The landscape of dentistry is constantly changing and so it is with endodontics. Over the past 15 years we have seen significant changes in instrumentation, irrigation protocols and obturation. It has been noted in previous articles that root canal shaping has been dictated and often adversely affected by technique sensitive obturation techniques. We would like to examine and concentrate, in this article, on the natural evolution from obturators to more conservative and user-friendly techniques that are based on material science.

An endodontic obturator is a plastic rod, with an attached handle (which in combination is known as a carrier), that has either gutta percha or Resilon attached to it. The first obturator introduced and clearly the most commercially successful was Thermafil. While Thermafil received notable criticism (when introduced) from the endodontic community, it has continued to enjoy some popularity among general practitioners. However, it is reported that very few endodontists use or would recommend solid core obturation. In fact, in a recently published abstract in the *Journal of Endodontics* (March 2009) it was stated, “in a survey of Board-Certified Endodontists and dental school educators, 96.4 percent indicated that they do not currently use a carrier based obturation system in their practice.” Furthermore, “80 percent of respondents indicated that they do not teach carrier based obturation to their students. Reasons for not teaching carrier based obturation included: difficult to remove, difficult to make post space and not predictable.”

However, while many of our endodontic colleagues continue to view Thermafil in a harsh light, it does have significance from a historical perspective. We believe endodontic obturators were an attempt to make endodontic obturation easier and therefore root canal treatment more accessible to the general practitioner.

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endodontics feature

Natural Evolution:
From Obturators to One Cone Bioceramic Techniques

by Drs. Kenneth Koch and Dennis Brave

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An endodontic obturator is a plastic rod, with an attached handle (which in combination is known as a carrier), that has either gutta percha or Resilon attached to it. The first obturator introduced and clearly the most commercially successful was Thermafil. While Thermafil received notable criticism (when introduced) from the endodontic community, it has continued to enjoy some popularity among general practitioners. However, it is reported that very few endodontists use or would recommend solid core obturation. In fact, in a recently published abstract in the *Journal of Endodontics* (March 2009) it was stated, “in a survey of Board-Certified Endodontists and dental school educators, 96.4 percent indicated that they do not currently use a carrier based obturation system in their practice.” Furthermore, “80 percent of respondents indicated that they do not teach carrier based obturation to their students. Reasons for not teaching carrier based obturation included: difficult to remove, difficult to make post space and not predictable.” However, while many of our endodontic colleagues continue to view Thermafil in a harsh light, it does have significance from a historical perspective. We believe endodontic obturators were an attempt to make endodontic obturation easier and therefore root canal treatment more accessible to the general practitioner. This is an admirable concept. We further believe that obturators, in general, (Thermafil, GT Obturators, Guidance OneFill, RealSeal, Soft Core, etc.) should be credited as first generation concepts that are leading to even better and more efficient techniques based on advanced material science. But first we need to examine the obturator technique in more detail.

Part of the success of a carrier-based system is that it gives the dentist something solid to “feel” during the obturation process. This “feeling” is marketed as an increased tactile awareness and therefore, greater control of the procedure. However, in reality, while the practitioner might feel like they have greater control, quite often they have no idea where the heated gutta percha or heated Resilon is going (not to mention where the sealer is going that is pushed ahead of the melted core material).
Nonetheless, the idea of having something to hold and feel is noteworthy. But let's think what is actually occurring with an obturator technique. If you are using such a system, here is what you are doing. You are using a plastic carrier to deliver heated gutta percha or heated Resilon into the root canal system. Yes, the material will flow but when it cools, the gutta percha will shrink.

What actually seals a root canal? Of course, it is the sealer not the gutta percha. This is why they call it sealer. What does the gutta percha do? It takes up space and provides a mechanism to deliver the sealer. The problem has always been that we did not have dimensionally stable sealers (and the greater their bulk in the canal, the less stable they were). What if we had a sealer that was dimensionally stable (would not shrink) and was biocompatible, bioactive and antibacterial? And what if it could be delivered into the root canal system with a room temperature gutta percha cone that would as well not shrink when placed into the canal (no heat required)? Would you want to use it?

The next level of obturation is now available. Utilizing a synchronized stiffer gutta percha cone (or a stiffer ceramic coated gutta percha cone) to deliver a dimensionally stable bioceramic sealer (into the root canal), which is antibacterial, biocompatible, and does not resorb, is a clear advancement over solid core (plastic) obturators. EndoSequence BC Sealer in combination with synchronized bioceramic coated cones is an excellent room temperature one cone obturation technique (Fig. 1). But, when we talk about a true one cone technique let's think about what this really means. The easiest way to comprehend this is to again compare a synchronized one-cone technique to carrier based methods. Recently, many in the endodontic community have come to the conclusion that excessive coronal enlargement (of the radicular dentin) can adversely affect the long-term prognosis of a tooth. While various thermoplastic techniques have contributed to the problem of over enlargement of the radicular dentin (and subsequent weakening of the tooth), the use of carrier-based obturation may also result in wider than ideal orifice enlargement. The rationale behind this is quite simple. The larger the hole at the top of the canal, the less likely it is to strip (denude) the carrier of gutta percha (or Resilon). This has been one of the challenges associated with carrier based obturation (stripping the carrier at the orifice during insertion).

As previously mentioned, one can certainly get good obturation results with carrier-based techniques (as with other methods) if done properly, but this issue of stripping a carrier remains a significant one in endodontics. In a recent article, it has been suggested that, “The solution to this problem is not difficult, it’s just technique sensitive.” It would appear from this conclusion that technique sensitivity should be of little or no concern to the practitioner performing root canal therapy. We would ask you to be the judge of that. Let it be said again, that the concept of filling a root canal with a device that you can “feel” makes sense. It is essentially the same with a synchronized cone and BC Sealer, but with a few significant differences. Again think about what you are doing. You are, in essence, using a stiff carrier (but one that is actually a stiffer gutta percha cone, not a plastic carrier) to deliver a stable, adhesive bioceramic sealer into the root canal system. So while you get the “feel” of a carrier based technique, you have the advantage of using gutta percha as a carrier to deliver the sealer. After all, it is the sealer that creates the seal in obturation, not heated gutta percha (which shrinks significantly when cooled). A quick review of the bioceramic
one cone technique and then a comparison of some specific concepts will make the differences (and ultimately the evolution) between carrier based obturation and one cone bioceramic technology more evident.

EndoSequence BC Sealer and gutta percha (Brasseler, USA) as a synchronized, adhesive endodontic obturation technique utilizes a constant taper preparation and matching gutta percha cones to facilitate predictable endodontic outcomes. Following cone selection (utilizing the same size master cone as the last instrument to working length) you attach a tip of choice to the bioceramic syringe, insert the tip into the canal no deeper than the coronal third and slowly dispense a small amount of the premixed sealer into the canal while simultaneously backing the syringe out of the canal. Now, using a #15 hand file, or something comparable (such as the master cone), proceed to lightly coat the walls with the existing sealer in the canal. Then coat the master gutta percha cone with a thin layer of sealer and very slowly insert this into the canal, taking it all the way to its final working length. The precise fit of the EndoSequence master cone (gutta percha or ceramic coated cone) in conjunction with a constant taper preparation creates excellent hydraulics that will move the non shrinking bioceramic sealer into webs, fins, and lateral canals. Think about what we have accomplished. The silicate components in the bioceramic sealer bond to the ceramic coated (or Activ GP) cones and, at the same time, we have created a bond to the canal wall as a result of the hydroxyapatite that is generated during the setting reaction of the bioceramic sealer. As a result of this bonded obturation and, the ease associated in achieving it, we can now state that the restoration of the endodontically treated tooth truly begins at the apex.

Comparison of Specific Concepts:

Plastic Carrier vs. One Cone

When filling a root canal system, utilizing an obturator based technique, you are totally dependent upon the plastic carrier not being denuded of gutta percha. The solid plastic carrier has the inherent risk of being stripped when inserted into the canal. This usually occurs up high, right at the orifice. This is also very difficult to determine radiographically; whether or not the plastic carrier has been stripped of gutta percha or Resilon. A one cone technique, on the other hand, employs a stiff gutta percha cone or a stiff ceramic coated gutta percha cone. In either case, if some of the sealer accidentally gets removed during the obturation process, you still have gutta percha remaining, not plastic.

Post Preparation

Post preparation with any solid core technique, such as a plastic obturator, has some very significant challenges. We really don’t need to discuss the challenges but more simply ask, “What would you rather make a post preparation in... gutta percha or plastic?” For even those die-hard obturator dentists, we recommend for those canals, which will require a post, that a gutta percha cone technique be used. To quote Dr. L. Stephen Buchanan, a proponent of solid core obturation (GTX Obturators), “Finally, beware of a manufacturer’s recommendation that their post drill (especially the one with an asymmetric tip) is safe to cut out carriers as they make the post space. I know several talented dentists who have used this method and have inadvertently caused a lateral root perforation with one of these drills.”
In addition, we would like to mention that the EndoSequence technique has a matching post system that solves the problem that is inherent in the discrepancy found between the final canal shape and available post sizes (and shapes) for most post systems. Here is the solution: The EndoSequence rotary file creates a fully tapered preparation (.04 or .06) from orifice to apex. The corresponding paper points and gutta percha cones are laser verified to precisely match the final canal shape (last instrument used to length). The EndoSequence post system now goes one step further and is likewise tapered (.04 or .06) to match the exact shape of the instrumented canal. Because of the synchronicity that has been established, there is no need to alter the shape of the root canal preparation to match the post. In a sense, the last rotary file taken to length is acting as a post drill. This concept has also been addressed in a recent article by Dr. Richard Trushkowsky when he wrote, “The ideal post should have the same shape as the endodontic preparation, and should be non-corrosive, readily adjusted, and able to be removed without difficulty.” Furthermore, since the dual cure resin cement that is used to bond the EndoSequence post to the canal wall is also the same material used to create the buildup (EndoSequence Build-up), one can think of this technique as an intra-radicular core buildup with a rebar. Not only is this “post technique” easy to replicate, it is kinder to the tooth and, most importantly, it is safer (Fig. 2).

Ease of Use
The proposed benefits of obturators were that they gave dentists a seemingly easier way to fill a root canal. For this concept alone, solid core obturators need to be recognized. However, how much easier can a technique be than a room temperature, one cone technique that utilizes an adhesive sealer (Fig. 3).

Antibacterial Activity and Sealability
It is very difficult these days to evaluate “research” because so much “research” is managed (supported) by manufacturers. You need to look for non-supported research in any aspect of dentistry that you wish to examine. We must mention that in a recent non-supported research project at the University of British Columbia, it was found that the BC Sealer killed all bacteria within two minutes of contact, including E. faecalis. They concluded that the bioceramic sealer “possessed potent antibacterial effect.”

Additionally, it was concluded in another non-sponsored research project that, “The present study found there was no difference in the ability of sealing root canals between iRoot SP (BC Sealer overseas) using the single cone technique and AH plus using the continuous wave condensation technique. Possible reasons for the results could be that iRoot SP is based on a calcium silicate composition, which does not shrink during setting and hardens in the presence of moisture. The result was also confirmed by SEM.”

Retreatment of Carrier Based Techniques vs. One Cone
Yes, we know you have heard from your endodontist about the difficulties of retreatning obturator cases. It can be challenging! Granted, some companies are now doing a lot of marketing about “how easy” it is to retreat carrier based obturation. However, once again, we will ask you to be the judge of that. Retreatment of a bioceramic one cone technique is quite easy. After all, it is gutta percha with an adhesive sealer. The following is our recommended technique for retreatting bioceramic one cone cases.

The technique itself is straightforward. A real asset in retreatting bioceramic cases is to use an ultrasonic with a copious amount of water. This is particularly important at the start of the procedure in the coronal half of the tooth. Work the
ultrasonic (with lots of water) down the canal to approximately half its length. At this point, add a solvent to the canal (generally chloroform although xylol is acceptable) and switch over to an EndoSequence file (#30 or 35/.04 taper) run at an increased rate of speed (1,000RPM). Proceed with this file, all the way to the working length, using solvent when indicated. An alternative is to use hand files for the final 2-3mm and then follow the gutta percha removal with a rotary file(s), used to the working length.  

Cost  
Cost certainly should never be the reason why you choose, or choose not to use a given system or technique. That said, we want you to always employ a technique that provides great results that you can reproduce time after time. This is the key, regardless of the cost factor. But, in case you were wondering, a bioceramic coated gutta percha cone is about 91 cents and a solid core obturator is... well, you tell us!  

Summary  
It has always been our goal to create techniques and products that give the greatest majority of dentists the ability to produce stellar endodontic results. We know that we are not alone in seeking to improve the lives of all dentists who choose to provide endodontic services to their patients. Technology and advanced material science have positioned us to take advantage of the past and look to the future. We are excited to be a part of that future and hope that you will join with us to experience the best that the future has to offer.  

References  

Authors’ Bios  
Dr. Dennis Brave is a diplomate of the American Board of Endodontics, and a member of the College of Diplomates, Dr. Brave received his DDS degree from the Baltimore College of Dental Surgery, University of Maryland and his certificate in Endodontics from the University of Pennsylvania. He is an Omicron Kappa Upsilon Scholastic Award Winner and a Gorgas Odontologic Honor Society Member. In endodontic practice for more than 25 years, he has lectured extensively throughout the world and holds multiple patents, including the VisiFrame. Formerly an associate clinical professor at the University of Pennsylvania, Dr. Brave currently holds a staff position at The Johns Hopkins Hospital. Along with having authored numerous articles on Endodontics, Dr. Brave is a co-founder of Real World Endo.  

Dr. Kenneth Koch received both his DMD and Certificate in Endodontics from the University of Pennsylvania School of Dental Medicine. He is the founder and past Director of the New Program in Postdoctoral Endodontics at the Harvard School of Dental Medicine. Prior to his Endodontic career, Dr. Koch spent 10 years in the Air Force and held, among various positions, that of Chief of Prosthodontics at Osan AFB and Chief of Prosthodontics at McGuire AFB. In addition to having maintained a private practice, limited to Endodontics, Dr. Koch has lectured extensively in both the United States and abroad. He is also the author of numerous articles on Endodontics. Dr. Koch is a co-founder of Real World Endo.