

Single point gutta percha obturation using a tricalcium silicate endodontic sealer

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Introduction

Lateral condensation and vertical compaction of gutta percha has been in wide use in performing endodontic obturation for decades. Historically this compression of gutta percha has been necessary because the sealers were themselves inadequate. They were hydrophobic, dimensionally unstable, not biocompatible, are susceptible to degradation, and irritating to periodontal tissue if extruded beyond the apex. Accordingly, these condensation techniques (lateral, vertical compaction, and warmed carrier based) were developed in order to minimize the sealer volume. It was acknowledged that more sealer meant more shrinkage, more leakage and more irritation, so techniques were developed to minimize the thickness of the sealer.

In this article, the author reviews the goals for endodontic treatment and the main obturation

methods. Then, a simplified technique will be described that utilizes a single gutta percha point with a new sealer material that overcomes the deficiencies of the older generations of endodontic sealers.

Goals of endodontic therapy

The endodontic triad of biochemical preparation, microbial control and complete obturation of the canal forms the basis for endodontic therapy.¹ The pulp space, chamber and canal must be thoroughly debrided of tissue and properly shaped. This is done by both mechanical and chemical means and when completed, leaves a canal that is free of infection and is ready for obturation.

¹ Cohen S, Hargreaves K. Pathways of the Pulp 9th ed. Mosby, St. Louis, MO, 2006.



A good root canal seal entombs any residual bacteria so that they are deprived of their food supply and are unable to replicate. In addition, the fill material should be antimicrobial so that it does not support further bacterial growth. It is also important to seal off the canal from the oral cavity and from the periapical region so that new bacteria do not cause reinfection.

To accomplish these objectives we use gutta percha, a solid core material that has the desired properties of being non-resorbable, has minimal reactivity with the host tissues, is well tolerated by the body, dissolves in solvents when necessary and is dimensionally stable.

The other component to the endodontic seal is the sealer cement that functions with the gutta percha, the requirements of which are as follows:

1. Easily introduced into the canal
2. Should seal laterally as well as apically
3. Should not shrink after being inserted
4. Should be impervious to moisture
5. Should be bacteriostatic
6. Should be radiopaque
7. Should not stain tooth structure
8. Should not irritate periapical tissues
9. Should be easily sterilized immediately before insertion
10. Should be easily removed from the endodontic system if necessary.²

Current obturation techniques

There are several current techniques for obturating the root canal, all of which employ gutta percha.

The first is called Cold Lateral Condensation where the operator has traditionally tapered the canal by way of a “step back” preparation. The master cone is coated with sealer and fitted to length, and then using a spreader, the operator condenses a number of accessory gutta percha points until he or she believes that the remaining



Fig. 1: Lateral condensation.

space between the master cone and the canal walls is fully obliterated.

Another method is Vertical Compaction first described by Schilder³ where a master gutta percha cone is fitted to length, coated with sealer and inserted into the canal. The original method involved heating up a plugger to cherry red then quickly stabbing it into the gutta percha mass leaving behind thermoplastic material that is condensed with a plugger. This method has been shown to generate hydraulic forces that can fill lateral canals as well as the irregularities within the root canal system. The coronal two thirds of the master cone come out when the hot instrument is withdrawn, forming a solid apical plug so that backfilling with softened gutta percha through an extrusion mechanism is controlled. Many advances have occurred concerning this technique, however, it is still difficult to accomplish with many of the problems associated with lateral condensation. One issue is the need to get the hot plugger

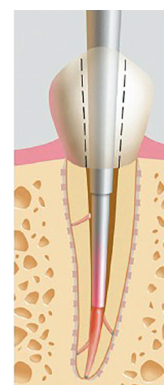


Fig. 2

to within 4 mm from the apex, necessitating the removal of excessive amounts of dentin in the coronal two thirds of the canal. Other drawbacks include lack of homogeneity, a high proportion of endodontic sealer at the apex, poor adaption to canal walls and apical extrusion of gutta percha.⁴

Of vital importance to the long term survivability of the tooth is the strategic preservation of the coronal dentin of the canal. This translates to making not only as small an endodontic opening into the chamber and the canal as possible, but also in respecting this coronal dentin when creating the final restoration. Unfortunately both of these obturation methods tend to result in canal preparations that take away too much coronal dentin and create a weakness in the structure of the tooth.

² Cohen S, Hargreaves K. Pathways of the Pulp 9th ed. Mosby, St. Louis, MO, 2006.

³ Schilder H. Filling root canals in three dimension, Dent Clin of North Amer 1967;723-44.

⁴ Tasdemir T, Er K, Yildirim T, Buruk K, Çelik D, Cora S, et al. Comparison of the Sealing Ability of Three Different Techniques in Canals Shaped with Two Different Rotary Systems: a Bacterial Leakage Study Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009 Sep;108(3):e129-34.

Single cone obturation

Recently there has been an increase in the use of only the master cone, especially in the cases of larger cones with the larger taper sizes that best match the geometry of rotary nickel-titanium systems (NiTi).⁵ This system does not require accessory points, lateral condensation, or warmed vertical compaction. Rather, the canals are shaped with the rotary NiTi files and filled with a master gutta percha cone that matches the last instrument used. This combination of the single cone with the appropriate endodontic sealer results in a uniform mass which prevents failures occurring around multiple cones. This technique takes less time when used with the rotary NiTi instruments, results in less operator fatigue, is easier on the patient and eliminates lateral pressure on the root.



Fig. 3: Single cone technique.

Endodontic instrumentation

The use of NiTi rotary instrumentation sets the case up for a simplified obturation of the canal by enabling the insertion of a snugly fitting a single gutta percha point (corresponding to the last instrument used) to length. When this technique is employed with a bioactive, biocompatible, non-shrinking sealer, the requirements for a successful preparation, disinfection, shaping and seal are met, avoiding the indiscriminate removal of dentin and leading to a higher long term success rate.

The tricalcium silicate endodontic sealer

A tricalcium silicate endodontic sealer, BioRoot™ RCS (Septodont, Inc.) incorporates many improvements over the older materials. Its alkaline pH (imparting antibacterial properties) calcium ion release, and suitable radiopacity and flow characteristics are indeed an advance over earlier formulations. This sealer is dimensionally stable, biocompatible, hydrophilic, stimulates bone growth, and will provide a reliable dentin bond to the radicular dentin.

Clinical Cases

The patient, a 68 year old female came to the office complaining of pain and tenderness in the lower left quadrant. She stated that she was taking Augmentin (antibiotic) as prescribed by her physician. The x-ray revealed a periapical lucency and a diagnosis of periapical abscess was made for tooth #20.

The canal was accessed and shaped to a #30.06 taper. Disinfection was accomplished with a 5% solution of sodium hypochlorite. The canal was flushed with anesthetic solution (Septocaine, Septodont) and followed with an EDTA/chlorhexidine rinse. After another rinse with anesthetic solution the canal was left to soak with 5% sodium hypochlorite. The fit and length of the #30.06 master gutta percha point was verified, then the



Fig. 1: Pre-Op View; Note periradicular lesion.

⁵ Pereira CA, et. al: Single-Cone Obturation Technique: a literature review. RBSO Oct-Dec 9(4):442-7 2012.

sealer cement (BioRoot™ RCS, Septodont, Inc) was mixed according to manufacturer's directions. The canal was then thoroughly dried using paper points and the master gutta percha point was rolled in the sealer mix and inserted into the canal to length, using the gutta percha to coat the canal walls with BioRoot™ RCS sealer. The master cone was withdrawn, recoated, and inserted to length. The gutta percha was finished at the level of the chamber with a hot plugger, and the seal was further refined using a #2 round bur. (Fig. 1-4).

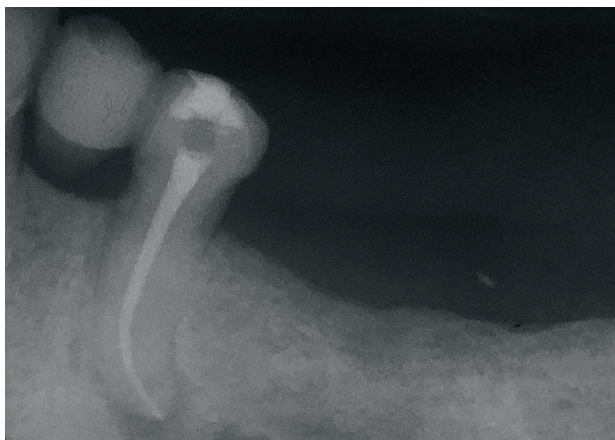


Fig. 3: Master cone coated with BioRoot™ RCS, cemented, and finished with a hot plugger at orifice.

Discussion

Successful endodontics requires the complete debridement (mechanically and chemically) of the root canal plus a smooth, tapered shaping so to set the case up for its final seal.

Endodontic sealers have had their shortcomings such as shrinkage, degradation, and tissue irritation. Accordingly, the traditional methods of obturating canals involve compressing the solid core aspect of the fill (gutta percha) so to displace as much of the endodontic sealer as possible. Unfortunately these obturation methods can be time consuming, operator dependent, fatiguing to the patient and to the clinician, and potentially hazardous in that they might cause a fracture of a root due to the pressure exerted. A new method has come into practice which involves the use of a single master gutta percha point in conjunction with a tricalcium silicate

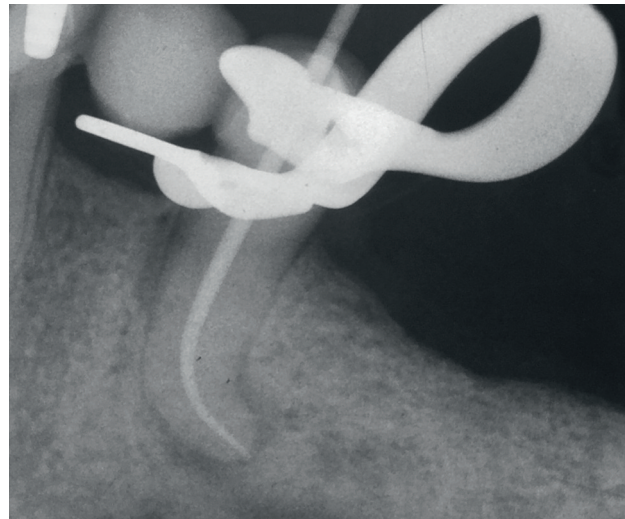


Fig. 2: Canal instrumented, gutta percha master cone fitted to length.

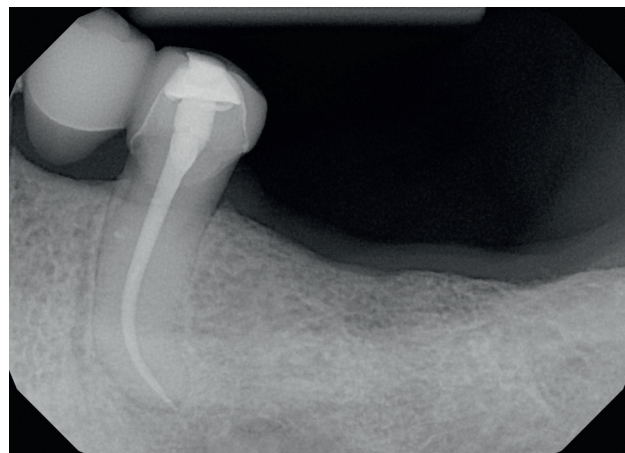


Fig. 4: One year post-op showing complete periapical healing.

sealer that overcomes the problems that were associated with earlier materials. This tricalcium silicate sealer is antimicrobial, anti-inflammatory, bonds to dentin, and remains dimensionally stable, so that it better meets the stated objectives of root canal sealer materials. Accordingly, it is not necessary to use substantial force to compact the gutta percha into the prepared canal, since this sealer will fill voids and prevent bacterial colony formation. Since this sealer neither shrinks nor degrades, micro leakage is prevented apically and coronally. Also, the gutta percha used in this technique slides consistently to length thus making obturation simpler and less likely to result in a root fracture. In addition, not having to create excessive taper strengthens the tooth by preserving the coronal dentin of the root canal preparation.

Conclusion

When the canal is properly cleaned, dried, and shaped, a gutta percha mas-ter point that corresponds to the last instrument taken to the apex is coated with BioRoot™ RCS endodontic sealer, inserted to length, and finished with a hot plugger at the level of the canal orifice. This material and technique will meet the objectives

of good obturation by preventing recurrent infection, avoiding procedural accidents, creating a stable long lasting seal, and by preserving the coronal dentin. Taken together, these methods will preserve teeth longer, especially when combined with a rational, tooth-conserving approach to restorative dentistry.



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Dr. Cohen has been in the practice of general, restorative dentistry with an emphasis on endodontics and surgery since graduating from Temple University in 1982.

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