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RESTORATIVE

Efficient Core Buildups

Sonic-Activated Composite Resin in Endodontically Treated Teeth

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INTRODUCTION

Core buildups are frequently required when restoring endodontically treated teeth with or without posts. These teeth often lack sufficient restorable tooth structure due to the causes necessitating the root canal in the first place, such as extensive caries, extensive restorations, or fracture. For this reason, additional structure is often needed to provide necessary retention form and resistance form in order to predictably restore the tooth with a crown.

This article discusses material choices for composite resin core buildups, and illustrates a rapid placement technique for a lower second molar without using a post.

The Post Question

Restorative dentists are often faced with the decision whether to place a post prior to core buildup when restoring the endodontically treated tooth. Although glass fiber-reinforced composite posts are popular today, historically, prefabricated or custom-made metallic posts with metal cores were routinely placed before full-crown restoration.[1] This was because endodontic teeth were thought to lack moisture and were therefore brittle, and that placement of a post would strengthen the overall restored unit. Research has shown this not to be true. The moisture content and brittleness of endodontically treated teeth are not significantly different than vital teeth.[2,3] Furthermore, studies show that posts do not significantly strengthen endodontic teeth and that preparation of the post space can actually weaken teeth.[4-10] Indeed, root fracture has been reported to be the second most common cause of post and core failure.[11-13] In light of these facts, and the fact that post-preparation carries risk factors such as perforation or disturbance of the root canal filling, it would seem logical that post-retained restorations should be avoided, whenever possible. Since posts are really only necessary to retain the core, they should not be needed when sufficient tooth structure, or its configuration, allows for retention of the core material.[14] Due to the presence of internal walls and a large deep pulp chamber, molars should rarely, if ever, require a post. A recent study suggests that composite resin cores without posts show increased resistance to fracture when compared to post and core systems, as long as there is a sufficient ferrule.[15] Several papers have confirmed the benefit of a ferrule to restoration survival and suggest that it should be at least 1.5 mm in height above the crown margin.[16-18]

Figure 1. Sonic-activated, bulk-fill composite resin technology (SonicFill [Kerr]).

Core Buildup

Core buildups can be extensive, particularly in molars. Additionally, because of the high functional

Figure 2. Preoperative view of the endodontically treated lower second molar.

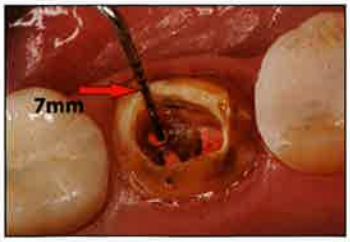

Figure 3. The axial wall depth measures 7.0 mm to the pulpal floor. Externally, there is approximately 2.0 mm of ferrule.

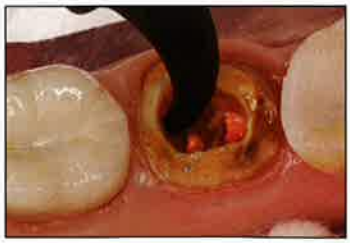

Figure 4. After curing the adhesive, the SonicFill tip is placed at the bottom of the cavity before activation. The high frequency vibration causes liquefaction and extrusion. No low viscosity liner is needed.

Figure 5. Large round-ended condenser is used to compress the material and blend the margins.

Figure 6. A second 5.0 mm increment is extruded from the activated tip.

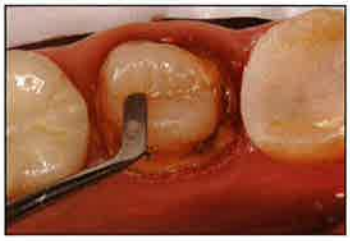

Figure 7. The nonsticky, nonslumping sonically-activated composite is easily sculpted.

Figure 8. Occlusal view of final preparation.

Figure 9. Buccal view shows the additional preparation height provided by the core.

demand required of these teeth, core materials must have high compressive and tensile strengths. Amalgam was often used in the past, but bonded composite resin buildups are very popular today. Composite resin choices fall into 2 broad categories: high viscosity, highly filled materials, or low viscosity, lower filled materials. Although high in strength, high viscosity materials usually need an initial, thin, low viscosity layer to achieve good adaptation to the cavity floor. Since the cavity floor is deep, and most high viscosity materials have a low depth of cure, as many as 3 to 5 layers of separately cured composite may be needed for the buildup. Low viscosity materials promoted for core buildups have either high depth of cure and high translucency or are dual-cured. Although lower in strength than high viscosity materials, they wet the cavity walls well. A new product, SonicFill (Kerr), a unique, sonic-activated, bulk-fill composite resin material, would seem to give dentists the combined advantages of each of these classes of material without the disadvantages (Figure 1).

SonicFill is an 84% filled composite which is activated and inserted into the cavity using a sonic handpiece. Upon activating the air-driven handpiece, high frequency vibration lowers the viscosity of the specially formulated composite material by 87% and rapidly extrudes it from the narrow diameter tip. Although liquefaction doesn't reach quite a flowable consistency, the vibration causes intimate adaptation to cavity walls so no flowable liner is needed. Expedient placement of the core is accomplished due to SonicFill's high depth of cure. Independent investigators have confirmed cure depth to be 5 mm using the clinically relevant bottom to top hardness ratio of 80%.[19-21] Coupled with its nonsticky, nonslump consistency, core buildups with SonicFill are fast, easy, well adapted, aesthetic, and strong, as the following case illustrates.

CASE REPORT

A patient reported with an endodontically treated lower second molar in need of restoration. The tooth lacked sufficient tooth structure to retain a crown, so a core buildup was necessary. The ferrule height was approximately 2.0 mm circumferentially (Figure 2). The coronal tooth height measured 7.0 mm from the pulpal floor (Figure 3). To create 4.0 mm of retention and resistance form would mean building a core which would extend 2.0 mm above the existing coronal tooth structure. Therefore, the total core thickness from top to bottom would be 9.0 mm.

After placing and light-curing the dentin adhesive, Optibond XTR (Kerr), the SonicFill tip is placed at the bottom of the pulp chamber (Figure 4). Upon activation of the sonic handpiece, liquefaction of the SonicFill composite resin occurs instantaneously and, with the handpiece setting at 5, the material extrudes rapidly from the tip orifice. The tip is gradually backed out of the cavity as it fills. The handpiece is deactivated 3 to 5 seconds from the start when the material has reached 5.0 mm of thickness. Scribing a line on the internal cavity wall helps in knowing when sufficient material has been extruded. It is not necessary to condense the composite because the high frequency vibration yields intimate adaptation to cavity walls. A condensing instrument is used only to quickly smooth and adapt the material at the margins (Figure 5).

Using a high-output LED curing light, the composite is cured 20 seconds more than what is recommended in the manufacturer's directions for use. This is to compensate for the greater distance from the light tip to the floor of the pulp chamber as compared to the shorter distance to the pulpal floor of a vital tooth. Immediately after curing, the tip is placed back into the cavity, activated, and 5.0 mm more of the material is extruded (Figure 6). Although liquefac-

Figure 10. Note the difference in adaptation, density, and radiopacity of the SonicFill core compared to the low viscosity composite core in this patient's first molar.

tion occurs instantly upon handpiece activation, SonicFill returns to its original high viscosity state somewhat slowly. Because of this feature, the still energized material is nonsticky and does not slump, making it easy to quickly shape and sculpt (Figure 7). Light-curing yields an overall core buildup of 10 mm. Having excess height allows for some reduction during final preparation. The final result is an adequate 4-mm preparation height and an aestheic foundation for an all-ceramic crown (Figures 8 and 9). An x-ray shows the density and adaptation of the SonicFill composite resin core prior to crown placement (Figure 10).

CONCLUSION

Research has given dentists a greater understanding regarding the restoration of endodontically treated teeth. It seems clear that molar teeth may not routinely require posts. This has reduced the risk inherent in placing posts and reduced additional loss of tooth structure required by the procedure. It also reduces the cost to the patient for this extra treatment. The sonic-activated, highly filled composite technology presented in this article further increases speed and efficiency while providing adaptation and strength when placing core buildups.✦

References

1. Colman HL. Restoration of endodontically treated teeth. *Dent Clin North Am*. 1979;23:647-662.
2. Papa J, Cain C, Messer HH. Moisture content of vital vs endodontically treated teeth. *Endod Dent Traumatol*. 1994;10:91-93.
3. Sedgley CM, Messer HH. Are endodontically treated teeth more brittle? *J Endod*. 1992;18:332-335.
4. Ho MH, Lee SY, Chen HH, et al. Three-dimensional finite element analysis of the effects of posts on stress distribution in dentin. *J Prosthet Dent*. 1994;72:367-372.
5. Trope M, Maltz DO, Tronstad L. Resistance to fracture of restored endodontically treated teeth. *Endod Dent Traumatol*. 1985;1:108-111.
6. Sorensen JA, Martinoff JT. Intracoronal reinforcement and coronal coverage: a study of endodontically treated teeth. *J Prosthet Dent*. 1984;51:780-784.
7. Fuss Z, Lustig J, Katz A, et al. An evaluation of endodontically treated vertical root fractured teeth: impact of operative procedures. *J Endod*. 2001;27:46-48.
8. Ross IF. Fracture susceptibility of endodontically treated teeth. *J Endod*. 1980;6:560-565.
9. Reeh ES, Douglas WH, Messer HH. Stiffness of endodontically-treated teeth related to restoration technique. *J Dent Res*. 1989;68:1540-1544.
10. Reeh ES, Messer HH, Douglas WH. Reduction in tooth stiffness as a result of endodontic and restorative procedures. *J Endod*. 1989;15:512-516.
11. Bergman B, Lundquist P, Sjögren U, et al. Restorative and endodontic results after treatment with cast posts and cores. *J Prosthet Dent*. 1989;61:10-15.
12. Mentink AG, Meeuwissen R, Käyser AF, et al. Survival rate and failure characteristics of the all metal post and core restoration. *J Oral Rehabil*. 1993;20:455-461.
13. Hunter AJ, Feiglin B, Williams JF. Effects of post placement on endodontically treated teeth. *J Prosthet Dent*. 1989;62:166-172.
14. Cheung W. A review of the management of endodontically treated teeth. Post, core and the final restoration. *J Am Dent Assoc*. 2005;136:611-619.
15. Massa F, Dias C, Blos CE. Resistance to fracture of mandibular premolars restored using post-and-core systems. *Quintessence Int*. 2010;41:49-57.
16. Sorensen JA, Engelman MJ. Ferrule design and fracture resistance of endodontically treated teeth. *J Prosthet Dent*. 1990;63:529-536.
17. Hempton TJ, Dominici JT. Contemporary crown-lengthening therapy: a review. *J Am Dent Assoc*. 2010;141:647-655.
18. Ma PS, Nicholls JI, Junge T, et al. Load fatigue of teeth with different ferrule lengths, restored with fiber posts, composite resin cores, and all-ceramic crowns. *J Prosthet Dent*. 2009;102:229-234.
19. Thompson J. *Laboratory Research Report: Evaluation of SonicFill Composite*. Fort Lauderdale, FL: Nova Southeastern University; October 2010.
20. Yapp R, Powers JM. Depth of cure of several composite restorative materials. *Dent Advis Res Report*. 2011;33:1.
21. Christensen GJ. Advantages and Challenges of Bulk-Fill Resin. *CLINICIANS REPORT*. 2012;5:1-2.

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Disclosure: Dr. Jackson discloses that he acted as a consultant in the development of SonicFill (Kerr) and retains a financial interest in it.