Multi-Piece Post-Crown for Multi-Rooted Teeth with Non-Parallel Canals: A Direct Pattern Technique

Introduction

Adequate restorations must be done to the endodontically treated teeth because these teeth are considered brittle and remaining coronal tooth structure is mostly inadequate to retain full crowns [1]. The procedures traditionally involve posts and core followed by full crowns. The development of cast dowel cores was a logical evolution from the Richmond crown. Custom cast post and cores are well suited for canals that have an extremely tapered, noncircular cross section; irregularly shaped canals; and roots with little or no coronal tooth structure remaining [2,3].

The multi-piece post-crown technique is more effective in restoring residual root than other restoration techniques [4]. The direct pattern can be used for multi-rooted posterior teeth, with non-parallel canals, although limited access may make the indirect approach easier. The indirect technique has many drawbacks that may affect the accuracy and retention of the post. It needs extra steps like taking an impression and pouring a die, and air bubbles may be incorporated into post-hole spaces making removal of the wax patterns impossible.

The conventional direct pattern technique involves fitting prefabricated posts into prepared post holes, one post is roughened; the others are left smooth and lubricated. All posts should extend beyond the eventual preparation. The core is built up with cold-cure resin and shaped after hardening to the final form. The smooth lubricated posts are gripped with forceps and removed leaving holes in their place through the core. Resin pattern of the core with the roughened single post is invested and cast. The holes for the auxiliary posts can be refined with twist drill. After try in, the core is cemented and excess cement is removed from auxiliary post holes with twist drill, and the auxiliary posts are cemented to place.

A major drawback of the traditional direct pattern technique is related to using potentially corrodbile dissimilar metals for post and core. Many researchers concluded that there is a correlation between root fracture and corrosion of the base metal prefabricated post and cast core systems restoring them [5-8]. One study, reporting on 468 teeth with vertical or oblique root fracture, attributed 72% of these failures to electrolytic action of dissimilar metals used for the post and core. The mechanism was postulated as the corrosion products caused a volume change that split the root [5]. Another drawback results from casting a core onto a prefabricated post system is that the casting process may unfavorably affect the physical properties of wrought metal posts. The preheating temperature of the investment mold may lead to recrystalization of the wrought metal post [9].

In an attempt to overcome the drawbacks of the traditional direct pattern technique for multi-rooted teeth with non-parallel canals, this article described a technique for rapidly constructing direct pattern for posts and their corresponding core sections and hence can be cast from the same alloy.

Materials and Procedures

a. Prepare post hole spaces following the standard procedures. Rotary instruments (Penetration drill of Unimetric Set, Dentsply, Switzerland) were used to remove gutta-percha to [prepare post hole spaces. Chemical solvents were not used to remove gutta percha to avoid apical leakage [10,11].

b. Roughen loose-fitting orthodontic wires (0.7 mm in diameter, Stainless Steel wire, Dentoform, USA) was tried into the prepared post spaces (Figure 1 and 2). They should extend to the prepared canals full depth.

c. Lightly lubricate one canal with a periodontal probe and petroleum jelly (Relience Dental Manufacturing Co) and temporarily block other post hole or holes with cotton.
d. A cold cure resin, such as Durallay (Relience Dental Manufacturing Co) is mixed to a low-viscosity consistency and is loaded into a needle tube that is inserted into a Mark IIp Speed Slot syringe (Centrix). The acrylic resin is injected into the canal; beginning at the apical end of the canal and moving incisally as the resin is extruded from the syringe. The fitted orthodontic wire is wetted with the monomer liquid and inserted into the acrylic resin in the canal. The remaining acrylic resin in the needle tube is extruded from the syringe to form the core portion of the pattern. The resin pattern is loosened and reseated several times while it is still elastic but not removed entirely from the canal [12-14].

c. Once the resin has polymerized, remove the pattern and inspect for any defects or voids. Correct defects any voids by adding resin or soft wax and reseat the post. The core section is modified by removing any undercut adjacent to the other post-holes and to make dovetails grooves and lubricate it with petroleum jelly. Keep this post with its section of the core in place inside the tooth and build up the other post or posts with their corresponding section of the core, following steps 3 through 5 for the other canal or canals using either hard inlay pattern wax [15] (Keystone, USA), cold-cure resin (Durallay) (Figure 3 and 4), light-cured resin [16], or thermoplastic resin [17].

f. Invest post-core patterns (Figure 5) and cast those following standard techniques (no asbestos substitute liner).

g. Divest them and finish (Figure 6), and try them into the prepared canals (Figure 7 and 8), then cement them.

h. A clinical case for restoring endotreated tooth #36 with casted post core by the same technique mentioned in steps 1 through 7 is shown in (Figures 9-13).

Discussion

There are many methods, of constructing post and cores for posterior teeth, reported in the literature [18-22]. These methods include using prefabricated post with core build up or cast post and core. The procedures for prefabricated posts are simpler but their retention is inferior to cast posts if elliptical...
or extremely flared canals exist. The indirect cast post and core technique is still a popular method of fabricating post and core pattern for multi-rooted teeth with non-parallel canals, but it has many drawbacks that may affect the accuracy and retention of the post. Success of the indirect method depends on the accuracy of the impression replicating the post hole space. Impression material can be injected into post hole space and distributed by a spiral paste filler to capture the internal canal morphology [23]. Therefore in the indirect method many dimensional changes takes place during cast post fabrication due to impression and wax pattern materials.

Although the conventional direct pattern technique allows more accurate registration of one canal morphology in multi rooted teeth that may lead to a better fit of cast post which in turn is expected to improve retention and stability of the final restoration, it is not without drawbacks. One drawback is related to using potentially corrode dissimilar metals for post and core. Many researchers concluded that there is a correlation between root fracture and corrosion of the base metal prefabricated post and cast core systems restoring them [5-8]. Another drawback results from casting a core onto a prefabricated post system is that the casting process may unfavorably affect the physical properties of wrought metal posts. The preheating temperature of the investment mold may lead to recrystalization of the wrought metal post [9].

The present procedures allowed the prosthodontist to fabricate direct cast post and core for multi-rooted teeth with non parallel canals and at the same time eliminate the problems associated with the traditional direct pattern technique. This is because the pattern for posts and core sections are cast from the same alloy; hence the post core system is not susceptible to electrolytic corrosion.

References
1. Helfer AR, Melnick S, Schilder H (1972) Determination of the moisture content of vital and pulpless teeth. Oral Surg Oral Med Oral Pathol 34(4): 661-670.
2. Stephen FR, Martin FL, Fujimoto J (2006) Contemporary fixed prosthodontics (4th edn), Mosby, USA, pp. 1152.
3. Morgano SM, Milot P (1993) Clinical success of cast metal posts and cores. J Prosthet Dent 70(1): 11-16.
4. Lu LW, Meng GW, Liu ZH (2013) Finite element analysis of multi-piece post-crown restoration using different types of adhesives. Int J Oral Sci 5(3): 162-166.
5. Rud J, Omnell KA (1970) Root fracture due to corrosion. Diagnostic aspects. Scand J Dent Res 78(5): 397-403.
6. Angmar-Mansson B, Omnell KA, Rud J (1969) Root fracture due to corrosion. 1. Metallurgical aspects. Odontol Revy 20(3): 245-265.
7. Silness J, Gustavsen F, Hunsbæth J (1979) Distribution of corrosion products in teeth restored with metal crowns retained by stainless steel posts. Acta Odontol Scand 37(6): 317-21.

8. Milot P, Stein RS (1992) Root fracture in endodontically treated teeth related to post selection and crown design. J Prosthet Dent 68(3): 428-435.

9. Kwan EH, Harrington GW (1981) The effect of immediate post preparation on apical seal. J Endod 7(7): 325-329.

10. Mattison GD, Delivanis PD, Thacker RW Jr, Hassell KJ (1984) Effect of post preparation on the apical seal. J Prosthet Dent 51(6): 785-789.

11. Brunell G (1982) Casting and microstructure of post and core at different mold temperatures. Acta Odontol Scand 40(4): 241-246.

12. Coleman AJ, Urquidi J (1996) An injection technique for generating direct resin post and core patterns. Quintessence Int 27(11): 749-752.

13. Awad MA, Abdulghaffar HS (2014) Custom-made post and core - part I: technique to fabricate direct custom-made post with resin pattern. J Dent Health Oral Disord Ther 1(3): 00013.

14. Awad MA (2014) Custom-made post and core - part II: fabrication of direct resin core using special mold. J Dent Health Oral Disord Ther 1(3): 00014.

15. Ingle JI, Bakland LK (2002) Endodontics: Restoration of endodontically treated teeth (5th edn) BC Decker Inc Hamilton-London.

16. Waldmeier MD, Grasso JC (1992) Light-cured resin for post patterns. J Prosthet Dent 68(3): 412-415.

17. Rosenstiel SF, Land MF, Holloway JA (1997) Custom-cast post fabrication with thermoplastic material. J Prosthet Dent 77(2): 209-211.

18. Baraban DG (1970) A simplified method for making post and cores. J Prosthet Dent 24(3): 287-297.

19. Hudis SI, Goldstein GR (1986) Restoration of endodontically treated teeth: a review of the literature. J Prosthet Dent 55(1): 33-38.

20. Abou-Rass M (1992) Post and core restoration of endodontically treated teeth. Curr Opin Dent 2: 99-107.

21. Schneider RL (1994) A one-appointment procedure for cast post and core restorations. J Prosthet Dent 71(4): 420-422.

22. Morgano SM, Hashem AF, Fotoohi K, Rose L (1994) A nationwide survey of contemporary philosophies and techniques of restoring endodontically treated teeth. J Prosthet Dent 72(3): 259-267.

23. Sall HD (1977) Restorative techniques for endodontically treated teeth. Dent Surv 53:45.