Journal of Endodontics
Copyright © 2003 by The American Association of Endodontists

Printed in U.S.A.
Vol. 29, No. 9, September 2003

Comparison of Two Techniques for Removing Fiber Posts

A. Gesi, DDS, S. Magnolfi, DDS, C. Goracci, DDS, MS, and M. Ferrari, MD, DDS, PhD

The purpose of this study was to evaluate the time needed to remove several types of fiber posts using two different bur kits. Estimates refer to the time needed to pass the fiber post until arriving at the gutta-percha. Sixty extracted anterior teeth were treated endodontically. A post space with a standard depth of 10 mm was prepared in each root canal. The sample was randomly divided into 3 groups of 20 specimens each. Three different types of posts were cemented: group 1, Conic 6% tapered fiber posts (Ghimas); group 2, FRC Poster fiber posts (Ivoclar-Vivadent); and group 3, Composipost carbon fiber posts (RTD). To remove the post, for half of each group's specimens the burs from the RTD fiber posts removal kit were used (subgroup A). From the other half of the teeth in each group (subgroup B), posts were removed by using a diamond bur and a Largo bur. Composipost carbon fiber posts (group 3) took significantly less time to remove than the other two types of posts ($p < 0.05$). For the bur kits, the procedure involving the use of a diamond and a Largo bur (subgroup B) was significantly faster ($p < 0.05$). The interaction between the type of post and the type of bur kit used was not significant ($p > 0.05$).

It is common knowledge that a significant percentage of endodontically treated teeth need retreatment at some point in time because of the development or reappearance of periapical pathology (1–6). A recent review of studies assessing the rate of success in endodontic treatment has shown that this rate ranges between 53% and 94% (2–6). According to Tronstad et al. (6), from 19% to 46% of endodontic therapies fail to ensure the complete and definite health of periapical tissues.

In nonsurgical retreatment, which is the preferred approach among clinicians (7, 8), 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 use of ultrasonic vibrations or other devices has been proposed for this purpose (9–12). Removing a post can be more or less difficult depending on the type of post. The removal of a metal post and of its luting cement is often time-consuming and carries the risk of damaging the root.

Over the past few years, fiber posts have gained popularity (13, 14). In terms of structure, they are made of fibers (e.g., carbon, quartz, silica, zircon, 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, is thought to drastically reduce the likelihood of a root fracture, which is the most frequent cause of failure with metal posts (15–17). The wide-spread use of fiber posts poses the question of evaluating how difficult their removal for retreatment can be and whether a particular type of post or bur can create especially favorable conditions for that purpose.

The purpose of this study was to evaluate the time needed to remove three types of fiber posts with two different bur kits. The null hypothesis that neither the type of post nor the bur kit has a significant effect on the time used for post removal was tested.

MATERIALS AND METHODS

Sixty extracted anterior teeth were selected and stored in water before use. The inclusion criteria were that the teeth were free from any fracture and had root lengths of at least 14 mm as measured from the apex to the labial CEJ. After opening the access cavity with a diamond bur (#219 Intensive, Dentsply Maillefer, Ballaigues, Switzerland) on a high-speed handpiece, part of the crown was removed, so that the cavity margins were all around at the same level.

Root canals were instrumented using the crown-down technique. After checking the patency of the canal with a precurved file, Gates Glidden burs (Dentsply Maillefer) were used in the coronal third of the canal in a decreasing order from #3 to #1. After removing all coronal interferences, the working length was established by inserting a #10 file up to the apex. Root canal instrumentation was continued with Profiles .06 (Dentsply Maillefer) and ended when a #40 was brought to the working length. Root canal irrigation was performed between file sizes with a 3% solution of sodium hypochlorite delivered by a 30-gauge needle.

After drying the canal with paper points, a master cone of adequate size was cut to the dimension of the apical preparation by using a sizing instrument for gutta-percha cones (Dentsply Maillefer) and a scalpel blade. The master cone (Hygienic, Coltène/Whaledent Inc., Mahwah, NJ) was tried for tug back in the apical portion of the canal. An endodontic sealer (Pulp Canal Sealer, Kerr Manufacturing Co., Romulus, MI) was used coating only the master cone. The endodontic space was then obturated through vertical condensation of gutta-percha, using the System B device (Analytic Technology, San Diego, CA), with a plugger that could reach a 4-mm distance from the apex. Back-filling was completed with the Obtura syringe (Obtura Corp., Fenton, MO). Finally, the access cavity was sealed with a noneugenol temporary filling (Coltosol, Coltène), and the tooth was placed in water again.

After 2 days of storage the temporary filling was removed, and a #3 Largo bur (Dentsply Maillefer) was used to prepare a post space with a standard depth of 10 mm. The sample was then randomly divided into three groups of 20 specimens each. In group 1 specimens, the canals were treated with an enamel-dentin bonding system (Pulpdent, Watertown, MA), strictly following the manufacturer's instructions. Conic 6% tapered fiber posts (Ghimas, Bologna, Italy) were luted with the appropriate dual resin cement (Pulpdent) after the post surface was treated with the priming-adhesive solution of the bonding system. In group 2, Excite DSC (Ivoclar-Vivadent, Schaan, Liechtenstein) was used as a bonding system, and FRC Poster fiber posts (Ivoclar-Vivadent) were placed, together with the dual cement Variolink II (Ivoclar-Vivadent), after the post surface was coated with a silane solution (Monobond, Vivadent). Finally, in group 3, one-step bonding material (Bisco, Schaumburg, IL) was applied on the canal walls, and Composipost carbon fiber posts (RTD, St. Egève, France) were luted with the Duo-Link (Bisco) dual-cure resin cement.

In all specimens the cement was carried into the canal by a #30 lentulo and polymerized for 2 min after post insertion. The abutment was gradually built up with a flowable resin composite (Tetric Flow, Ivoclar-Vivadent), high enough to cover the head of the post under a layer of composite to prevent contact of the post with the storage medium.

After 2 days of storage in water, the layer of composite covering the post was removed with a diamond bur. In half of the specimens from each group, collectively classified as subgroup A, the RTD Fiber Post Removal Kit (RTD) was used. This consists of two burs: the first, with a very short working portion, prepares a hole on the surface of the fiber post; the second, following this opening, drills through the fiber post.

From the other half of each group's specimens, together forming subgroup B, fiber posts were removed as follows. An opening was created on the head of the fiber post with the tip of a diamond bur (#862 Komet, Germany). Then, a #3 Largo bur (Dentsply Maillefer) was used to penetrate the post. The time needed to remove the post from each specimen was noted, beginning just before mounting the first bur on the drill and ending when the apical gutta-percha first appeared from the canal.

The differences among the times measured for all of the groups and subgroups were tested for statistical significance using two-factor factorial ANOVA and Tukey's multiple comparison test. The level of significance was set at $p = 0.05$. The analysis was processed with SPSS software.

RESULTS

Table 1 reports the time measurements recorded for all experimental groups. On average the least time was needed to remove Composiposts (group 3), and the difference was statistically significant ($p < 0.05$). The other two types of posts required similar time to remove ($p > 0.05$). For the bur kits, the procedure using a diamond and a Largo bur was less time consuming, and the difference was statistically significant ($p < 0.05$).

Finally, there was no significant interaction between type of post and type of bur as far as removal time is concerned ($p < 0.05$). Regardless of the type of post inserted, time for post removal was always longer when the RTD kit was used. In only one specimen, from group 1–subgroup A, did the breakage of a bur (#1 of the RTD kit) occur.

DISCUSSION

Composiposts (RTD), the first carbon fiber posts to appear on the market, were compared with white fiber posts (Ghimas) and with translucent fiber posts (Ivoclar-Vivadent), more recently proposed as offering superior aesthetic properties. The different composition of the three types of posts, in particular the different optical properties of carbon versus quartz versus glass fibers, may account for the results of this study. More precisely, the supposedly improved light transmission through translucent fiber posts may allow for a more complete resin polymerization in the apical area and thus for an increased retention of the post (18).

The statistical analysis proved that post removal was significantly faster for Composiposts and when using the combination diamond plus Largo burs. However, from a clinical standpoint, the time on average needed to remove a fiber post seemed, regardless of its type and the bur kit used, satisfactorily short.

TABLE 1. Post removal time in seconds recorded for all of the groups and subgroups

Sample	Group 1		Group 2		Group 3	
	Subgroup A	Subgroup B	Subgroup A	Subgroup B	Subgroup A	Subgroup B
1	37	37	38	29	28	27
2	28	35	35	25	24	22
3	41*	30	31	25	23	19
4	37	32	31	26	25	22
5	35	25	35	25	22	22
6	34	28	33	32	27	26
7	28	31	32	29	23	23
8	33	30	30	34	22	20
9	35	33	31	33	24	25
10	35	27	33	34	27	22
Mean ± SD	34.3 ± 11.7	30.8 ± 10.5	32.9 ± 6.8	29.2 ± 11	24.5 ± 5.8	22.8 ± 7

* The first bur of the kit broken.

A direct comparison of this trial's findings with the average times needed to remove metallic posts cannot be performed, because the tests measuring this variable with metal posts have been conducted using different methods (9–11). However, the clinical belief is that removing a fiber post is faster and easier than removing a metal post. This latter procedure, in addition, involves a greater risk of damaging tooth structure.

The breakage of the first bur from the RTD kit in one of 30 removal procedures can be considered a fortuitous event. The failure was probably caused by the application of an excessive load on the thin and short working portion of the bur, which is used to create a hole on the fiber post. The breakage did not create any particular problem, because the detached fragment of the bur could readily be removed.

Other types of burs should be tested for their effectiveness in removing fiber posts. Further studies should also be conducted to assess the receptivity to a new bonding procedure of root canal walls that had already been treated to adhesively retain a fiber post.

Dr. Gesi is clinical professor of endodontology, University of Genoa, Italy. Dr. Magnolfi is in private practice in Pistoia, Italy. Dr. Goracci is visiting professor, and Dr. Ferrari is Dean, School of Dental Medicine, Chair and Professor of Dental Materials and Restorative Dentistry, University of Siena, Italy. Address requests for reprints to Dr. Marco Ferrari, Piazza Attias. 19, 57120 Livorno, Italy.

References

1. Friedman S. Treatment outcome and prognosis of endodontic therapy. In: Ørstavik D, Pitt Ford TR, eds. Essential endodontology: prevention and treatment of apical periodontitis. 3rd ed. Oxford: Blackwell Science, 2001: 22–9.

2. Strindberg LZ. The dependence of the results 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.

3. Ørstavik D. Time-course and risk analyses of the development and healing of chronic apical periodontitis in man. Int Endod J 1996;29:150–5.

4. Sjögren U, Hagglund B, Sundqvist G, Wing K. Factors affecting the long-term results of endodontic treatment. J Endodon 1990;16:498–504.

5. Sjögren U, Figdor D, Persson S, Sundqvist G. Influence of infection at the time of root filling on the outcome of endodontic treatment of teeth with apical periodontitis. Int Endod J 1997;30:297–306.

6. Tronstad L, Asbjørnsen K, Døving L, Pedersen I, Eriksen HM. Influence of coronal restorations on the periapical health of endodontically treated teeth. Endod Dent Traumatol 2000;16:218–21.

7. Gutmann JL, Harrison JW. Surgical endodontics. Boston: Blackwell Science, 1991.

8. Allen RK, Newton CW, Brown CE. A statistical analysis of surgical and nonsurgical endodontic retreatment cases. J Endodon 1989;15:261–6.

9. Buoncristani J, Seto BG, Caputo AA. Evaluation of ultrasonic and sonic instruments for intraradicular post removal. J Endodon 1994;20:486–9.

10. Johnson WT, Leary JM, Boyer DB. Effect of ultrasonic vibration on post removal in extracted human premolar. J Endodon 1996;22:487–8.

11. Dixon EB, Kaczkowski PJ, Nicholls JI, Harrington GW. Comparison of two ultrasonic instruments for post removal. J Endodon 2002;28:111–5.

12. Ruddle CJ. Nonsurgical endodontic retreatment. In: Cohen S, Burns RC, eds. Pathways of the pulp. 8th ed. St. Louis: Mosby, 2002:45–8.

13. Duret B, Reynaud M, Duret F. Un nouveau concept de reconstitution corono-radiculaire: le composiposte (1). Chir Dent France 1990;540:131–41.

14. Drummond JL, Toepke RS, King TJ. Thermal and cycling loading of endodontic posts. Eur J Oral Sci 1999;107:220–4.

15. Asmussen E, Peutzfeldt A, Heitmann T. Stiffness, elastic limit and strength of newer types of endodontic posts. J Dent 1999;27:275–278.

16. Ferrari M, Vichi A, Mannocci F, Mason PN. Retrospective study of clinical performance of fiber posts. Am J Dent 2000;13:9B–14B.

17. Ferrari M, Vichi A, Garcia Godoy F. Clinical evaluation of fiber-reinforced epoxy resin posts and cast posts and cores. Am J Dent 2000;13:15B–8B.

18. Ferrari M, Vichi A, Grandini S. Efficacy of different adhesive techniques on bonding to root canal walls: an SEM investigation. Dent Mater 2001;17: 422–9.