth receiving DT Light fiber posts were prepared according to the manufacturer's instructions i.e., the preshaping DT Light post drill was used which was followed by size No 1 DTlight post drill to a depth of 9mm. All the teeth receiving Parapost Fiber Lux Posts were also prepared according to manufacturer's recommendations. The No.5 red Parapost drill was used to a depth of 9mm. Then the posts were tried in to evaluate the fit.

Post cementation:

Group 1: The canal was etched with 37% Phosphoric acid (Ivoclar Vivadent) for 15 seconds andrinsed with water. The canals were dried with paper points, making sure not to desiccate the dentin.Two applications of Te-Ecom (Ivoclar Vivadent) dental adhesive was applied to the canal walls and cured for 30 sec. The posts were etched with 9% hydrofluoric acid (Ultradent products) for 30seconds and rinsed with water. The posts were dried and then silanated with coupling agent (Ultradent products). Rely X U100 (3M ESPE) dual cured resin composite luting cement was mixed with a small amount of Methylene Blue dye (Nice Chemicals) and was coated to the post and applied on to the canal wall. DT Light post was then seated to a full depth of the post preparation. To prevent contact of the post with the storage medium, posts were covered with Filtek Z250 resin composite(3M ESPE Dental Products). The composite was then light cured with QTH Curing unit (Hylux, Heraeus Kulzer), and the teeth were stored in opaque individual vials containing sterile saline until post removal.

Group 2: Canal and post surface treatment was done similar to that as group 1. Parapost fiber Lux post no.5 was then seated to a full depth of the post preparation. To prevent contact of the postwith the storage medium, posts were covered with Filtek Z250 resin composite(3M ESPE DentalProducts). The composite was then light cured with QTH Curing unit (Hylux, Heraeus Kulzer), and the teeth were stored in opaque individual vials containing sterile saline until post removal.

Post Removal:

The composite covering the posts was removed to the previous decoronated height, priorto fiber post removal, using a diamond bur with water cooled, high speed hand piece.Teeth were then randomly assigned to

Subgroup A1: Fiber posts were removed using the DT Light Post removal kit (Bisco Dental Products, RTD France) according to the manufacturer's recommendations. The pilot hole was made in the centre of fiber post with the low speed latch pilot drill. The pilot drill was followed byanother low speed latch DT Removal drill that drills through the fiber post up to the post length when apical pressure is applied.

Subgroup A2: DT Light fiber post were removed using a ½ round bur, no.850 coarse diamond burs, and no.3 and no.4 Peeso reamer burs. A ½ round bur was used at a high speed to indent the centre of the fiber post surface, followed by a no 850 coarse diamond bur in high speed hand pieceto prepare a pilot hole in the centre of the fiber post. After a diamond bur is used to prepare the pilot hole, the no.3 and no.4 Peeso reamer's are used to the full length of the post,

successfully hollowing out the fiber post.

Subgroup B1: Fiber posts were removed using Kodex twist drills according to the manufacturer'srecommendations. Initially a ½ round bur is used at high speed to indent the centre of the fiber post surface. Then, a Kodex twist drill is used at slow speed to create a pilot hole to its full depth.The Kodex drill is followed by an end cutting Tenax starter drill that drills through the fiber post when apical pressure is applied until the gutta-percha is visible. The standard Parapost drills are used to the original diameter of the post preparation.

Subgroup B2: Parapost fiber post were removed using a ½ round bur, no 850 coarse diamond burs, and no.3 and no.4 Peeso reamer burs. A ½ round bur was used at a high speed to indent the centre of the fiber post surface, followed by a no 850 coarse diamond bur in high speed hand pieceto prepare a pilot hole in the centre of the fiber post. After a diamond bur is used to prepare the pilot hole the no.3 and no.4 Peeso reamers are used to the full length of the post, successfully hollowing out the fiber post.

Data collection:

Post removal times, representing efficiency, for each tooth were recorded, starting just before mounting the first bur on the drill and ending when the apical gutta-percha was fully exposed in the canal.

Evaluation of Effectiveness of fiber post removal:

After post removal was completed, the teeth were grooved longitudinally on the facial and lingual sides with diamond disk in low speed under constant cooling with distilled water and theywere split with a chisel. The 2 halves of the root were placed back in tooth's individually numberedvial and later evaluated.Using a stereomicroscope, the effectiveness of fiber post removal was graded on a 5-pointordinal scale as follows:

1. Only dentin can be seen after post removal.
2. Only cement can be seen after post removal.
3. Less than 25% of post fibers are left after the post removal.
4. 25%-50% of post fibers are left after post removal.
5. More than 50% of fiber posts are left after post removal.

Statistical analysis:

Attributed scores were tabulated and submitted to statistical analysis for comparison of techniques using Tukey's Multiple comparison test, Mann Whitney U test and Kruskal Wallis ANOVA test to determine whether there was significant difference between the groups ($p<0.05$).

Results

The mean and standard deviations of time to remove the fiber posts for the 4 subgroups, measured in seconds, are given in Table 1 (Graph 1). Table 2 (Graph 2) shows the mean time to remove fiber posts for the 3 fiber post removalsystem subgroups. The 3 subgroups did not differ significantly in average removal time. There was no significant difference between two removal kits and diamond bur/Peeso reamer combination in terms of efficiency for removal of fiber posts.

Pair wise comparison of four different removals (DT (A1), Diamond bur/Peeso reamer removal(A2)(Universal), Parapost (B1) and Diamond bur/Peeso reamer removal (B2) (Universal) with respect to efficiency by Tukey's multiple post hoc procedure

Tables: **1**

Removals	DT (A1)	Diamond bur / Peeso reamer (A2)	Parapost(B1)	Universal(B2)
Mean	27.4830	27.0000	27.5710	26.5640
DT (A1)	-			
Diamond bur/Peeso reamer (A2)	0.7536	-		
Parapost (B1)	0.9979	0.6442	-	0.1743
Diamond bur/Peeso reamer (B2)	0.2435	0.8061	0.1743	-

Pair wise comparison of four different removals (DT (A1), Diamond bur/Peeso reamer removal(A2)(Universal), Parapost (B1) and Diamond bur/Peeso reamer removal (B2) (Universal) with respect to effectiveness by Kruskal Wallis ANOVA.

Removal	Cervical		Middle		Apical	
	Mean +/- SD	P Value	Mean + SD	P Value	Mean + SD	P Value
DT(A1)	2.2+/-0.41	0.0002*	2.13+/-0.35	0.0890	2.20+/-0.41	0.0712*
Diamond bur/ peesoreamer(A2)	1.27+/-0.46		1.73+/-o.46		1.73+/-0.70	
DT(A1)	2.2+/-0.41	0.6632	2.13+/-0.35	0.933	2.20+/-0.41	0.8519
Parapost (B1)	2.07+/-0.70		2.13+/-0.64		2.13+/-0.64	
DT(A1)	2.20+/-0.41	0.0015*	2.13+/-0.35	0.0023*	2.20+/-0.41	0.0035*
Diamond bur/ peesoreamer(B2)	1.40+/-0.51		1.40+/-0.51		1.47+/-0.52	
Diamond bur/ peesoreamer(A2)	1.27+/-0.46	0.0048*	1.73+/-0.46	0.1249	1.73+/-0.70	0.1466
Parapost (B1)	2.07+/-0.70		2.13+/-0.64		2.13+/-0.64	
Diamond bur/ peesoreamer(A2)	1.27+/-0.46	0.5338	1.73+/-0.46	0.119	1.73+/-0.70	0.3615
Diamond bur/ peesoreamer(B 2)	1.40+/-0.51		1.40+/-0.51		1.47+/-0.52	
Parapost (B1)	2.07+/-0.70	0.0181*	2.13+/-0.64	0.0075*	2.13+/-0.64	0.0144*
Diamond bur/ peesoreamer(B2)	1.40+/-0.51		1.40+/-0.51		1.47+/-0.52	

Figure 1: Placement of post

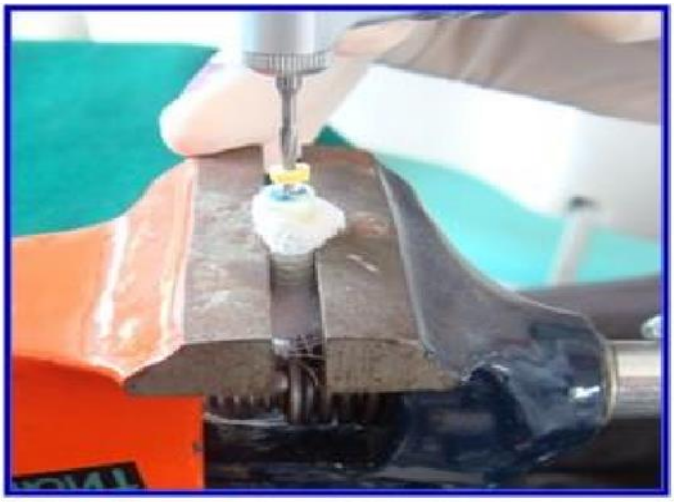

Figure 2: Removal of fiber post

Figure 3: Split specimen from the DT removal group demonstrating presence of post remnants in the cervical, middle and apical thirds

Figure 4: Split specimen from the kodex twist drill/ parapost removal drill kit group demonstrating presence of post remnants in the cervical, middle and apical thirds

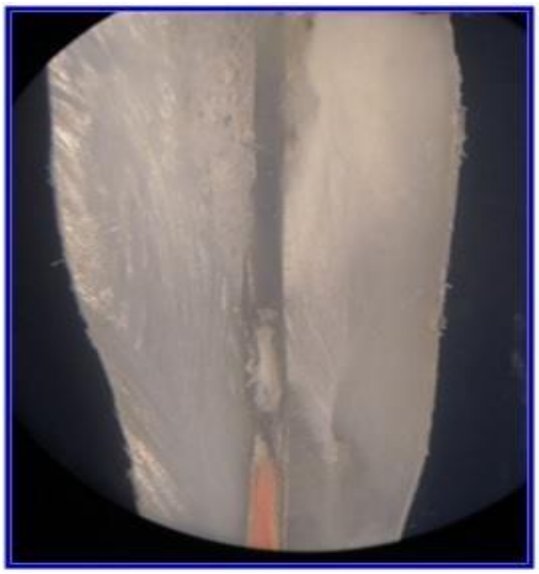

Figure 5: Split specimen from the diamond bur/peeso reamer combination demonstratingremnants in the apical third only

Discussion

Endodontically treated teeth often have a significant coronal and radicular compromise of tooth structures. Factors responsible for this include extensive caries, fracture, andtrauma to the tooth, iatrogenic causes and pulp pathology as well as endodontic treatment.[1]The restoration of such teeth with compromised tooth is accomplished using intraradicularrestorations and posts to protect and reinforce the weakened tooth. Certain factors must be evaluated to determine whether a post system is indicated for endodontically treated teeth. These factors include amount of remaining healthy dentin, the internal canal configuration, morphologyof the root and quality of remaining dentin.[1] A recent review of studies assessing the rate of success in endodontic treatment has shownthat this rate ranges between 53% and 94%.[20,21,22,23] Implying that, a significant percentage of endodontically treated teeth needed retreatment at some point in time because of development or reappearance of periapical pathology. [20,21,22,23,24] In other

instances, the endodontic treatment maybe judged successful, but restorative needs require the removal of an existing post to improve the design, mechanics, or aesthetics of a new restoration.[13]In a nonsurgical retreatment, which is preferred approach among clinicians, a post cemented into the root canal obviously represents an obstacle that has to be removed to regain access to the endodontic space and apex. The removal of fiber posts has been described as a quick and simple procedure by De Rijk.The unique structure of the fiber posts, consisting of stretched parallel fibers within a resin matrix,is said to help guide the removal drills and burs and to keep them in the confines of the post, thuseliminating the risk of root perforations.[25] Sakkal[26] and later De Rijk[25] described procedures to remove fiber posts using a kit containing a pilot drill, a removal drill, and a Peeso reamer. Essentially, fiber posts are removed by drilling a pilot hole to make a channel through the centre of the fiber post to full length and then hollowing out the post with successively larger diameter drills until the post is removed. In the present study scoring system suggested by Lindemann M[27] was used. The samples were evaluated under stereomicroscope and the effectiveness of the post removal was measured from the coronal to the apical part of the root canal with ocular micrometer. The results were statistically analyzed and comparisons showed The two fiber posts i.e., DT Light post no 1 and Parapost no 5 did not vary significantly inamount of time (efficiency) needed for removal of fiber post removal. The Kodex Twist Drill/Parapost removal drill kit had highest efficiency grade. DT Removal drill kit was more efficient than diamond bur/Peeso reamer combination.There was no significant difference in the effectiveness of fiber post removal with two different removal systems i.e., DT Light post and Parapost removal drill kit in retrieving their respective posts. However there was significant difference between the effectiveness of fiber post removal using diamond bur/Peeso reamer and DT removal drill kit, Kodex twist drill/Parapost removal drill kit. The diamond bur/Peeso reamers combination had a higher effectiveness grade than the Kodex Twist Drill/Parapost removal kit, which had higher grade than DT Light post removal kit. The effectiveness of fiber post removal in the present study showed that different postsdid not significantly vary from each other which confirm the results of the study done by Gerald et al.[19] With diamond bur/Peeso reamer combination the posts were retrieved effectively. Theseresults are in accordance with Gerald et al[19] and Lindeman et al.[27] In selecting a post removal system, both speed and effectiveness remain important factors to consider, while safety of the post removal system is of utmost importance.

Conclusion

Within the limitations of the present study, it can be concluded that There was no difference between the three post removal systems i.e., DT Removal drill kit, Kodex Twist drill/ Parapost removal drill kit and diamond bur/Peeso reamer in terms of efficiency of removal of fiber posts. Diamond bur/Peeso reamer removal system effectively removed the fiber post.There was no difference in effectiveness between DT Removal drill kit, Kodex Twist drill/ Parapost removal drill kit.

References:

1. De Almeida LA, Vasan LP, Paulino SM, Sousa Neto MD. Fracture resistance of weakened roots restored with a transilluminating post and adhesive restorative materials. Journal of Prosthetic Dentistry 2006;96(5):339-344.
2. Robbins JW. Restoration of endodontically treated teeth. Dental Clinics of NorthAmerica 2002; 46:367-84.
3. Deutsch. Prefabricated dowels: A review literature. J Prosthet Dent 1983;49:498-503.
4. Mattison GD. IR and NMR analyses of hardening and maturation of glass ionomer cement. Journal of Dental Research 1982;75:1920-1927.
5. Reech ES, Messer HH, Douglas WH. Reduction in tooth stiffness as a result of endodontic

and restorative procedures. J Endod 1989;15:512-516.
6. Steven R. Potashnick, Franklin S. Weine, Sherwin Strauss. Restoration of endodontically treated teeth. Weine 6th edition:546-584.
7. Bitter K, Kielbassa AM. Post endodontic restorations with adhesively luted fiber reinforced composite post systems: A review. American Journal Dentistry 2007;20:353-360.
8. A.F.V Santos, J.B.C Meira, C.B Tanaka, T.A Xavier, R.Y. Ballester. Can fiber posts increase root stresses and reduce fracture? Journal of Dental Research 2010;89(6):587-591.
9. Cormier CJ, BurnsDR, Moon P. In vitro comparison of fracture resistance and failure mode of fiber, ceramic and conventional post systems at various stages of restoration. Journal of Prosthetic Dentistry 2001;10:26-36.
10. Asmussen E, Peutzfeldt A, Heitmann T. Stiffness, elastic limit and strength of newer types of endodontic posts. Journal Dentistry 1999;27:275-278.
11. Ferrari M, Vichi A, Mannocci F, Manson PN. Restrospective study of clinical performance of fiber posts. American Journal Dentistry 2000;13:9B-14B.
12. Ferrari M, Vichi A, Garcia Godoy F. Clinical evaluation of fiber reinforced epoxy resin posts and cast posts and cores. American Journal Dentistry 2000;13:15B-18B.
13. John I Ingle, James HS Simon. Retreatment of non-healing endodontic therapy and management of mishaps. Ingle Endodontics 6,1088-1161.
14. Gerald C, Andreason, Perdigao, James S, Hodges. Efficiency and effectiveness of fiber post removal using 3 techniques. Quintessence International 2007;38:663-670.
15. Strindberg LZ. The dependence of the result of pulp therapy on certain factors. An analytic study based on radiographic and clinical follow-up examinations. Acta Odont Scand 1956;14(suppl 21):1-175.
16. Ostravik D. Time-course and risk analyses of the development and healing of chronic apical periodontitis in man. International Endodontic Journal 1996;29:150-155.
17. Sjogren U, Hagglund B, Sundquist G, Wing K. factors affecting the long term results of endodontic treatment. Journal of Endodontics 1990;16:498-504.
18. Tronstad L, Asbjornsen K, Doving L, Pedersen I, Eriksen HM. Influence of coronal restoration on periapical health of endodontically treated teeth. Endodontic Dental Traumatology 2000;16:218-221.
19. Friedmann S. Treatment outcome and prognosis of endodontic therapy. In Ostravik D, Pitt Ford, eds. Essential Endodontology: prevention and treatment of apical periodontitis. 3rd ed. Oxford: Blackwell Science;2001;22-29.
20. Maria Leticia Borges Britto de Lima Machado. ECLER Endodontology vol 1, no 3. 1999.
21. Sakkal S. carbon fiber post removal techniques. Compend Contin Educ Dent Suppl 1996;(20):S86.
22. Matthew Lindemann,, Peter Yaman, Joseph B. Dennison, and Alberto A. Herrero. Comparison of the efficiency and effectiveness of various techniques for removal of fiber posts. Journal of Endodontics 2005;31(7):520-522.