Synchronicity in Obturation

by Drs. Dennis Brave and Kenneth Koch
Real World Endo
Wilmington, DE

Educational objectives:
 Upon completion of this course, participants should be able to achieve the following:
• Realize that whatever the technique employed, the sealer is what creates the seal in endodontic obturation.
• Fully understand the concept of a monobloc and recognize the benefits associated with it.
• Learn the multiple benefits associated with glass ionomer cements and their use in endodontics.
• Realize that glass ionomer cement, when used as a sealer rather than a “filler,” can be retreated in a straightforward manner.
• Fully understand the Activ GP technique and its intended goal.
• Understand the multiple criteria that are satisfied with Activ GP.
• Appreciate the benefits associated with placing a “final canal cap.”

As previously mentioned, the goal of endodontic instrumentation is two-fold. The first is to create a shape that will allow our irrigation agents to work effectively in cleaning and disinfecting the root canal space. The second goal is to impart a shape that will expedite the obturation process. Ideally, we want this shape to be achieved in as conservative a manner as possible to preserve the integrity of the tooth. The preservation of tooth structure, particularly in the coronal third of the canal, is critical for long-term retention of the tooth.

While the first part of this axiom (irrigation) is well understood, the second part (obturation) can be a source of enormous frustration. The mission of Real World Endo is to create technology and techniques that will allow the greatest percentage of
dentists to achieve superior endodontic results. Chief among these has been the desire to create a user-friendly obturation technique that will give all practitioners the ability to produce excellent obturation results. But prior to a discussion about a new filling technique, some historical perspective of obturation is required.

Initially, in endodontics, we had silver-point techniques that attempted to match a silver cone to a hand made preparation. This was basically not a bad idea, it’s just that we had the wrong materials and were not capable of creating synchronicity between the cone and the preparation. Nonetheless, silver points were popular until the late 1960s when room-temperature lateral condensation of gutta percha replaced silver points.

Lateral condensation remains a popular technique and when performed properly, can deliver good results. However, in the mid 1980s thermoplastic techniques began to replace lateral condensation.

One of the advantages of a thermoplastic technique is that when done correctly, it minimizes voids and can create a homogenous mass of gutta percha. Consequently, heated gutta percha techniques were viewed by many in the endodontic community as an upgrade in terms of methodology. Unfortunately, what was missed in the excitement about a homogeneous fill was that heated gutta percha shrinks significantly when cooled.

Furthermore, it is a method that is fairly complicated and, most definitely, is not user-friendly.

As endodontic obturation entered the 1990s, we witnessed the introduction of carrier-based obturation techniques. The rationale behind the obturators was sound, and it was a well intentioned attempt to make obturation easier for the general practitioner. However, the difficulty in retreatment and the challenge in making a post preparation were seen as limitations by the endodontic community.

When these different methods are reviewed, we discover a common theme. The use of a sealer is recommended for every method discussed. In actuality, what creates the seal in all these techniques (silver points, lateral condensation, thermoplastic methods) is the sealer. The sealer is what seals the canal; gutta percha merely takes up space and, if heated, can hopefully move the sealer into webs and fins.

Therefore, as endodontic obturation has evolved, we have come to realize that the sealer remains the key to obtaining a true hermetic seal. The challenge, more specifically, has been to find a sealer that would simultaneously bond to both the canal wall, as well as to a gutta percha cone or a similar core material. Clinicians and material scientists have long realized that if they could satisfy such a challenge, we would have the ability to create a single-cone technique that would deliver a true monobloc seal.

In the pursuit of a single-cone (or sealer-based) technique, we had two material options: resin or glass ionomer. We chose glass ionomer because of the multiple benefits and properties associated with the material. Some of these are the following.

Glass ionomers not only do well in moist environments (wet bonding), they actually create an ionic bond to the dentin. This bond is critical if we are thinking in terms of creating a monobloc and an eventual hermetic seal. Glass ionomer sealers are also non-resorbable after setting, which is critical in any single-cone or sealer-based obturation technique. What is unique to glass ionomers is that any GIC extruded out the apex will not set and consequently will resorb over time. However, once glass ionomer sets (within the confines of the tooth), it will not undergo resorption.

Glass ionomers are also considered to be both bio-active and biocompatible. Bio-active in the sense that they can be stimulated to release fluoride. Fluoride can be important in endodontics because it will act as an antibacterial agent and has been shown to promote remineralization. Furthermore, glass ionomer cements react well in areas of inflammation. Concerning the tolerance of glass ionomer cements, their use in orthopedic surgery is evidence of their excellent biocompatibility.

Another aspect of glass ionomer that is preferred (when compared to resins) is that it does well in the presence of sodium hypochlorite. Resins and their bonding capability are adversely affected by exposure to bleach (sodium hypochlorite). This is not a fact...
tor in restorative dentistry but becomes problematic in endodontics, where we routinely use copious amounts of bleach during a root canal procedure. Webs, fins and anastomoses are difficult, at best, to completely dry. Glass ionomer is hydrophilic and will bond to dentin in the presence of moisture. Resins are hydrophobic.

Finally, it must be mentioned that setting time is also important in obturation and the setting time of glass ionomer is such that the clinician can do a post preparation and place a post at the same visit as the endodontic procedure. This is not always the case with other materials.

While the merits and properties of glass ionomer were well known, there remained some limitations with glass ionomer as sealers. The handling characteristics of glass ionomer had been difficult and they generally did not produce a sufficient working time. Furthermore, glass ionomer did not demonstrate a bond to gutta percha. Consequently, our first priority was to modify the properties of glass ionomer to meet the requirements of a true monobloc.

We started with the working time, and by modifying its particle size the working time has been extended. The working time of our glass ionomer sealer (Activ GP) is 10 minutes for pre-measured capsules and 20 minutes on a chilled glass slab for hand mixing. Activ GP sealer comes in either a powder/liquid combination that is mixed by hand and is also available in pre-measured capsules that are triturated.

Although changes were made to the sealer, the lack of a bond between the sealer and the gutta percha still remained a challenge. This challenge was met, in part, by taking silanated glass ionomer particles, that are present in the sealer, and placing them into the gutta percha. Additionally, the impregnated cones were coated with glass ionomer particles at a thickness of two microns. The science (SEM’s) demonstrates that there is no gap between the coating of glass ionomer and the glass-ionomer-impregnated gutta percha cones.2

As a result of these enhancements, Activ GP sealer now has the ability to chemically bond directly to the Activ GP points. The result is a true monobloc seal between the canal wall, the Activ GP sealer, and the master cone. This allows the development of a true hermetic seal which is what we have been searching for in endodontics.

In addition to the glass ionomer sealer, the Activ GP system is available in two types. A traditional design and an enhanced version (Activ GP Plus). Activ GP Plus employs calibration rings for easy depth measurement and a unique barrel handle which, when placed with an insertion instrument (transporter), facilitates easy placement into the canal.

This Activ GP Obturation system has been designed to deliver a monobloc restoration of the canal space through a single-cone technique. However, the system still remains precision-based, which means it requires synchronicity between the last file used to working length and the master cone. The sizes of Activ GP points are consistently accurate and are verified as such by laser measurement. In fact, all Activ GP points are laser verified at three points (D-1, D-3, and D-16) to match the preparations made by the .04 or .06 constant tapered EndoSequence file system. The precision matching of the primary cone to the preparation is very important with a single-cone technique because the accuracy of the cones to the constant tapered preparation minimizes the amount of sealer and makes retreatment a non-issue.

The technique associated with Activ GP is straightforward. Following completion of your constant taper preparation and verification by X-ray of the fit of the Activ GP cone, choose a handfile that matches the final size of the preparation. Coat the file with the

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**Glass Ionomer as Sealer**

**Merits**
- Creates ionic bond to dentin
- Non-resorbable after setting
- Bio-active and biocompatible
- Hydrophilic (will bond in presence of moisture)
- Does well in presence of sodium hypochlorite

**Previous Limitations**
- Difficult handling characteristics
- Short working time
- Does not bond to gutta percha

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References
4. Koch K, Brave D. Introducing the Activ GP precision obturation system Dental Equipment & Materials January 2006; 120-122

Activ GP sealer, and take the coated file to working length. We recommend that you repeat this process a second time.3

Following the placement of the sealer, coat the Activ GP cone with sealer and slowly insert it into the canal to its working length. As a result of the synchronicity between the file and master cone, hydraulics are generated which will move the sealer into lateral canals. However, because it has been inserted slowly, any excess sealer will extrude out coronally alongside the cone. This is very similar to cementing a post.

After the cone has been inserted to working length and verified with a digital image or X-ray, it is recommended to sear off the cone at the orifice and to remove an additional 1-2mm of gutta percha from the canal orifice. Following this removal, place the remaining Activ GP sealer on top of the cone. This will act as a final canal cap, which will effectively prevent coronal leakage.4

In the past, some have questioned the ability to retreat glass ionomer when used in a root canal. This is because they were working with canals that had been entirely filled with glass ionomer. In actuality they were using glass ionomer as a “filler,” not a sealer. The consistent accuracy of Activ GP points (laser verified) results in an extremely close match between the preparation and the master cone. Therefore, only a minimal layer of sealer is required with the net result being a canal that is principally filled with gutta percha material. Hydraulics will drive the sealer into the webs and fins. Consequently, retreatment is readily achievable with the Activ GP system.

The Activ GP obturation technique meets a number of significant criteria. First is the introduction of improved glass ionomer technology that can result in a true monobloc obturation that allows us to create a hermetic seal within the root canal. Second, a specific technique has been introduced that has a sophistication level high enough to make it simple (single-cone). This gives the greatest majority of practitioners the ability to produce superior obturation results. The third criterion is that Activ GP now lets the clinician perform a constant .04 taper preparation that will be easily and predictably filled. The use of more .04 taper preparations will allow us to better retain the integrity of the tooth which will improve the long term prognosis (retention) of the tooth. The net result is the maintenance of the natural dentition. ■

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.

Disclosure: Dr. Brave declares that he is a consultant for and receives other financial or material support from Endodontic Education Seminars, LLC.

Dr. Kenneth Koch received both his D.M.D. 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.

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Post-test

1. The goal of endodontic instrumentation is:
   a) to create a shape that will allow our irrigation agents to work effectively
   b) to create a shape that will expedite the obturation process
   c) to create a technique that can be accomplished in one visit
   d) a & b

2. The key to obtaining a true hermetic seal in endodontic obturation is:
   a) the file used to create the preparation
   b) the taper of the preparation
   c) the sealer
   d) none of the above

3. Glass ionomer cements:
   a) do well in moist environments
   b) are non resorbable after setting
   c) are resorbable if not allowed to fully set
   d) all of the above

4. Glass ionomer is considered to be:
   a) bio-active
   b) biocompatible
   c) a & b

5. Which statement is true?
   a) Glass ionomers are hydrophobic
   b) Glass ionomers are hydrophilic
   c) Resins are hydrophilic
   d) None of the above

6. Activ GP cones are coated with glass ionomer particles to a thickness of:
   a) one micron
   b) two microns
   c) five microns

7. All Activ GP points are laser verified at:
   a) D-1, D-3, D-16
   b) D-1, D-3, D-5
   c) D-1, D-5, D-16
   d) Activ GP points are not laser verified

8. A monobloc occurs between:
   a) the canal wall and the cone
   b) the sealer and the cone
   c) the sealer and the canal wall
   d) the canal wall, the sealer, and the cone

9. Re-treatment of glass ionomer cement in endodontics:
   a) is impossible
   b) is difficult when used as a “filler,” rather than a sealer
   c) is readily achievable with the Activ GP system
   d) b & c

10. Activ GP allows the clinician to perform .04 taper preparations that will be easily and predictably filled. The use of more .04 taper preparations will:
   a) allow us to better retain the integrity of the tooth
   b) help in the long term retention of the tooth
   c) a & b are true
   d) a & b are false
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