

# Obturation of the Root Canal — Listening to the Needs of the Tooth with Science and Simplicity

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**E**ndodontics is a science that embodies etiology, diagnosis, prevention, and treatment of apical periodontitis and its repercussion in the organism but yet is based upon opinions, personal histories and empirical deductions.<sup>1</sup> As a result of this scenario, the rate of success after some years is very low.<sup>2</sup> Some of the main reasons for these levels of failure is related to root canal filling materials, the obturation technique and leakage.<sup>3</sup> After cleaning, shaping and disinfecting, the root canal system must be filled in three dimensions with biocompatible materials and be an integral part of the endo-restorative relationship.<sup>4,5</sup>

A variety of products and techniques, either system based or hybridized, have been offered with the goal of achieving the most effective fill, with operator ease and efficiency. These methods include the traditional cold lateral Condensation technique, the warm vertical technique (also known as the Schilder Technique), carrier based obturators, single cone techniques and thermoplasticised methods. Most of these methods employed to fill the root canal space have one or two commonalities, namely, the application of heat, and/or the application of force. Until very recently, the above methods usually involved Gutta Percha, and a Zinc Oxide Eugenol

based sealer, neither of which bond to dentin or restorative materials. Another disadvantage is that the majority of sealers are soluble. If the canal is not fully filled in three dimensions, tissue fluids may leach out the sealer over time.<sup>6</sup> While thermoplasticized techniques do allow for better adaptation to the dentinal walls and improved homogeneity of the obturation mass, their success is somewhat shape-dependant.<sup>7</sup> DeDeus et al. further reported that “it can be clearly stated that the quality of root canal filling in oval-shaped canals is compromised even when thermoplasticized techniques are used.<sup>8</sup> In short, while our objectives of obturation have been pure, the technologies and methods to achieve them are still less than the ideal.

## THE VIRTUES AND LIMITATIONS OF GUTTA PERCHA

Gutta Percha has historically been regarded as an acceptable obturation material due to its biocompatibility, radiopacity, deformability, and it appears to satisfy most, if not all of Grossman’s 10 requirements of the ideal root canal filling material.<sup>9</sup> Among these criteria, GP still ranks high as a retrievable material should re-entry or retreatment be required. If there is a shortfall with this material it is its ability to seal, or lack thereof. The sealer itself can also be a weak link if it does not

bond well to the dentinal walls, leaving many potential pathways for re-entry of pathology into the root canal space. Resilon™, a soft resin obturation material has recently emerged as a promising alternative. Other resin based and BioCeramic materials are emerging, but most endodontic specialists have not made the switch, preferring to wait for long term clinical evidence. In the meantime, gutta percha, even with all of its shortcomings is still the evidence-based material of choice for endodontic success.

## Technique limitations

If all root canals resembled the nice symmetrical cone shapes pictured on marketing brochures or as found in plastic blocks, then obturation would not be perceived as any sort of clinical challenge. The reality is however that the root canal system, even after thorough, cleaning, shaping and chemical debridement and disinfection, is a complex system of irregular shapes with lateral canals, fins, vagaries, anastomoses and other canal aberrations. Additionally, “over the ages, the dynamics of occlusion and arch form have guided the development of human tooth roots such that at least half have ovoid roots.<sup>10</sup> Into these complex systems go perfectly round cones, or straight carriers. These must be deformed or heated in order to fill

the space in three dimensions, if traditional ZOE sealers are used as the interface. While all the above mentioned techniques have shown reasonable success rate in the literature, they are not without risks of iatrogenic mishaps such as vertical root fracture caused by excessive force during vertical or lateral compaction, uneven coating of sealer during placement resulting in gaps or voids, improper force or velocity of obturation carrier insertion resulting in uneven distribution of Gutta Percha and sealer in the apical region.<sup>11</sup> Some of these techniques also require significant flaring of the canal to allow for carrier insertion or deep condensation, sacrificing precious dentin, thus weakening the remaining tooth structure.

A new objective or even a requirement of the ideal filling material should be the creation of a monoblock within the canal space, an intimate fit or seamless interface between the core material, the sealer, the canal wall and restorative crown material.

This article will review a one of many clinically acceptable techniques available today, with several years of clinical research and basic science behind it that addresses the goals of preserving tooth structure, providing operator ease and creating a monoblock inside the canal with a seamless link to the direct or indirect restoration of the tooth.

**Properties of EndoRez**

EndoRez (Ultradent, South Jor-

dan, UT) is an integral part of the concept of ADO™ (apically delivered obturation) developed in 1999. EndoRez is a UDMA (urethane dimethacrylate) resin based, self-priming endodontic sealer which is used with passively placed UDMA resin coated gutta percha cones which chemically bond with the EndoRez sealer (Fig. 1). EndoRez Kit The syringe/tip delivery design allows for extrusion of EndoRez into the entire anatomy of the canal in one step. This technique is a passive one which relies on chemistry, not physical forces, to seal the canal. As a result, even the most minimally invasive root canal preparations, without any significant flaring can be easily obturated.

EndoRez sealer has the same radiopacity as gutta percha, has good flow and wetting characteristics, and sets slightly softer than dentin to facilitate post preparations or easy removal if retreatment is necessary. The sealer is hydrophilic in nature, so it has an affinity for moisture deep in lateral canals and dentinal tubules (Fig. 2—SEM analysis). On the practical side, this eliminates the need to desiccate the canal with a parade of paper points; rather, prior to obturation, the canal can be evacuated with a luer vac adaptor, and dried with one paper point. More importantly, this pene-



FIGURE 1—Endorez kit.

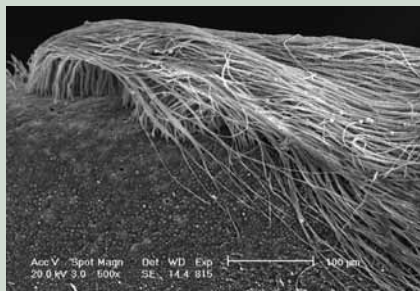


FIGURE 2—Sealer tags extending in dentinal tubules.



FIGURE 3A



FIGURE 3B



FIGURE 3C—After 500 days.



FIGURE 4—FileEze.



FIGURE 5—EDTA 18%.



FIGURE 6—Luer vac.



FIGURE 7—Master cone.



FIGURE 8—Two-spense into skini syringe.



FIGURE 9—Skini plus NaviTips.



FIGURE 10—NaviTips.



FIGURE 11—Sealer into canal.



FIGURE 12



FIGURE 13—EndoRez plus accessory cones.



FIGURE 14—Touch 'n Heat.



FIGURE 15—Accessory cone placed in accelerator.

tration creates the first phase of a monoblock inside the canal, an intimate seal to the dentinal wall. UDMA resin has been used in orthopedic surgery for years as bone resin so has a long track record of biocompatibility. This is very important since an endodontic sealer may be in direct contact with apical connective tissues for a long period of time, and so has the potential to cause inflammatory degeneration, delaying periapical healing. The biological properties of sealers are as important to clinical success as their sealing ability. Several studies on EndoRez sealer have proven its biocompatibility,<sup>12</sup> extremely low cytotoxicity<sup>13,14</sup> especially in comparison with other sealers and it demonstrates an antimicrobial action.<sup>15</sup>

It is, as a result, very well tolerated by the body, in the event of an inadvertent overfill into periapical tissue (Figs. 3A-C). Further studies have shown it to be more resistant to root fracture than traditional obturation methods and sealers.<sup>15</sup> A very impressive study reviewing the use and success of EndoRez period concluded that EndoRez “performed very well as a root canal sealer over a period of up to five years”.<sup>16</sup> In addition to being the central material used in the ADO technique, EndoRez may be used with ANY obturation technique as an alternative high performing sealer with exceptional physical and biological properties.

**IRRIGANT CONSIDERATIONS**

Most practitioners routinely use a

chelating gel or file lubricant during the first few instrument passes into the canal. It should be noted that many of these contain urea peroxide, which could interfere with the setting of any resin based sealer. However, FileEze (Ultradent, South Jordan, UT) (Fig. 4) does not contain peroxide, so is absolutely compatible with any resin based sealer such as EndoRez, and is easily rinsed out of the canal due to its aqueous base. Sodium Hypochlorite is also routinely used during the cleaning and shaping process. There is no need to eliminate this irrigant from your irrigation regimen, it should simply not be used as the LAST irrigant as it also contains free radicals which may interfere with the setting of a resin sealer.

Instead, use a 17 or 18% liquid EDTA (Fig. 5), for 30 seconds to one minute in each canal at the conclusion of the case. This dovetails beautifully with the hydrophilic properties of EndoRez, as this will allow for deep penetration in to the dentinal tubules, as deep as 1200 microns.

Step by Step Apically Delivered Obturation (ADO) technique (Figs. 6-12).

1. With the canal cleaned, shaped, and disinfected, the excess moisture is removed with a luer vac adaptor (Fig. 6) and a purple Capillary tip (Ultradent, South Jordan, UT) and one paper point.
2. EndoRez point (UDMA resin coated Gutta Percha point) master cone is trial fitted into the canal (Fig. 7). These points form the next link in the monoblock concept, as the resin coated point will bond to the EndoRez sealer.
3. The sealer is injected from the TwoSpense syringe directly into a Skini Syringe (Fig. 8) fitted with a 29 gauge NaviTip (Fig. 9). The NaviTip (available in different lengths (Fig. 10) allows maximum flow of the sealer and deep penetration into the canal so that the sealer may be delivered "from the bottom up".
4. The Skini syringe/NaviTip is placed 2-3mm coronal from working length, and the EndoRez sealer is slowly injected (Fig. 11). The syringe is slowly withdrawn while the sealer is delivered but with the needle always submerged in the sealer to avoid any entrapment of air. The canal is filled to the orifice with the EndoRez sealer.
5. The pre-fitted master EndoRez point is now inserted slowly and passively into the canal (Fig. 12) and seated to working length. If necessary, additional accessory cones may be in-

serted passively (Fig. 13).

At this point, the canal is obturated. The EndoRez points may be seared off at the orifice with a Touch'N Heat (Sybron Endo, Orange, CA) (Fig. 14) or similar hot instrument. Two additional optional steps can be taken in consideration of how and when the tooth will be restored. If an immediate post and core placement is desired, then EndoRez Accelerator (Fig. 15) is introduced with an accessory cone (after master cone placement). This will speed up the setting time to approximately four minutes (Endorez typically sets in 20-25 minutes) enabling immediate post preparation.

Alternately, when the obturation is completed, EndoRez can be light cured at the orifice for 40 seconds. This dual cure capacity will result in a thin skin coat at the orifice which will aid in the immediate placement of additional direct restorative materials to achieve immediate coronal seal, which is essential to endodontic success.

If another obturation method is used, then the same steps are taken to introduce the sealer into the canal, then you may proceed with your technique of choice.

Leonardo DaVinci said that "simplicity is the ultimate sophistication." If obturation methods used for decades are still lacking, then we owe it to the tooth and patient to seek better chemistry and technique to simply do better at filling sophisticated root canals. **OH**

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*Oral Health welcomes this original article.*

**REFERENCES**

1. Leonardo MR, Leonardo RT. Crown-down pressureless root canal preparation technique. In: Leonardo MR, Leonardo RT. Endodontics: biological concepts and technological resources. São Paulo: Artes Médicas; 2009. p. 57-78.
2. Cheung GS, Chan TK. Long-term survival of primary root canal treatment carried out in a dental teaching hospital. *Int Endod J.* 2003; 36: 117-28.
3. Ridell K, Petersson A, Mattsson L, Mejäre I. Periapical status and technical quality of root-filled teeth in Swedish adolescents and young adults. A retrospective study. *Acta Odontol Scand.* 2006; 64:104-10.
4. Madison S, Wilcox LR. An evaluation of coronal microleakage in endodontically treated teeth. Part III. In vivo study. *J Endod.* 1988; 14: 455-8.
5. Khayat A, Lee SJ, Torabinejad M. Human saliva penetration of coronally unsealed obturated root canals. *J Endod.* 1993; 19:458-61.
6. Carrotte, P. Endodontics: Part 8 Filling the root canal system. *Brit Dent J.* 2004; 197: 667-72.
7. Kersten HW, Fransman R, Thoden van Velzen SK. Thermomechanical compaction of gutta-percha: part II—a comparison with lateral condensation in curved root canals. *Int Endod J.* 1986; 19:134-40.
8. De-Deus G, Reis C, Beznos, D, Abranches AMG, Coutinho-Filho T, Paciornik S. Limited ability of three commonly used thermoplasticized gutta-percha techniques in filling oval-shaped canals. *J Endod.* 2008; 34: 1401-5.
9. Leif K, Bakland J, Craig B. Ingle's Endodontics, John Ide Ingle, Teton Data Systems (Firm). 6th ed. Illustrated. p. 1019.
10. Clark D. Shaping and Restoring Ovoid Canal Systems. 5 (2). *Endodontic Therapy.* Vol. 5 NO. 2 2005 P. 9-13
11. Souza et al. Effect of filling technique and root canal area on the percentage of gutta percha in laterally compacted root fillings. *Int Endod J;* 2009 accepted for publication
12. Beece CH. Private practice, Savona, Italy, and C.H. PAMEIJER, University of Connecticut SDM, Simsbury, USA Biocompatibility of a new endodontic sealer [abstract # 2483]. 81st General Session of the IADR; 2003 June 25-28; Goteborg.
13. Silva PT, Pappen FG, Souza EM, Dias JE, Bonetti Filho I, Carlos IZ et al. Cytotoxicity evaluation of four endodontic sealers. *Braz Dental J.* 2008; 19: 228-31.
14. Lodiene G, Morisbak E, Bruzell E, Ørstavik D. Toxicity evaluation of root canal sealers in vitro. *Int Endod J.* 2008; 41: 72-7.
15. Zhang H, Shen Y, Dorin Ruse N, Haapasalo M. Antibacterial Activity of Endodontic Sealers by Modified Direct Contact Test Against Enterococcus Faecalis. *J Endod.* July 2009. Vol. 35, Issue 7. 1051-1055
16. Hammad M, Qualtrough A, Silikas N. Effect of new obturating materials on vertical root fracture resistance of endodontically treated teeth. *J Endod.* 2007; 33: Issue 6, Pages 732-736
17. Zmener, Pameijer. Clinical and radiographical evaluation of a resin-based root canal sealer: A 5 year follow up. *J Endod.* 2007; vol 33, issue 6: 676-679.

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