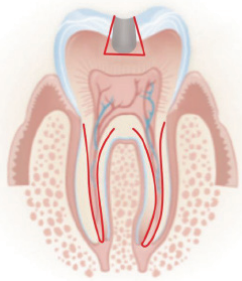


Bonded Restorative Endodontics for the Conservative Dentist

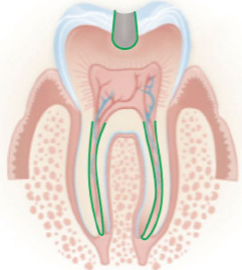
With the advent of a new class of materials known as bioceramics, minimally invasive techniques are entering the root canal system – challenging prevailing paradigms and maximizing the long-term prognosis of the endodontically treated tooth.

Historical Standard of Care



Vs.

Modern Standard of Care



It is unlikely that the father of restorative dentistry G. V. Black (1836-1915) could have imagined the direct bonding of modern day composite materials to coronal dentin, or that the father of endodontics Louis I. Grossman (1902-1988) could have imagined bioceramic sealers that could bond to radicular dentin. But both of these dentistry giants advocated the latest theory, techniques and technology of their day and certainly would have been quick to embrace the advent of bioceramics that we are seeing today.

Restorative endodontics

Historical standard of care versus the emerging modern standard of care

The reason for restoring a cavity and/or performing a root canal are both the same — to restore a tooth to its natural function and to preserve the tooth in that state for as long as possible.

Historically, dentists recognized the need for retentive preparations for the successful placement of an amalgam restoration when there was no other option. This served patients well and was the standard of care at the time. These techniques were advanced based on the physical and chemical properties (limitations) of the materials (Fig. 1).

Today we have newer and better materials that do not require outdated methods.

You were probably taught that gutta percha needs to be heated and condensed to achieve 3D obturation, that your endodontic sealers are the weak link in your root canal procedure and that it didn't matter how you got to the apex, only that you got there. Yet present day material science has shown these techniques, as well as many other concepts you might still be using, to be antiquated.

If we concede that the fundamentals of root canal therapy are cleaning, shaping and obturation, then it would make sense to look carefully at how each part of the procedure interfaces and supports the other. In addition, it is also important to consider how each part of the procedure supports the objective of maximizing the long-term retention of the endodontically treated tooth.

Some 50 years ago, Dr. Louis Grossman acknowledged that the then-current-day sealers (zinc oxide and eugenol- and resin-based sealers) left much to be desired. They were hydrophobic, shrunk upon setting, not very biocompatible, lacked resistance to wash out and were generally irritating if extruded past the apex.

Because of these less-than-stellar characteristics, it became accepted theory and practice to try and reduce the sealer interface to the thinnest possible thickness in the root canal — it being well understood that the thicker the sealer interface, the greater the shrinkage, the more irritating, etc. Therefore, all of our obturation techniques (warm vertical, cold lateral, and even heated-carrier based) were developed based on the recognition that the then-current sealers were, at best, poor and that the gutta percha should displace as much sealer as possible.

Condensation techniques have used the idea (as a basis of their acceptance) that we should replace the sealer with gutta percha, and the idea that the sealer is the weak link in the chain and needs to be reduced to the thinnest layer possible in the root canal. However, these are antiquated, meritless techniques now that there are root canal sealers that are superior to gutta percha in the canal. At best, gutta percha takes up space and is inert. It should be acknowledged that we still deliver the sealer and provide a retreatment path with a bioceramic-coated cone. However, condensation is not necessary because of the hydraulic nature of the bioceramic sealer.

The historical standard of care utilized the best techniques available at that time to overcome the limitations of the materials at our disposal. Modern material science (bonding) now allows us to remove decay and debride canals in a more conservative manner.

“Endodontics is a specialty that has long-held beliefs regarding the use of gutta percha and some minimal amount of sealer to seal any remaining space when obturating a root canal. With the advent of a new class of materials known as bioceramics, minimally invasive is now entering the root canal system.”

— Dr. Thomas Giacobbi

What are bioceramics?

Bioceramics are inorganic, ceramic materials specifically designed for use in medicine and dentistry. They are non-toxic, non-corrosive, biocompatible, do not shrink, are chemically stable within the biological environment and are able to withstand interfacial interactions with surrounding organic tissue.

10 tips for using bioceramics in endodontics

1. Do not store in a refrigerator. Store at room temperature.
2. Do not use too much sealer.
3. New users do not have to place the syringe into the tooth.
4. Use bioceramic-coated cones.
5. Use the residual sealer material that remains in the tip.
6. Use bioceramics for pulp caps.
7. Do apexifications with bioceramics.
8. Use bioceramics as a retrofilling material.
9. Use bioceramics as a canal locator.
10. Use advanced obturation technique with bioceramics.

For a detailed version of these tips, read "Ten Tips for Using Bioceramics in Endodontics" (Dentaltown Magazine, December 2010) by Drs. Kenneth Koch and Dennis Brave.

The emergence of bioceramic nanotechnology

A new technology that paves the way for minimally invasive shaping, system synchronicity and bonded obturation

The World Congress of Minimally Invasive Dentistry defines minimally invasive dentistry as those techniques that respect health, function, and aesthetics of oral tissue by preventing disease from occurring or intercepting its progress with minimal tissue loss.

Such a technique, restorative endodontics is the concept of embracing modern material science for root canal therapy in the same way that has been done in restorative dentistry. Just as bonded composite restorations have antiquated retention forms with amalgams, bioceramic nanotechnology has now excelled beyond excessive root canal shaping.

Present-day material science has allowed us to produce nanoparticle bioceramic root canal sealers (BC Sealer, Brasseler USA) (Fig 2.) that meet all of Dr. Grossman's ideal requirements for an endodontic sealer, such as:

- No shrinkage
- Biocompatible
- Osteogenic by nature
- Hydrophilic
- Anti-bacterial
- Produce hydroxyapatite upon setting
- Highly radiopaque, premixed and will produce a true chemical bond to the dentin and gutta percha when used with a bioceramic-coated cone (BC Sealer and BC Points, Brasseler USA) (Figs. 2-4)

Because we are now able to chemically bond to the radicular dentin (right down to the apex), it is now possible to produce a true monoblock for the first time. This is why it can be said that the restoration of an endodontically treated tooth should begin at the apex. With bioceramic materials, this is now possible.

FIG 2>



FIG 4>

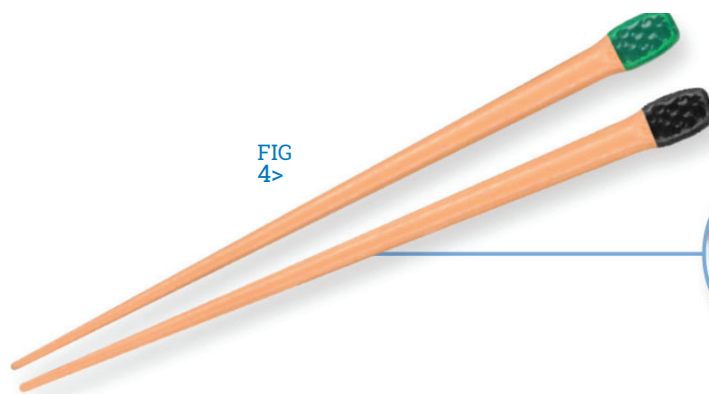


FIG 3>



a NiTi file system developed to fulfill the vision of "Restorative Endodontics"

ESX features ▼

- Synchronized from instrumentation, obturation and post placement
- Minimally invasive shaping protocol
- Two-file shaping system for most cases
- Matching bioceramic obturation system
- Drill-free fiber post system (matches ESX preparation)

FIG 5>

ESX BASIC PROTOCOL

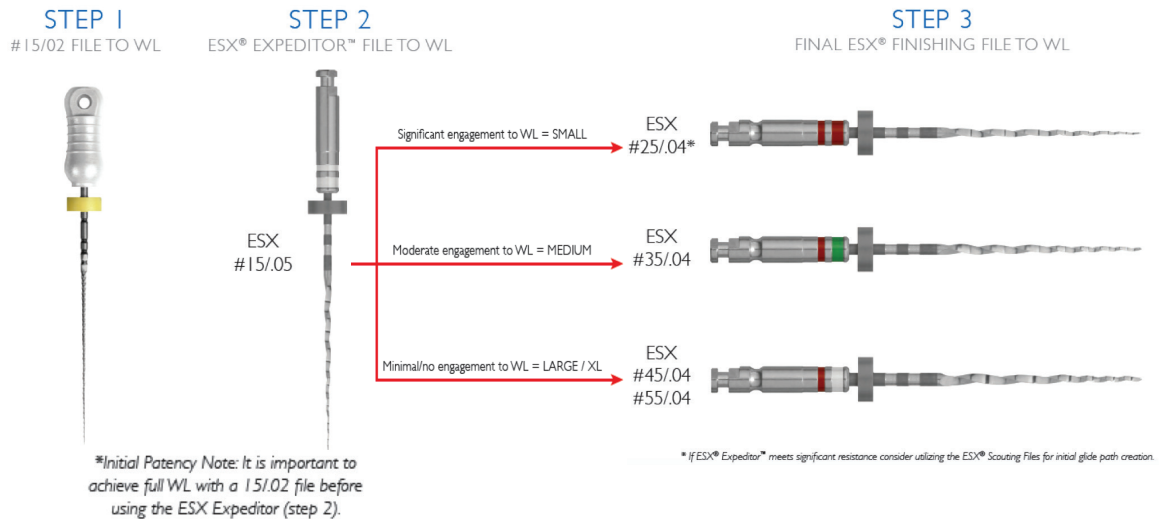
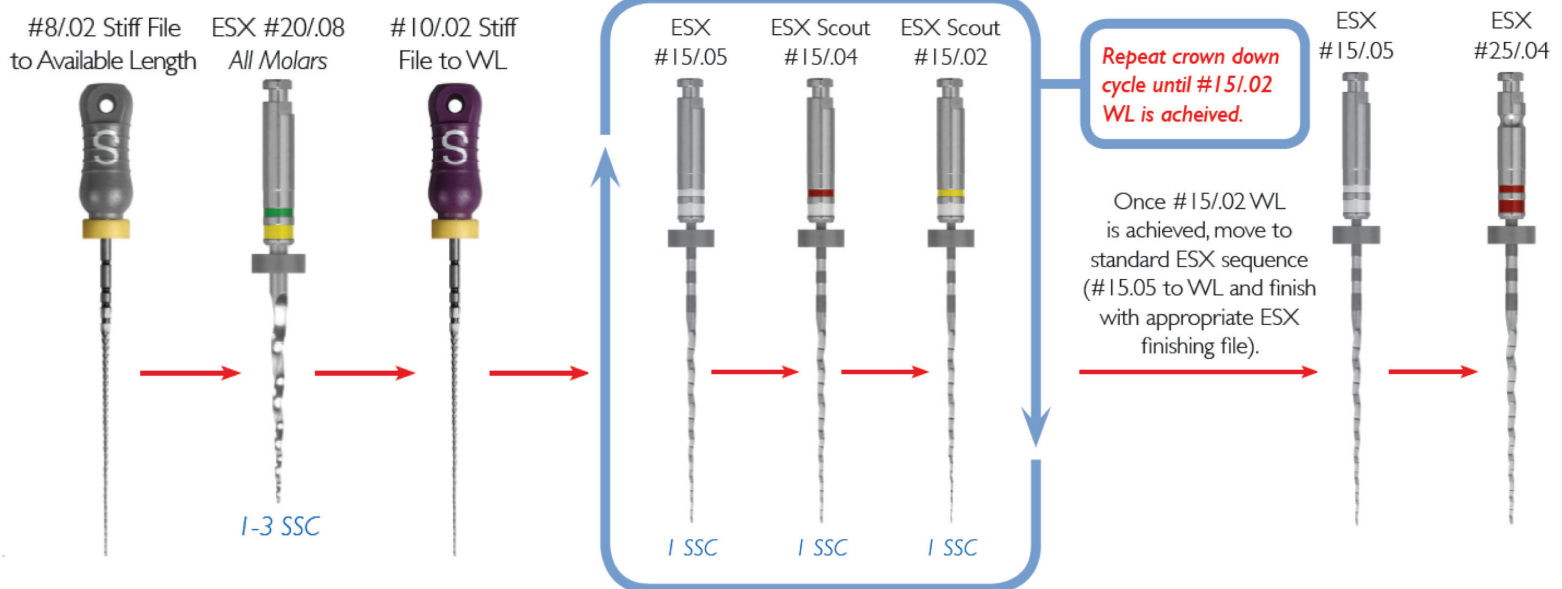


FIG 6>

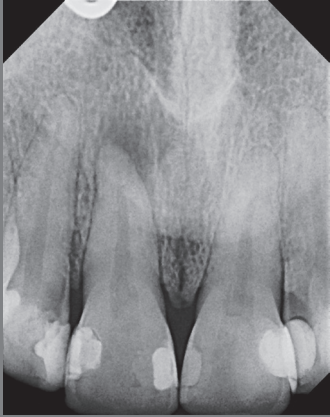
ESX ADVANCED PROTOCOL

All Calcified and/or Curved Canals

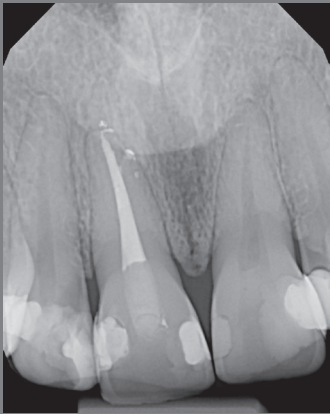


Restorative Endodontics

Photos courtesy of Dr. Ali Nasseh
(Boston, Massachusetts)



8a> Original pre-op radiograph with apical radiolucency



8b> Three-year recall completely healed

Minimally invasive root canal shaping

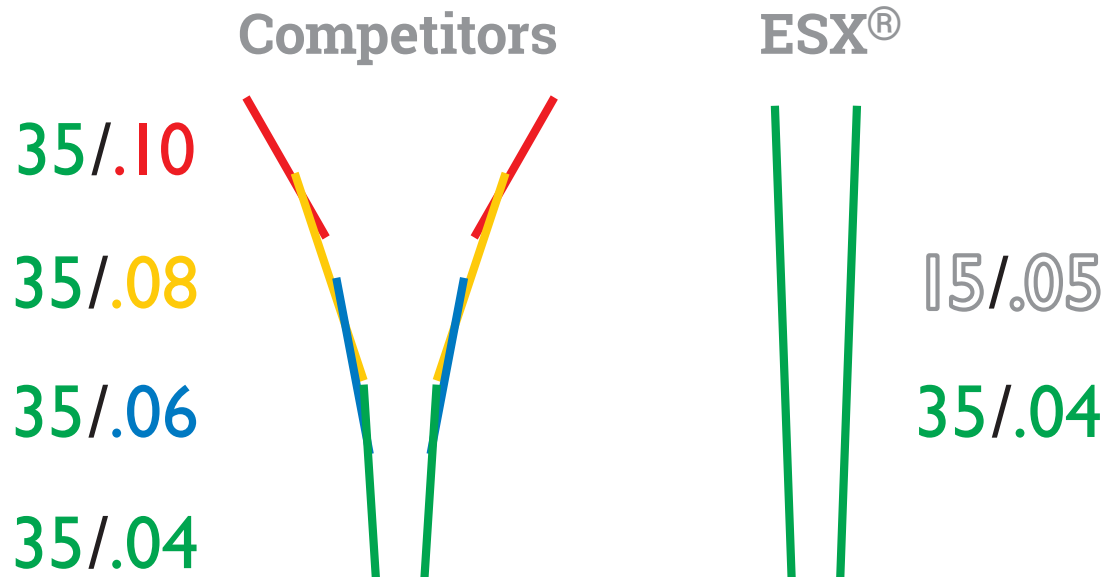
Maintaining the innate strength of the tooth through the use of root canal sealers that bond to the radicular dentin and instrumentation

The advent of bioceramic materials is not the end of the story but the beginning. And the future of bioceramics promises to be even more exciting!

For years the techniques used to prepare and shape canals have focused on trying to not only clean the canal but also produce a shape that will provide for the difficult task of condensing gutta percha — something we now understand is actually unnecessary (Fig. 7).

FIG 7>

Constant Taper = Constant Shapes = Conservative
Variable Taper = Variable Shapes = Non-Conservative



Cleaning, it turns out, can be accomplished with minimal coronal enlargement, particularly if facilitated with ultrasonics and good irrigation techniques. All that is truly required is to produce a shape that allows the canal to be cleaned responsibly to the apex. A size 35/.04 preparation to the apex has been documented as all that is needed in most canals.

We now have hydraulic obturation techniques utilizing flowable nanoparticle bioceramic technology that do not require excessive canal enlargement. Obturation should not dictate shaping! In doing so we have excused preparations that have removed good tooth structure (dentin) at the expense of the long-term prognosis of the tooth. Teeth (canals) that are overly prepared and weakened to accommodate filling techniques in the long term, lead to unnecessary fractures and their removal.

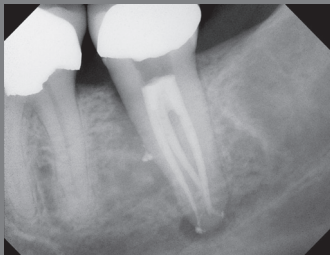
Minimally invasive root canal shaping is really what we should be focused on in an effort to preserve as much radicular dentin as possible. We should be maintaining the innate strength of the tooth through the use of root canal sealers that bond to the radicular dentin and instrumentation, and obturation techniques that do not require the excessive removal of dentin.

Restorative Endodontics

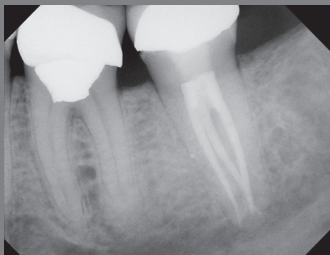
Photos courtesy of
Dr. Nadar Vajfaie (Novato, California)



9a> Mandibular second molar pre-op X-ray showing apical radiolucency



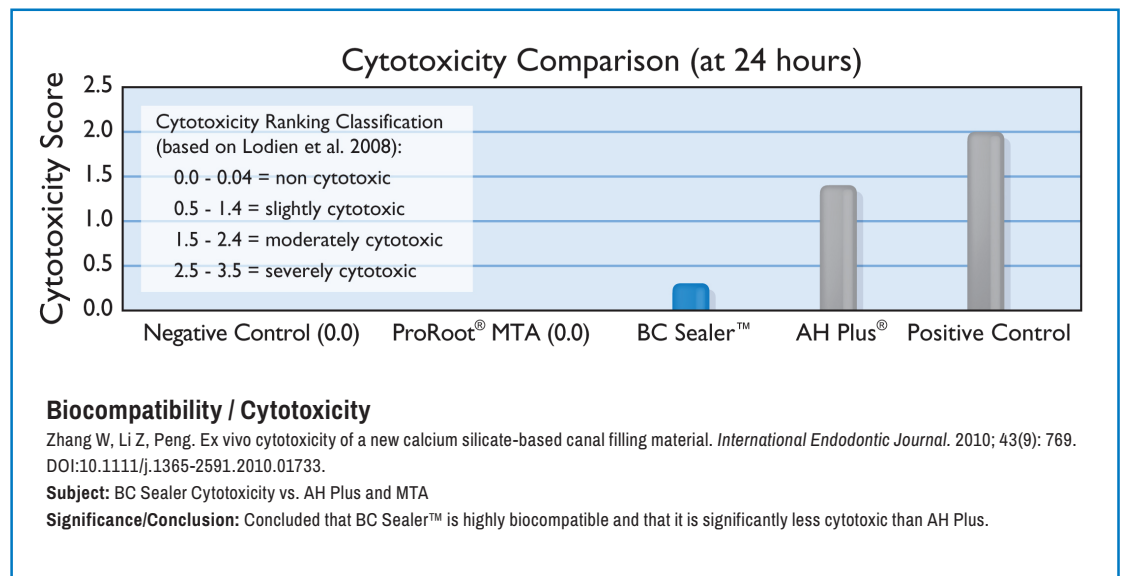
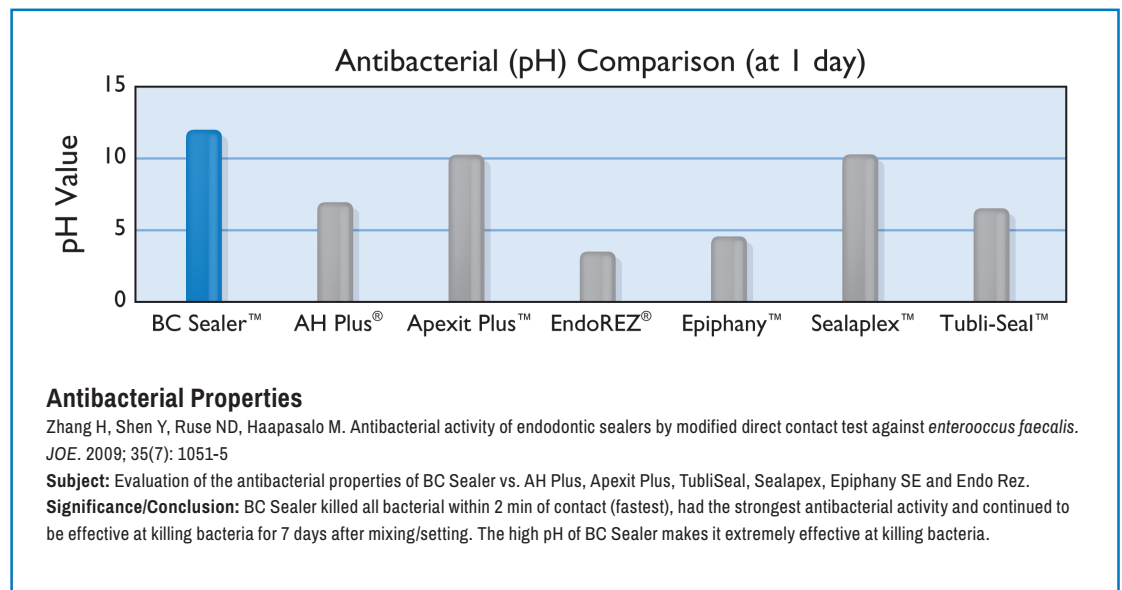
9b> Immediate post-op

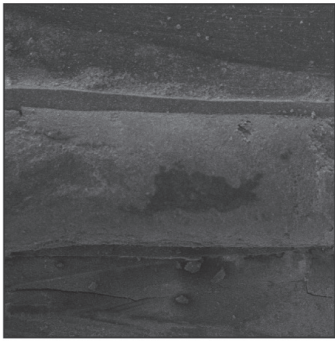


9c> Recall. Notice the excellent healing

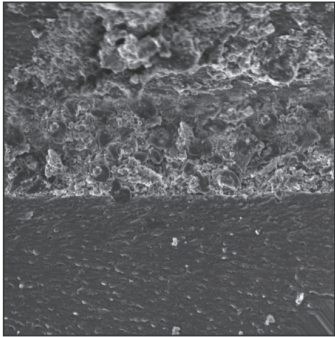
We have begun to look carefully at shaping and recognize that all instrument systems are not the same and do not accomplish the same goals. Some years ago, it was recognized that constant tapered file systems (versus variable tapered) would consistently produce minimally invasive shapes in the root canal. Further, that synchronization of all the parts of the procedure (i.e., the instruments, paper points, gutta percha and posts) would lead to the removal of less unnecessary dentin. Posts were designed to fit the space that the last rotary instrument actually produced. Thus, the first drill-less post system was developed with the recognition that the preservation of radicular dentin was critical to the responsible restoration of an endodontically treated tooth.

Those who claim that root canals fracture and don't hold up for the long term do not recognize the importance of maintaining the inherent strength of a tooth throughout the root canal procedure by the use of minimally invasive techniques and technology. Root canals that are carried out with instrumentation systems designed to retain as much coronal radicular dentin as possible and are restored utilizing bonded obturation (BC Sealer, Brasseler USA) will stand the test of time. Restoration of an endodontically treated tooth should begin at the apex. Through the use of minimally invasive techniques and advanced material science, this is now a reality. Grossman would be proud. ●

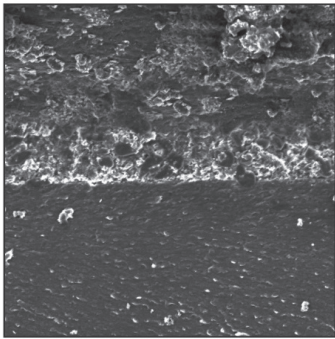




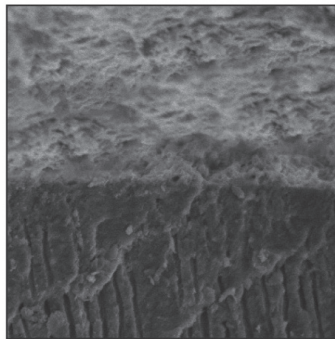
x35 Magnification



x200 Magnification



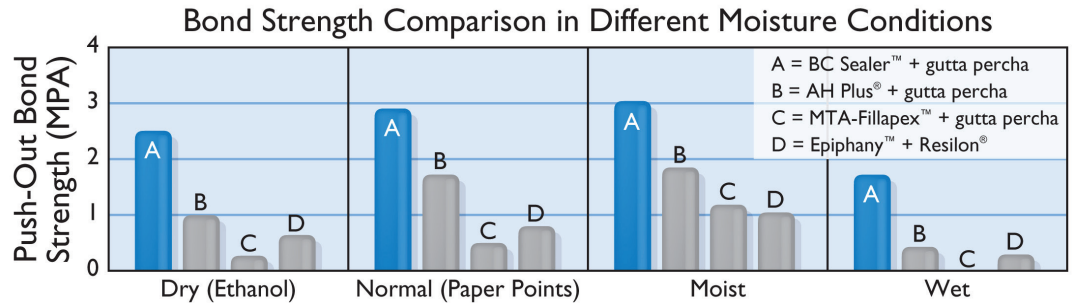
x350 Magnification



x1000 Magnification

SEMs courtesy of Martin Trope DMD, Clinical Professor; Department of Endodontics, School of Dental Medicine, University of Pennsylvania.

Subject: These SEMs show the intimate bond between BC Sealer, BC Point and the dentinal wall at various magnifications.

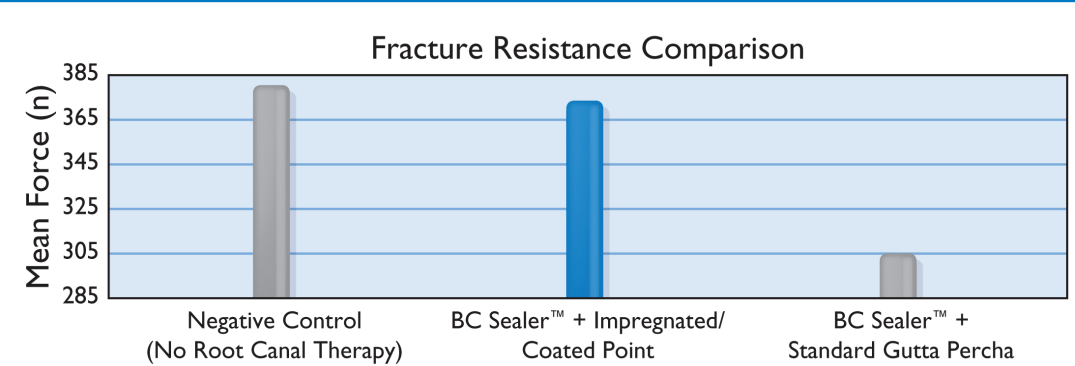


Bond Strength

Nagas E, Uyanik MO, Eymirli A, Cehreli ZC, Vallittu PK, Lassila LVJ, Durmaz V. Dentin moisture conditions affect the adhesion of root canal sealers. *JOE*. 2011; 38 (2): 240-4

Subject: Comparison of the push out bond strength (and the assumed sealability) of BC Sealer™ + Gutta Percha vs. AH Plus + Gutta, MTA Fillapex + Gutta and Epiphany + Resilon in a full range of moisture conditions (artificially dry, normal, moist and wet).

Significance/Conclusion: BC Sealer exhibited, by far, the highest bond strength in all moisture conditions. Many sealers are negatively affected if water or bleach remains in the canal when the sealer is applied. BC Sealer is hydrophilic and achieves its set by utilizing the moisture naturally present in the dentinal tubules. This study proves that regardless of moisture level in the canal, BC Sealer will achieve its set and it exhibits excellent bonding to the canal walls.

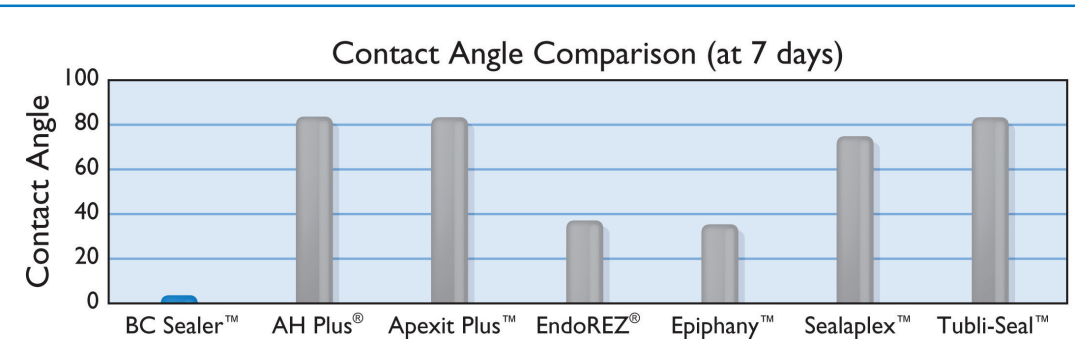


Fracture Resistance/ Strengthening the Root/ Restorative Endodontics

Ghoneim AG, Lutfy RA, Sabet NE, Fayyad DM. Resistance to fracture of roots obturated with novel canal-filling systems. *JOE*. 2011; 37 (11): 1590-2

Subject: Evaluation of the fracture resistance of teeth obturated with BC Sealer™ + gutta percha and BC Sealer™ + Silicate Coated Points.

Significance/Conclusion: The negative control for this study was tooth that had not undergone root canal therapy. The study concluded that BC Sealer used in conjunction with Brasseler's coated/impregnated cones (originally ActivGP Point™ but later updated to BC Points™) actually increased the fracture resistance of the root to a level comparable of the negative control. This type of restorative obturation could represent a significant advancement in root canal therapy.



Hydrophilicity, Low Contact Angle / Flow

Zhang H, Shen Y, Ruse ND, Haapasalo M. Antibacterial activity of endodontic sealers by modified direct contact test against *enterococcus faecalis*. *JOE*. 2009; 35(7): 1051-5

Subject: Evaluation of the flowability and antibacterial properties of BC Sealer vs. AH Plus, Apexit Plus, TubliSeal, Sealapex, Epiphany SE and Endo Rez.

Significance/Conclusion: "BC Sealer, by far had the lowest contact angle / wetting ability". The authors attribute the favorable sealing properties of BC Sealer to its "combination of high pH, hydrophilicity, and active calcium hydroxide diffusion".

RESTORATIVE ENDODONTICS™

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vs
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