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Valuable summer reading

It was a pleasure to see so many of you at the recent American Association of Endodontists Annual Session in Boston. Each year, the meeting is a wonderful opportunity to connect with one another, to learn about new products and to discover new techniques and innovations.

Now that summer is upon us, it’s also a good opportunity to catch up on some reading, and I hope that you will find this issue of roots to be beneficial.

Presented within the pages of this publication, among many other articles, you will find an interesting case report and an article about endodontic technology. You will also find our meeting coverage from AAE, plus articles on some of the latest product offerings.

What makes roots even more beneficial is its C.E. component.

By reading the article on apical microsurgery by Dr. John Stropko, then taking a short online quiz about this article at www.DTStudyClub.com, you will gain one ADA CERP-certified C.E. credit. Remember that since roots is a quarterly magazine, you can actually chisel four C.E. credits per year out of your already busy life without the lost revenue and time away from your practice.

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I hope that you will take the time to read all of the articles presented here in roots, and please send me your feedback and ideas. I can be contacted at f.weinstein@dental-tribune.com.

Until we meet again at the fall meetings, I wish you the very best.

Sincerely,

Fred Weinstein, DMD, MRCD(C), FICD, FACD
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on the cover
Confocal imaging showing live E. faecalis in green (main image), infiltration of the bacteria into the dentin tubules (upper right), post treatment 30 seconds with Photon Induced Photoacoustic Streaming (PIPS) showing no live bacteria (middle right) only dentin autofluorescence in red. The samples were then imaged via SEM, confirming the effectiveness of PIPS application (lower right). Images courtesy of Enrico DiVito, DDS, and Technology4Medicine.
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Bryan M. Beebe D.D.S.
Endodontist, Sarasota, FL

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The REB and REP

The amount, or degree, of the root-end bevel (REB) is of utmost importance and should be precisely planned in advance after considering the overall crown/root ratio, presence of posts or other obstacles, the root anatomy and the periodontal status of the tooth. According to previous research, 98 percent of canal system ramifications occur in the apical 3 mm.

If the bevel is long (traditionally 25 degrees to 45 degrees) an excessive amount of root structure would have to be removed to include the apical 3 mm on the palatal, or lingual, part of the root’s apical canal system (especially in roots with multi canals). If the bevel is closer to 0 degrees, the lingual 3 mm is easier to remove; more root structure can be conserved, improving the crown/root ratio. With a long bevel, there is also an increased risk of completely missing some important palatal, or lingual, anatomy, especially if the operator is in any measure trying to be conservative in order to preserve as much crown/root ratio as possible (Fig. 1).

The long bevel creates a spatial problem that is generally impossible for the operator to overcome while trying to visualize the true long axis of the canal system (Fig. 2). The longer the bevel, the greater the tendency is for the operator to leave more of the palatal, or lingual, aspect of the root intact. Because it is difficult to visualize the long axis of the tooth, the resultant retroprep is not as likely to be within the long axis of the canal.

This concept is of utmost importance and is the primary reason that, on occasion, the retroprep unintentionally perforates to the lingual or palatal (Figs. 3a, 3b).

Another important consideration is, with a bevel as close to 0 degrees as possible, the cavo-surface marginal dimensions (bet you haven’t heard that term in a while!) of the root end preparation will be considerably decreased. Therefore, the restoration will be easier to place and have less chance of leakage.

The root anatomy is especially important when there are more than two canals in one root. This occurs most commonly in maxillary bicuspids and in the mesial roots of nearly all molars. It has been shown that as many as 93 percent of the MB roots of the maxillary first molars have a second (MB2) canal. However, the operator has to be constantly aware that multiple canals can occur in any root, no matter what tooth is being operated on. If there is an isthmus present, it can usually be seen with the OM if the root has been adequately beveled and stained with methylene blue.

The refinement of the bevel is best accomplished with a surgical length 1171 carbide-tapered fissure.
A standard high-speed handpiece should never be used for the above reason. On occasion, the refinement of the bevel can cause additional bleeding due to some enlargement of the crypt. The operator should address any newly created crypt management problem before proceeding any further. Remember that it is of utmost importance to fully complete one step before proceeding to another!

After the REB is refined and crypt management is completely under control, the apical surface is rinsed and dried with a Stropko Irrigator (www.stropko.com). The clean and dried surface is then stained with methylene blue. It is important to allow the methylene blue to remain on the tooth for just a short period of time before gently rinsing and drying again to enable inspection of the stained surface.

Normally, a fresh, white piece of Telfa is reinserted for better lighting. If there are any fractures, presence of isthmus tissue or accessories present, the staining will greatly enhance the operator’s ability to visualize them. Also, the methylene blue will stain the periodontal ligament and enable the operator to be sure the apex has been completely resected (Fig. 4). If there is an accessory canal present, the easiest answer is usually to bevel past it and restain. Or, on occasion, the accessory can be “troughed out,” leaving the bevel as is.

When two canals are present in the same root, it is necessary to prepare for an isthmus between the two canals even if the staining didn’t reveal one. It has been shown that in the mesiobuccal roots of the maxillary first molars with two canals, the 4 mm section displayed a partial or complete isthmus 100 percent of the time.3 This combined with the finding in the same root in maxillary molars, that two canals present clinically at least 93 percent of the time in the mesiobuccal root of the maxillary first molar, lends importance to always preparing isthmus area of the REB.2

Although staining doesn’t always reveal the presence of an isthmus, it may lie just below the surface, only to be exposed during the remodeling process of the surface of the beveled root that normally takes place during the healing process (Fig. 5). The rule is to always prepare an isthmus when there are two canals in one root.

The preparation of the root-end preparation (REP) is best accomplished using ultrasonics. There are many different ultrasonic units available. For the most part, they are all dependable and have a good service record. There are multitudes of ultrasonic tips to choose from. The newer diamond coated and vented tips (ProUltra Tips from DENTSPLY Tulsa Dental or KIS Tips from Obtura/Spartan) are much more efficient and especially good at removing gutta-percha.

The most important consideration is not the brand of the ultrasonic unit or type of tip but how the instrument is used. The tendency for the new operator is to use the ultrasonic in the same manner (pressure-wise) as the handpiece.  The secret is to start at a low power setting and use an extremely light touch! The lighter the touch, the more efficient the action of the tip will be.

The correct amount of coolant is also important. If too much spray is used, visibility and cutting efficiency are both decreased. If too little spray is used, the necessary amount of cooling will not be available and overheating and/or micro cracks can be the result.

The occasional left and right, variously angled tips are necessary on occasion, but in most cases, the anterior type tips will suffice. If the canal is large and/or filled with gutta-percha, a larger, coated tip can be used most efficiently. The key is to: 1) slow down; 2) be gentle; 3) use a light, brushing movement; and 4) carefully regulate the power setting of the ultrasonic unit. The power setting will vary greatly depending on the tip being used and nature of the preparation task at hand.
For the preparation of an isthmus, an uncoated, fine-pointed tip (CT-1 by SybronEndo) is inserted into the ultrasonic and used to create a precise series of multiple "dots" on the stained or "imaginary" line between the two canals. For the DOT Technique, the ultrasonic unit is set at a low power setting but inactivated, water spray is turned off, a CT-1 tip is placed exactly where desired and the rheostat is "tapped" for just an instant. The process is repeated again, and again, as many times as necessary, until there are a series of "dots" (Fig. 6a). Then, while the water spray is still off, the dots are gently connected to create the initial, shallow but precise "tracking groove" (Fig. 6b).

The DOT Technique is of great value, especially when there is concavity present and the width of the beveled root is very thin mesial to distal. The resultant groove serves as a definite guide for the completion of the isthmus portion of the REP. Then with the water spray turned back on and the power increased slightly, a pointed, coated tip can be used more aggressively to deepen the tracking groove. In this manner, accuracy is completely controlled and there is no chance of "slipping off" while preparing the isthmus in a very thin root. On occasion, if the walls of the prep become too thin, further beveling may be necessary.

Occasionally throughout the REP process, it is important to use the Stropko Irrigator to rinse and dry the REP to be sure it is kept within the long axis of the canals and all debris is being removed as planned. Various sizes of micro-mirrors, or an endoscope, are used to periodically inspect the preparation and confirm accuracy.

A pre-cut and pre-bent 25 gauge endodontic irrigating needle (Monoject) works well for this purpose. The notched end is removed by rapidly bending the end one-third back-and-forth with a Howe Pliers. The needle inserted into the Stropko Irrigator is then bent similar to the ultrasonic tip to be used for the REP (Fig. 7). Always keep in mind that cleanliness and dryness are essential for good visibility when using the OM.

Of particular interest is the buccal aspect of the internal wall of the REP. Dr. Rubinstein was the first to point out that often this area is not debrided due to the angulation of the ultrasonic tip within the canal system during the REP. If there is some gutta-percha “streaming up” the side of the wall, and
the preparation is finished, the best thing is to take a small plugger and fold the gutta-percha coronally so the wall is clean once more. It is usually futile to try to “chase after” the gutta-percha with an ultrasonic tip.

The ideal REP should: 1) be within the long axis of the canal system; 2) have parallel walls; 3) be at least 3 mm in depth (including the isthmus portion of the preparation); 4) adequately extended to include any buccal/lingual variations of the canal system; 5) be clean (free of a smear layer) and 6) be dry and ready to accept any type root-end filling material.

After completion of the REP, it should be rinsed and dried once more with the Stropko Irrigator. The REP is re-inspected, using micro-mirrors and the varying powers of the OM and/or endoscope, to be sure it is clean and within the long axis of the canal system. At this time, the REP is etched with blue 35 percent phosphoric acid gel (Ultra-Etch by Ultradent) to remove the smear layer. After 15 to 20 seconds, the REP is thoroughly rinsed and dried with the Stropko Irrigator and re-examined with the OM.

If all is as desired, a 15-second rinse with 2 percent chlorhexidine will help eliminate any residual organisms present. One more gentle rinsing and drying with the Stropko Irrigator and the REP is ready for the root-end fill (REF).

**_REF_ materials, techniques**

The necessary steps and procedures have been presented, enabling the operator to atraumatically and predictably allow the root-end preparation (REP) to be sealed using any accepted root-end fill (REF) material.

The surgical crypt should be clean and dry so vision is clear and unobstructed. Remember, the steps must be followed completely in order to achieve as predictable a result as humanly possible. If, for some reason, crypt management is not complete, or the REP is not clean and finished, it is required to “go back” and repeat a step, or two, to achieve the desired result. The importance of having total control at this point in the apical microsurgical procedure cannot be over-emphasized.

The operator is now at a stage in the microsurgical procedure where the tissues have been atraumatically retracted, the crypt is well-managed and the acid etched; rinsed and dried REP is ready to fill. Removing the smear layer barrier, exposing the organic component (collagen fibrils) of the resected cementum and dentin, has been shown to enhance cementogenesis and is one of the keys to dentoalveolar healing.⁷

There are several materials that are currently available as a retrofill: amalgam, IRM, Super EBA “SEBA” (Bosworth, USA), bonded composites Optibond (SybronDental, United States), glass ionomers, such as Geristore (Den-Mat, United States) and more recently, Mineral Trioxide Aggregate “MTA” (DENTSPLY Tulsa).

The number of publications in literature about research on the above materials is extensive, so only a few of them will be mentioned due to space. The author doesn’t want to recommend or disapprove of any retrofill material (except amalgam), but will generalize and relate his and others’ experience with them and opinions about their applications.

Amalgam and IRM were used for many years as the only commonly available retrofill materials. However, in almost every “leakage” study published during the past few years, amalgam has proved to be the worst offender, exhibiting the most leakage.⁵,⁶ This fact, accompanied by the general controversy about mercury in amalgam, strongly suggests that there is no valid reason to continue its use as a retrofill material. The only real advantage to amalgam is the Fig. 8a. Amalgam is the most radiopaque REF material, but its use is highly controversial.

Fig. 8b. SEBA has a radiopacity similar to that of gutta-percha.

Fig. 8c. The MTA has a radiopacity just slightly better than gutta-percha.
favorable radiopacity (Fig 8a). In fact, of all REF materials commonly in use today, none of them compare to the radiopacity of amalgam.

Since the advent of the anatomically correct, ultrasonic REP, one of the most popular and still-used REF material is Super EBA (SEBA). A recent follow-up study demonstrated a success rate of 91.5 percent using SEBA. The author used SEBA routinely in the early 1990s with full confidence of its sealing capabilities.

To some, the major drawback of SEBA is its technique sensitivity. The surgical assistant had to mix it until it was thick enough to roll into a thin tapered point with a dough-like consistency. For even a well-trained assistant, this was often the most stressful part of the microsurgical procedure. The “dough-like” tapered end of the thin SEBA “roll” was then segmented with an instrument, such as a small Hollenbeck Carver.

The small cone-shaped endpiece was then inserted into the retroprep and gently compacted coronally with the appropriate plugger. Two to five of these small segments were usually necessary to slightly overfill the retroprep.

Another problem experienced by many was that SEBA was unpredictable as to its setting time — sometimes setting too quickly and, at other times, taking much too long for the tired surgeon.

At any rate, after the REP is complete, an instrument, and/or bur, is used to smooth the resected surface, producing the final finish. A mild etchant is then used to remove the “smear layer” produced during the final finishing process. SEBA has a radiopacity comparable to that of gutta-percha, so it was necessary to educate the new referring doctor that a retrofill had indeed been performed (Fig. 8b). However, in some recent studies, SEBA has been shown to have a better sealing ability than IRM, but not as well as MTA.

Bonding, using composite retrofill materials, is now completely possible due to having total control over the apical environment utilizing good crypt management procedures. Many different materials are available for use as a REF. Optibond (SybronDental) and Geristore (Den-Mat) are popular because of their ease of use. They both have good flowability, dual-cure properties and the ability to be bonded to dentine. Geristore is supported by research demonstrating biocompatibility to the surrounding tissues.

The usual etching, conditioning of the dentin, insertion of the selected material, and curing by chemical or light is accomplished in a routine manner
when bonding into the retroprep. (Note: Because the light source for the OM is so intense, it is mandatory to obtain an orange filter to use while placing the composite to prevent a premature set.) For most microscopes, an orange filter is available that easily and inexpensively replaces the “blood filter.” After the composite is completely cured, the material is finished with a high-speed finishing bur and the resected root end is etched with a 35 percent blue gel etchant (Ultradent, United States) for about 12 seconds to remove the “smear layer” and to demineralize the surface.

Several studies showed no leakage with bonding techniques and many operators use it as their technique of choice.

However, there is some controversy as to whether the resected surface of the root should also be coated with a thin layer of the bonding material. A “cap” of material (usually Optibond) was placed with the intention of sealing the exposed tubules on the resected surface.

The operators who cover the resected surface believe it necessary to ensure a good seal and the predictability would be better. On the other hand, there are also operators who do not believe the exposed tubules are a factor concerning the predictability of the healing process. They reason that nothing would heal as well, or be more biocompatible, than the exposed dentin of the apically resected surface.

The author did not cover the exposed apical surface and is convinced the jury is still out on this issue!

More recently, another material has become very popular and is widely used by many. Mineral Trioxide Aggregate (MTA) has attracted many converts. There is so much research that has been done, and so many publications presented, that just one reference would be futile.

The evidence extolling the virtues of MTA, regarding its sealing capabilities and its biocompatibility with the surrounding tissues, is overwhelming. The author has talked to many respected endodontists, and most are now using MTA as their routine retrofill material. MTA is chemically similar to calcium sulfate, forgiving to work with, and has a radiopacity slightly better than gutta-percha (Fig. 8c).

The main advantage of MTA is its ease of use, much like handling “Portland Cement.” One of the secrets to using MTA is to keep it dry enough so it doesn’t flow too readily (like wet sand), but yet is moist enough to permit manipulation and maintain a workable consistency.

The desired “thickness” is easily accomplished by using dry cotton pellets, or the MTA mix can be gently dried with a dedicated, air-only Stropko Irrigator (www.stropko.com). If the MTA is too dry and needs moisture added, that, too, is easily done with a cotton pellet saturated with sterile water. Properly mixed MTA can be extruded in pellets of various sizes (depending on the size of the carrier used) using a Dovgan Carrier (Quality Aspirators) and condensed with an appropriate plugger.

More recently, a simple method for delivery of the MTA into the REP was introduced (Fig. 9a). The Lee MTA Pellet Forming Block has several differently sized grooves to create the desired aliquot of MTA. The MTA adheres to the instrument, allowing for easy and efficient placement into the REP (Figs 9c-9e).

For a denser and stronger consistency, the assistant can touch the non-working end of the plugger, or explorer, with an ultrasonic tip during the condensation process. The flow is increased and a much denser fill is achieved. As a result, “ultrasonic densification” also increases the radiodensity of the MTA’s appearance in the post-op radiograph, but it is still similar to gutta-percha (Fig. 8c).

MTA has approximately an hour of working time, which is more than adequate for apical microsurgery and takes much “time pressure” out of the surgical procedure. Finishing the MTA is simply a matter of carving away the excess material to the level of the resected root end (Fig. 10a). The moisture necessary for the final set is derived from the blood, which fills the crypt after surgery. The MTA is very hydrophilic and depends on moisture for the final set, so it is im-
operative that there is enough bleeding re-established after crypt management to ensure the crypt is filled. If any material, such as ferric sulfate, has been used for crypt management, it must be judiciously removed to restore blood supply to the crypt.

This can be considered the final step in "crypt management" and is especially important when MTA is used for the REF. If the size of the lesion indicates the use of guided bone regeneration, good blood supply is indicated anyway, so allow the blood to cover the MTA before placing the GBR material of choice. In a large lesion, it is sometimes difficult, even after curettage, to restore bleeding into the crypt (perhaps the crypt management was a little too effective), and it may be necessary to use a small round bur in the surgical handpiece to make several small holes in the surface of the crypt to aid in the re-establishment of the desired flow of blood.

Based on current studies, the operator can choose any one of the above mentioned REF materials and be comfortable that, if the proper protocol is followed, the apical seal will be predictable and healing uneventful.

**Sutures, suturing techniques**

All steps have been meticulously followed, the REF has been placed, the crypt has refilled nicely, the final radiograph has been approved, and it is time to suture the flap into position.

Sadly, most operators now push the microscope aside and suture without it. To do this robs the operators of an opportunity to demonstrate to themselves and their patients the amazing capabilities of the OM. The doctors must make a commitment to master the suturing technique using the OM.

It will never be accomplished with the OM pushed aside at this critical step in the apical microsurgical procedure. The following will be based largely on the author’s own experiences during nearly 20 years of doing, teaching and writing about apical microsurgery.

Dr. John Harrison has published some of the most clearly written and comprehensive work on wound healing associated with periapical surgery.

There are five publications that are a “must read” for the endodontic surgeon. These publications can be found in the Journal of Endodontics: 1991, Vol. 17, pp. 401-408, 425-435, 544-552; 1992, Vol. 18, pp. 76-81; and 1993, Vol. 19, pp. 339-347.

After reading these articles, the microsurgical protocol developed by Drs. Gary Carr, Richard Rubenstein and others becomes clearer and is more easily understood. The word "atraumatic" is an important factor to achieve predictable wound healing.

When the surgical site is ready for closure, the flap should be gently massaged to close approximation with the attached tissue. But, keep in mind, the flap has probably lost dimension, or "shrunk" slightly, due to the mere act of retraction over a period of time and has endured a slight decrease of blood flow to it. Fortunately, this is usually not a problem. If the initial incision was planned with this final step in mind, the tissues should re-approximate with minimal manipulation. Now is when the operator will appreciate nice "scalloping" and a sharp scalpel when making the incision in the beginning of the surgery (Fig. 11).

Remember the old saying, "Hindsight is always 20/20"? The smooth side of a small #2 mouth mirror can be used to hold the tissue in position while the second surgical assistant (on the same side of the chair as the doctor) hands the doctor the needle holder with the needle positioned properly in the beaks so the sutures can be easily and accurately placed.

All suturing is accomplished using 6-0 black monofilament nylon (Supramid, S. Jackson). Some microsurgeons are using 8-0 and, even 10-0 sutures; but the 6-0 is easy to use, doesn’t tear through the tissue as readily and the results are no different than with the more technique-demanding, thinner sutures. Keep in mind, the sutures will be removed in 24 hours so it is really a moot point as to whether the suture is 6-0, 8-0 or 10-0.

The results achieved with 6-0 suture seem to be well suited to apical microsurgery. The black silk suture, traditionally used in surgery, is a detriment to the rapid healing we are trying to achieve. Not only does bacterial plaque more readily accumulate on it than monofilament but, also, the braiding...
acts as a wick for the migration of bacteria into the wound. This can result in an increased inflammatory response and compromised healing.

The type of needle used depends on the type of flap to be sutured. For the Oshenbein-Leubke Flap, a taper point needle (TPN), 3/8 circle (Supramid, S. Jackson, code MEA-60B) is used. The TPN is far superior to the reverse cutting type needle (RCN) because there isn’t the tendency to cut, or tear, the flap edges. Also, the TPN require less effort to exit at a point in the attached tissue where the operator intends, not where the needle wants to exit. In other words, it is easier to guide a TPN to the desired point of exit in the attached tissue than it is an RCN. They just seem to cooperate more when suturing this type of flap! One of the nicest things about using this flap design is the ability to easily see the healing taking place (Figs. 12–16).

For the Sulcular Flap, a reverse cutting needle (RCN), 3/8 circle (Supramid, S. Jackson, code MPR-60B) is used. This needle is used because the larger size facilitates passing it through the contacts when doing a sling suture. The sling, or mattress type, suture is routinely used to save time on closure, rather than doing individual buccal to lingual sutures. On many occasions, the TPN (see above paragraph) is also used to suture the attached gingival area of the flap at the coronal aspect of the releasing incision.

A technique for suturing using the SOM: While the scope assistant holds the retractor in place, the second assistant uses a small Castro-Viejo type needle holder. The beaks of the holder must grasp the needle approximately 3/4 of the distance from the pointed end to where the suture is attached to the needle. Special attention, by the second assistant, must be taken to keep the beaks of the holder away from either end of the needle, as these are the areas of the needle’s greatest weakness and can be inadvertently bent or broken (Fig. 17).

Care is taken so the needle is firmly grasped perpendicular to the beaks of the holder. This allows the operator more definite control and a better “feel” of the needle during the suturing process.

The second assistant now passes the needle holder into the doctor’s normal working hand (Hand A). The doctor then begins the suturing process by inserting the needle through both sides of the incision. When the needle is completely through both sides of the incision, the needle is then grasped between the thumb and index finger of the opposite hand (Hand B). While the doctor is doing this, the second assistant is holding the end of the suture so it won’t inadvertently be pulled through the tissues. The doctor proceeds to make the three loose “loops” around the beaks of the needle holder to start the first knot. While the doctor is making these initial “loops,” the second surgical assistant is placing the end of the suture into the doctor’s visual field of the microscope, so the end of the suture can be easily grasped in the beaks of the needle holder by the doctor.

The second assistant can be sure the end of the suture is within the doctor’s field of vision by looking into a monitor that has been placed so it is easily seen (Fig. 18).
The "loops" around the beaks of the needle holder create enough friction so there is a controllable tension between the doctor's Hand B and the beaks of the needle holder in Hand A. Care must always be taken that the tension is only between Hand B and the needle holder in Hand A, so no undesirable tension is exerted on the tissue during the suturing process.

The purpose of maintaining some tension is to give the doctor a positive tactile sense while taking up the excess suture material in Hand B. As the suture is drawn through the tissue by Hand B, Hand A is lowered to prevent exerting too much tension on the tissue.

The tension on the suture is regulated by the looseness, or tightness, of the "loops" which control the amount of friction for the suture to overcome as it is gathered. Hand B continues gathering as Hand A yields the suture with a "descending" motion while still maintaining the desired tension, and the beaks of the holder have the end of the suture firmly secured.

When the end of the suture is at the desired length relative to the incision, the "loops" are allowed to slip off the beaks for the initial knot. Then, using the same basic rhythm of movements, the "securing" and "locking" knots are placed. It is an alternating rhythm of movement that is difficult to describe in writing, but is actually very easy for the beginning microsurgeon to learn.

The doctor now allows the second surgical assistant to take the needle holder from Hand A and simultaneously be handed the micro-scissors so the suture can be cut close to the knot.

After the second assistant takes the scissors and the suture, the doctor is handed a micro-forceps to gently move the knot between the point of insertion and the incision, helping to prevent plaque buildup over the incision itself (Fig. 19).

Note: When moving the knot with the micro-forceps, it is important that the knot be "pushed" to place, not "pulled" to place. This ensures the suture's original tension and integrity is maintained.

One of the most common mistakes made when suturing is to make the suture too tight. It is better to make the suture a little too loose than to make it too tight. When the suture is too tight, it causes ischemia and thus compromises rapid healing. When making a sling suture in a sulcular flap, it is easy to be too aggressive when tying the knot, causing the rest of the suture to get too tight. The doctor should always recheck the tension over the entire length of the suture before completing the securing knots.

The releasing incision is usually an integral part of every flap and is considered differently from the rest of the incision. Normally, the releasing incision is not sutured, but if it is, the suture should be looser than the other sutures. It has been shown that epithelial creep, or streaming, occurs rapidly, or at a rate of about 1 mm per side per 24 hours.

In other words, a wound whose edges were separated 2 mm would be expected to come together within a 24-hour period. In hundreds of surgeries during the past 12 years, there were only a few cases where the releasing incision wasn’t completely closed.

Of those few that didn't close within 24 hours, they all closed within 48 hours. To repeat: If the operator prefers to suture the releasing incision, it must be sutured loosely (Fig. 20). Another consideration is to be sure to suture "like tissues to like tissues." Never suture attached gingival tissue to unattached gingival tissue. If one side of the suture "tears out," it will be the attached gingival side.

When using the OM to suture, the incision can be closed accurately with extremely good approximation. It is because of well-planned and nicely scalloped incisions; atraumatic flap elevation procedures; and the very close repositioning of the flap with thin, hair-like sutures (6-0) that we can plan on routinely removing sutures in 24 hours (see Figs. 16 and 17).

The sutures have completed their task after 24 hours, and in fact, have now become foreign bodies that can cause irritation, excessive inflammation, be a source of infection and, ultimately, result in a retardation of the healing process.
For those who doubt the 24-hour Suture Removal Theory, an easy exercise is this:

1) At the next surgery, be sure to place at least five sutures.
2) After 24 hours, have the patient come in and remove the worst-looking suture, the one you think isn’t healing as well as the others.
3) Then, the next day, remove the next worst-looking suture.
4) The next day, do the same, and so on. At the end of the fifth day, the worst-looking suture will be the one remaining! If that doesn’t convince you, nothing will.

Post-operatively, the usual result is little, or no, pain or swelling. The post-operative instructions are ice packs 15 minutes on and then 15 minutes off for the first six hours only, gentle rinsing with Peridex for the next 24 hours, and have sutures removed the next day. Experience has demonstrated that prescribing Ibuprofen 600mg every six hours, along with two tabs of Tylenol OTC (taken between the doses of Ibuprofen), has a very effective anti-inflammatory effect.

It is the exception, rather than the rule, that a patient requires a stronger medication for post operative pain. Antibiotics are not usually prescribed.

If everything is within normal limits, the patient is instructed to begin gentle cleaning of the area on the third day post-op, using a wash cloth over his or her index finger, and to begin gentle brushing, with a soft brush, on day five. The patient is scheduled for a follow-up visit two weeks after surgery.

At the two-week visit, normally the incision is barely visible, and on most occasions, can hardly be detected.

A word of caution: Not all patients respond to treatment as well as others. Don’t be in a hurry to treat a problem that may not exist. On a few occasions, patients may be slower than normal in response to treatment, sometimes taking several weeks to heal as well as other patients have or do in just days.

If there is any doubt, place the patient on antibiotics and an anti-inflammatory for a week as a precaution, but what is really desired is more time for delayed healing to occur.

The apical microsurgical technique described in the previous six parts has become the standard of care in endodontic treatment and raises endodontic apical surgery to a new and exciting level.

For the first time, apical surgery can be performed with predictable results. But these results can only be achieved if the proper protocol is followed meticulously.

The steps must be followed without compromise. Much more could be written, but hopefully enough of an overview has been given to stimulate just one more doctor to begin using the OM. It is the finest tool our profession has ever been given.

Apical microsurgery can be an enjoyable part of the daily regimen, for both the doctor and the newly involved dental team.

Editorial note: Part I of this article appeared in roots, the international magazine of endodontics, Vol. 1, No. 1, 2011. A complete list of references is available from the publisher.

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**Fig. 19** The suture knot is ‘pushed’ into the proper position, not ‘pulled.’

**Fig. 20** If the vertical releasing incision is sutured, it must be kept very loose.

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John J. Stropko received his DDS from Indiana University in 1964, and he practiced restorative dentistry for 24 years. In 1989, he received a certificate for endodontics from Boston University and recently retired from the private practice of endodontics in Scottsdale, Ariz. Stropko is an internationally recognized authority on micro-endodontics. He is the inventor of the Stropko Irrigator, has published in several journals and textbooks and is an internationally known speaker. He is the co-founder of Clinical Endodontic Seminars and was an instructor of microsurgery for the endodontic courses presented at the Scottsdale Center for Dentistry. Stropko and his wife, Barbara, currently reside in Prescott, Ariz. You may contact him at docstropko@gmail.com.
A logical basis to judge endodontic innovations

Author Barry Lee Musikant, DMD

The introduction of new technology has as its goal to improve a process that was unable to be achieved, poorly achieved by other means or achieving the same or superior results in a more time and cost-efficient manner. Using these criteria as the justification for the introduction of rotary NiTi, the burden of proof is on demonstrating that at least some of these conditions previously existed.

Certainly prior to the introduction of rotary NiTi, dentists were shaping canals in many cases quite well. One simply has to observe the work of Dr. Herb Schilder to recognize excellence before the implementation of rotary NiTi.¹

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Fig. 1. Photo of a K-File. Note the high number of horizontally oriented flutes. (Photos/Provided by Dr. Barry Lee Musikant)

Fig. 2. Photo of a relieved reamer. Note the patented flat side and the decreased number of vertically oriented flutes.

Fig. 3. Photo of a relieved reamer that negotiated easily to the apex in a highly curved canal.
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“"The sodium hypochlorite product with added surface active agent was the most effective in tissue dissolution at all concentrations and temperatures.""
Yet, most dentists would admit that achieving that level of perfection is quite challenging using the tools Schilder had to work with. So, while it was possible to attain perfection with what previously existed, the incorporation of rotary NiTi made it possible for more dentists to achieve results approaching the excellence of Schilder.

The justification for the implementation of rotary NiTi is that it produces superior results more simply and in less time than conventional endodontics. Yet to make this an accurate comparison, we have to settle on just what conventional endodontics means.

For most dentists, conventional endodontics means the shaping of canals with a series of K-files used in a stepback manner. Yet, this was not the technique Schilder used to shape canals. Rather, he used reamers, instruments whose design includes fewer and more vertically oriented flutes than K-files, instruments that are used conventionally, but not nearly as well known as K-files.

If one considers the use of K-files as the only option if one doesn’t adopt rotary NiTi, one also has to admit that the adaptation of rotary NiTi does not eliminate the use of K-files since they are a requirement for glide path creation, a necessity before rotary NiTi can be safely used. Therefore, at best, rotary NiTi implies the reduction in the use of K-files without replacing them completely. All the problems associated with K-files in their creating the initial canal shaping are still present. It is only the latter part of canal shaping for which the rotary NiTi are responsible.

With the notable improvements that rotary NiTi bring to canal shaping, is it not reasonable to assume that these same improvements would exist whether or not K-files or K-reamers unrelieved and relieved were used?

To make this judgment, one would have to appreciate the beneficial effects of a reamer design in comparison to a K-file.

Certainly, Schilder did have that appreciation. He noted in his papers that reamers engaged less along length reducing the resistance to apical negotiation. He noted the superior tactile perception, their greater flexibility and the increased ability to shave dentin from the canal walls.

Yet are these improvements sufficient to eliminate the need for rotary NiTi? It has been stated many times that 02 tapered stainless steel instruments tend to distort transport canal walls to the outside curve as progressively larger tipped sized instruments become stiffer and stiffer. Equating K-files with K-reamers one would conclude that this is a distinct possibility with either design and the more flexible rotary NiTi instruments would shape these canals to greater dimensions with less chance of distortion.

This progression of thought is undermined by the fact that K-reamers are significantly less stiff than comparably sized K-files; that by incorporating a flat along the K-reamers working length, the cross sectional area is reduced making the instruments even more flexible; that the reduced engagement along length allows the instruments to adapt to the canal walls, more readily taking advantage of stainless steel’s property of recording curves rather than snapping back to the straight position, a unique NiTi property and detrimental to our goal of distortion-free shaping.
As we can see, the concept of conventional shaping versus the new world of rotary NiTi is a bit more complex than one might originally think. We can state categorically that K-reamers that are relieved are significantly more flexible than comparably sized K-files, and that they engage far less along length and provide for a superior tactile perception, giving the dentist the ability to know when the reamer is either hitting a solid wall, in a tight, but patent canal or in a canal that is so curved that it requires prebending to negotiate around without distortion. Providing this superior tactile perception sets the relieved reamers apart from K-files.

While acceding to the superior usage of relieved reamers over K-files, wouldn’t the incorporation of rotary NiTi after glide path creation make the procedure even more efficient and effective? As its name implies, NiTi instruments are used most effectively in rotation. Yet, using NiTi in rotation increases the chances of instrument separation, a product of either torsional stress or cyclic fatigue or some combination of both. In contrast, the relieved reamers are used with either a tight watch-winding stroke or in a 30-degree reciprocating handpiece, virtually eliminating the two factors that make rotary NiTi vulnerable to breakage.

The K-reamers, routinely shape canals to a minimum of 35, one mm back to a 40 with a 25/06 overlaid taper. After the canal is shaped to a 20, a tapered peeso is used to straighten any coronal curve that may exist generally to within 6 mm of the apex. The relieved reamers 25 thru 40 are mostly limited to shaping the apical 6 mm of the canal. Even highly curved canals are not susceptible to distortion via these thicker relieved reamers because they are still far more flexible than comparably sized K-files, their motion is confined to a short arc that keeps them centered within the canal and the tactile perception clearly tells the dentist if the tip of the instrument is hitting a wall or negotiating a highly curved canal from the straight position.

With resistance mainly defined by what lies ahead of the tip of the instrument, be it from a solid wall or an abruptly curved canal, the dentist knows when to remove the instrument, bend it at the tip and manually negotiate around the curve prior to reattaching it to the reciprocating handpiece followed by rapid negotiation to the apex.

All the rotary NiTi systems make sense if the premise for their use is based on the K-file, an instrument Schilder clearly understood to be a poor design for the function asked of it. None of the rotary NiTi systems make sense, if the better designed reamers — both unrelieved and relieved — are utilized with a short arc of motion either generated manually or in the reciprocating handpiece. Rotary NiTi addresses
‘Once the relieved reamer records the curve, it is in effect a passive instrument with the blades shaving the dentin along the length of the canal walls on the downstroke and removing dentin on the upstroke wherever the dentist directs the length of the instrument to contact the canal walls.’

An instrument need not be as flexible as NiTi if it is capable of combining the flexibility it does have with the ability to record curves rather than snap back to the straight position. Once the relieved reamer records the curve, it is in effect a passive instrument with the blades shaving the dentin along the length of the canal walls on the downstroke and removing dentin on the upstroke wherever the dentist directs the length of the instrument to contact the canal walls.

In this way a uniform layer of dentin is removed circumferentially retaining the original canal shape and not undermining the thinner walls of oval canals the way it would occur if rotary NiTi was used instead. That is not to say that relieved reamers could not distort a canal wall. All one would have to do is hit a wall, know you hit the wall and continue to peck aggressively despite all the apical resistance encountered. Distortion would inevitably follow.

However, the relieved reamers offer such superior tactile perception of what the tip of the reamer is encountering that knowing when to remove the reamer, bend it at the tip and manually negotiate around the impediment is obvious making it unlikely that distortions will result.

Schilder knew what he was doing when he chose K-reamers over K-files. He never needed rotary NiTi to create a standard of shaping that rotary NiTi does not measure up to. You can achieve that standard in a thoroughly safe manner by using relieved reamers, instruments that Schilder would have noticed negotiate through the canal with even less resistance than non-relieved reamers and in using them with either a tight watch-winding motion or in the reciprocating handpiece they are being used with the tight arc of motion that Schilder would have approved of (Figs. 5a, 5b).

References


About the Author

Barry Lee Musikant, DMD, is a member of the American Dental Association, American Association of Endodontists, Academy of General Dentistry, the Dental Society of New York, First District Dental Society, Academy of Oral Medicine, Alpha Omega Dental Fraternity and the American Society of Dental Aesthetics. He is also a fellow of the American College of Dentistry (FACD). As a partner in the largest endodontic practice in Manhattan, Musikant’s 35-plus years of practice experience have established him as one of the top authorities in endodontics. He may be contacted at info@edsdental.com.
A case of diagnosis by access

Author_L. Stephen Buchanan, DDS, FICD, FACD

Fig. 1. Pre-op radiograph showing a well-performed root-canal therapy on tooth #19 (conservative access preparation and coronal shapes, dense fills to each canal terminus). Tooth #20 was treatment planned for root-canal therapy after the patient’s pain had not been alleviated by treatment of #19. (Photos/Provided by Dr. L. Stephen Buchanan)

Fig. 2. Pre-op radiograph of the maxillary arch, showing relatively large pulp horns in the chambers of teeth #13, 14 and 15, with restorations near each of them.

_She was related to my practice neighbor, a good friend and a very talented oral surgeon (OS), and was visiting him in Santa Barbara for the holidays. She was experiencing intractable pain in her left facial region. Could I see her today?

Two weeks before, her general dentist had referred her to an endodontist, who treated the root canal in tooth #19. However, the pain continued to escalate thereafter and endodontic treatment of tooth #20 was his secondary treatment plan. Fortunately, she left before that tooth was invaded.

When I met her at my front desk, I questioned her about her chief complaint — the chronology, eliciting factors and the pain referral pattern of her symptoms. She stated that the pain had been intensifying for the last two weeks, was spontaneous in onset and, for the most part, she was not aware of thermal sensitivity.

The patient felt pain in her upper and lower left teeth and down her neck. I immediately thought that this might be a classic case of myofascial pain masquerading as an endodontic problem. While dying pulp will refer pain indiscriminately to both upper and lower jaws, it never refers pain below the lower border of the mandible or above the patient’s cheekbone. I call it the endodontic zone (EZ). When asked whether she had any history of myofascial or joint pain, the patient informed me that her temporomandibular joint clicked and that she had an occlusal night guard, which she had not been wearing lately.

So, not reactive to thermal stimulus, pain referred outside the EZ and a history of temporomandibular dysfunction — interesting. I thought that I had diagnosed this case in my reception area and that I had the wonderful opportunity to tell the patient that she did not need another root-canal treatment.

My assistant took the patient back to an operatory, took conventional X-ray (Figs. 1, 2) and CBCT images, and gathered clinical findings and
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No peri-radicular pathosis was seen in any of the X-rays, cold tests of all teeth on the left side of the patient’s face were within normal limits (WNL), and I was itching to find the myofascial trigger-point that had been making her miserable. I had her open half-way — as per Dr. Janet Travel — then palpated her left masseter and temporalis muscles, but they were stellar — surprising!

I then felt like I was in the “Twilight Zone” instead of the EZ. The patient had not reported thermal sensitivity and had pain referred beyond where dying pulp refers. But I was unable to reproduce the pain by palpating her muscles of mastication.

At this point, I had no option but to turn to my standard process of pulp testing to rule pulpitis out as the etiology of her symptoms (although the previous endodontist had ruled out tooth #19). I did cold testing (with an H2O ice pencil formed in an autoclaved empty anaesthetic carpule) on all of her teeth on the upper and lower left side of her face, and while they all responded WNL, teeth #18, 14 and 15 responded sharply, but transiently — not definitive by any means.

The possibility of more than one tooth being irreversibly inflamed was virtually zero. I still did not know what was going on, although tooth #14 was very slightly sensitive to biting pressure and percussion. It had been restored recently with composite and was nearly in crossbite and therefore more likely to be affected by bruxism.

Therefore, I was left to my best next move in these kinds of situations. I heat tested all of the upper and lower teeth (except #19 of course) with my System B Heat Source (SybronEndo). SybronEndo sells a special heat-testing tip for Touch’n Heat and System B Heat Source that allows users to apply a sustainable heat stimulus to both quadrants of teeth in under a minute, with gutta-percha on the tip and the sources set to 200 degrees C.

In my experience, using sustainable sources of thermal stimuli to test pulp is the sine qua non of endodontic diagnosis. With transient sources of thermal stimuli — spray refrigerants and flame-heated gutta-percha — the temperature is never the same, which adds another variable to an already subjective data point. Additionally, it sometimes takes a bit of time to elicit a response when insulating acrylic, porcelain or calcification of the pulp chamber delays the response of a tooth with a relatively healthy pulp.

I tested teeth #18, 20, 21, 12 and 13 and achieved WNL responses (little or no response to heat is normal). However, when I heated #14, I reproduced the patient’s chief complaint exactly and it had a prolonged effect. This was a huge relief and far better than having to say “I just don’t know what is making your sister-in-law miserable.” We scheduled the patient for an emergency appointment the next day, as her pain was at a manageable level when she had taken an adequate dose of ibuprofen and as my schedule was already full, with three other emergency appointments.

My OS buddy called me the next morning to inform me that his sister-in-law was nervous about another possible misdiagnosis and erroneous treatment plan. In my mind, this concern qualified her as passing the IQ test. I repeated the thermal testing just to be certain that I was not going to be the second endodontist that would perform a needless root-canal treatment on a dentist’s relative, while failing to resolve her chief complaint. Cold testing gave the same vanilla responses, but heat testing on the mesiobuccal (MB) line angle of #14 reproduced her pain, and it was also a bit more sensitive to percussion and bite.

I felt even more confident in my diagnosis when the patient’s pain was totally alleviated by infiltration with 1.5 carpules of 2 percent lidocaine 1/100k epinephrine on the buccal side of tooth #14 and 0.5 carpule on the palatal side — given comfortably with extremely slow administration of the anaesthetic using the STA Anesthesia Delivery System (Milestone Scientific) — in this very tight tissue.

As an aside: I really do not trust local anesthesia as a diagnostic procedure. It is not specific enough...
to rule out a single tooth, it may mask adjacent myofascial aetiology and, after giving any local anaesthesia, further diagnostic work is not possible. As a confirmation of our definitive pulp testing results, however, the elimination of her symptoms after anaesthesia was good to see.

After anaesthesia had been confirmed by heat testing and percussion, tooth #14 was isolated with a rubber dam and an access cavity into the pulp chamber was cut. As was expected from the tooth’s sensitivity to heat stimulus, the pulp was partially necrotic – the MB and distobuccal (DB) canals having fully degenerated tissue and the palatal canal pulp virtually intact (Fig. 7).

The volumetric images gathered with my Accuitomo (J. Morita) revealed that the MB root held two canals that diverged from a single orifice and then joined again in the apical third, where it appeared to have a severe palatal curve (Figs. 3–6). As I had learned from my friend and colleague Dr. John Khademi, I cut a shallow MB2 groove in the mesial access wall to facilitate treatment of the only canal in the upper molars that does not have an access line angle dropping into it (Fig. 8).

All canals were negotiated with rotary NiTi instruments – first with a Vortex (DENTSPLY Tulsa) 15/.06 file to mid-root, followed by a Vortex 15/.04 to length in each canal except the MB1 and MB2, which required the more flexible PathFiles (DENTSPLY Tulsa) to reach the terminus owing to their abrupt apical curves. Rotary negotiation (in most cases without using hand files beforehand) has been a gratifying procedural upgrade in my practice. While I have not found the PathFiles to be dependable as first instruments in tight canals, Vortex files accomplish this in a way that is counter-intuitive to my previous paradigm (using #8, 10 and then 15 K-files to length in the presence of a lubricant). By a fluke I found that in all but the most severely curved canals (of course those with impediments as well) these small Vortex instruments usually cut to length in less than a half-minute.

I am not exactly certain why Vortex files work so well for handpiece-driven negotiation, but my best guess is that their triangular cross-sectional geometry has enough space between the three cutting flutes to auger, rather than compact, vital pulp tissue from the apical thirds of small canals. I have yet to block a canal with these instruments, although I am very careful to stop using them at the slightest hint of apical resistance. If the 15/.06 meets resistance, I use the 15/.04. If the 15/.04 becomes stuck, I bring in hand files in sizes 08 and 10 C-files to length, and then I use the #1, 2 and 3 rotary PathFiles to length (all 0.02 tapered with tip diameters of 0.13, 0.16 and 0.19 mm).

I used the Root ZX II (J. Morita) with all initial files taken to length, thereby knowing at all times when I had reached the termini, and obviating the need for a length determination X-ray. As usual, I used the straight apex locator probe instead of the test clip version. Even with hand files, I dislike the spring clip file probe, as it interferes with my tactile sense and it gets in the way of the rubber dam field. With rotary negotiation, the straight probe with its v-cut tip makes it very easy to pick up as estimated length is approached with the rotary negotiating file, and its tip notch rides smoothly on the rotating file. The final reason I prefer this probe set is because it is thinner and fits more easily between the stop and handle and it is very effective at positioning the stop exactly at the reference point once length has been indicated. An additional advantage of doing the initial negotiation procedure with Vortex 15/.06 and 15/.04 files is that with these tapers being greater than the typical 0.02 tapered hand files, there is less change in curved canal lengths during the shaping procedures to follow.

I never do initial negotiation procedures with NaOCl irrigant in the access cavity. While all the cur-
rent apex locators work in the presence of conductive fluids, none of them work as well as when relatively non-conductive lubricants are used instead. NaOCl short-circuits the apex locator to metallic restorations and even without metal nearby, the readings in the presence of this irrigant are much less stable.

A note of caution: while non-landed shaping instruments are safe in the smallest sizes, I would not recommend using them for shaping canals. To prevent apical damage, I use only radial-landed rotary files (Fig. 9) to cut final shapes after initial negotiation. Final shapes were cut in the palatal canal with a single 30/.08 GTX File, with a 20/.06 and a 30/.06 GTX File in the DB canal, and three instruments in the apically curved MB canals. I cut a crown-down shape in these canals with first a 20/.06 and then a 20/.04 GTX File.

After confirming that there was apical continuity of taper in each canal, by using NiTi K-files as radial feeler gauges — this is done in the presence of 17 percent EDTA (to remove the smear layer) — my efforts turned to cleaning the root-canal system with pre-heated 6 percent NaOCl. I began by ultrasonically vibrating the irrigant with a #10 K-file taken 1 mm beyond the terminus — this prevents the microradiography that occurs when the vibrated file tip is held inside the apical third — for a couple of minutes in each canal, and then switched to active irrigation with the negative pressure EndoVac System (Discus Dental).

Despite heating the solution, using ultrasonication and a state-of-the-art delivery method, in an inflamed vital case like this I still feel that the NaOCl needs additional time to digest any tissue that may remain in lateral and accessory canals. Failure to clean the lateral aspects of root-canal systems containing severely inflamed pulp remnants adequately is what causes some of these patients to complain of persistent pain to biting and percussion despite apparently ideal root-canal treatment results evidencing no peri-radicular pathosis.

Obturation was accomplished after cleaning with the System B/Elements Obturation Unit (SybronEndo) using the Continuous Wave of Obturation Technique. Interestingly, when I was drying the palatal canal in preparation for cementing the pre-fit master cone of gutta-percha, the paper points were coming out soaked in blood. While this may be disconcerting to clinicians, it does not mean anything has necessarily gone awry, it just means that the bleeding must be stopped.

I soaked a paper point in 30 percent ferric sulphate (known by the brand name Cutox of the pharmaceutical name Monsel’s Solution), placed it to the end of the canal and a bit beyond, and after 10 or 15 seconds removed it, irrigated with NaOCl, gained patency with a K-file that could be passively placed beyond the terminus, and resumed drying the canal. Sometimes this must be done two or three times to staunch bleeding, but I have never seen it fail. In this case, while the paper point stopped absorbing blood at its tip, it continued to show a spot of blood in the middle of the cone (Fig. 10). The post-operative X-ray images revealed a lateral canal filled in the middle of the palatal canal (Figs. 11, 12).

A piece of sponge and Cavit (3M ESPE) were placed in the access cavity and the patient was dismissed after post-operative images had been taken and instructions given. As usual, the patient also received enough Aleve to last four days at two tablets BID and instructions about managing her pain of myofascial origin (finally located as emanating from her left sternocleidomastoid muscle).

A phone call four days later confirmed that she had no spontaneous pain referral, just the expected soreness to biting pressure.

So, looking back at this case, why the misdirection and wrong turns?

Firstly, my initial hypothesis about the etiology of her chief complaint was misdirected by the lack of
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 thermal sensitivity and by the pain she described in her neck region. Ironically, the patient did not relate thermal sensitivity because she does not care for really hot or cold foods or beverages and therefore had not thermally challenged tooth #14. As to the muscle tenderness outside the EZ, when I heard her describe this referral of pain below her mandible, I assumed she also had trigger-point myopathy in her masseter and temporalis muscles, the muscles that commonly refer pain into the EZ.

Regarding the first endodontist needlessly treating tooth #19 and failing to resolve the original etiology of the patient's pain syndrome, it is a profound truth that endodontic disease becomes less obscure and easier to diagnose with time. Therefore, being the second one in on the case undoubtedly was an advantage at some level. With that said, a pulpal status like this one (partial necrosis) will return a WNL cold test response, albeit a delayed and vague one, virtually every time.

Interpreting sharp but transient responses to cold testing as indicative of irreversible pulpitis is a very common mistake. Until sharp, prolonged responses are seen — ideally with identical reproduction of the patient's pain — clinicians must obtain further pulp testing results outside of normal limits before they start diving into pulp chambers. In this case, every tooth — except #19 (no response) and 14 (delayed, vague) — responded in a very sharp but transient manner. I had no doubt that #19 responded the same way before it was treated, as evidenced by the endodontist's secondary treatment plan of accessing #20, a perfectly healthy tooth.

Fig. 11. Post-op radiograph, revealing — to a limited degree — the multiplanar curvature of the DB canal and the apparently straight MB canal form. Note the conservative, mesially angulated access cavity preparation and the filling material in the distal pulp horn, which was intentionally left unroofed to preserve coronal tooth structure.

Fig. 12. Shallow, distally angulated post-op radiograph, revealing the severe apical curvature of the MB canal system and the mid-root lateral canal in the palatal canal that spotted the middle of the paper point in Figure 10 with blood.

Fig. 11 Fig. 12

is applied, thereby increasing the pressure inside the dead space, patients will be left in pain until the remaining pulp dies and clinicians will feel inclined to cut access cavities until the patient's pain is relieved.

We can and must do better than diagnosis by access._

Please visit www.endobuchanan.com for video clips of this case.

Note: An earlier version of this article appeared in roots, the international magazine of endodontics, Vol. 7, No. 2, 2011.

L. Stephen Buchanan, DDS, FICO, FACD, was valedictorian of his class at the University of the Pacific School of Dentistry, and he completed the endodontic graduate program at Temple University in Philadelphia in 1980. He began pursuing 3-D anatomy research early in his career, and in 1986 he became the first person in dentistry to use micro CT technology to show the intricacies of root structure. In 1989 he established Dental Education Laboratories, through which he has lectured and conducted participation courses around the world. Buchanan holds a number of patents for dental instruments and techniques, including variably tapered shaping instruments for use in endodontics. He pioneered a system-based approach to treating root canals. He is a diplomate of the American Board of Endodontics. He maintains a private practice limited to endodontics and implant surgery in Santa Barbara, Calif. Contact him at 1515 State St., Suite 16, Santa Barbara, Calif. 93101, (800) 528-1590 or (805) 899-4529, info@endobuchanan.com, www.endobuchanan.com.

about the author

roots

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Fig. 12 Shallow, distally angulated post-op radiograph, revealing the severe apical curvature of the MB canal system and the mid-root lateral canal in the palatal canal that spotted the middle of the paper point in Figure 10 with blood.
The American Association of Endodontists held its 2012 Annual Session April 18–21 at the Hynes Convention Center in Boston. The meeting offered endodontists, general dentists and other specialists the opportunity to participate in a large selection of endodontic courses as well as learn about the rich history of the specialty in the United States.

During the four-day event, meeting attendees could receive continuing education credit from eight different educational tracks, three of which were new this year: Exploring the Future, Evidence Based-Endodontics and Orofacial Pain, Oral Pathology and Trauma. The sessions were offered in a variety of learning formats.

The popular Master Clinician Series showcased live, state-of-the-art surgeries, including implant placement, regenerative endodontic therapy, molar endodontic microsurgery, the use of cone beam computed tomography and more.

This year’s master clinicians included Dr. Paul D. Eleazer, Dr. Shepard S. Goldstein, Dr. Mani Moulazadeh, Dr. Richard A. Rubinstein, Dr. Wyatt D. Simons and Dr. John D. West.

On the exhibit hall floor, companies showcased their products and services. Roydent Dental Products offered its popular C-Files in new sizes — 12.5, 15 and assorted packs 06-10, all in 21 mm and 25 mm lengths. The new 12.5 is an exclusive size to Roydent and allows doctors to make a half step when instrumentating between sizes 10 and 15.

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Nancy Connor, Roydent’s sales and marketing manager, said the C-Files provide an ideal and extremely effective way to instrument calcified canals. They are also ideal for locating canals and instrumenting narrow canals. Their non-cutting tip allows doctors to break through calcification safely and efficiently.

SS White, which had an expanded booth presence this year, introduced a full line of endodontic products driven around the company’s passion for conservation and efficiency. The offerings included the redevelopment of the V-Taper file and many other instruments.
“The V Taper really is unique because it has a patented variable taper that at the top of the file is much more conservative and allows for the preservation of cervical dentin to a higher degree than any other file system on the market,” said Tom Gallop, CEO of SS White. “As we are starting to learn, and as the endodontic and restorative community is starting to see, the value of that cervical dentin in terms of the long life creation of successful restorations is a vital element, so we feel that with that patented feature in V Taper files and a lot of the research pointing to the need to preserve that cervical dentin as much as possible that we are on the path to creating longer lasting endodontic procedures and restorative procedures.”

Other product highlights included the introduction of SafeSiders instruments from EDS in a new 31 mm size; a new, high-density foam for cleaning instruments, available from Jordco; new X-treme...
endodontic instruments from JS Dental Mfg.; a new Marwan Abou-Rass (MAR) microsurgical endodontic instrument line from Hu-Friedy; the Impact Air 45 high-speed, air-powered handpiece from Palisades Dental; and the introduction of a new Plasma light source for Seiler microscopes.

The AAE recognized six individuals with the organization’s highest honors and awards.

Dr. Jerome V. Pisano received the AAE’s highest honor, the Edgar D. Coolidge Award, given for leadership and exemplary dedication to dentistry and endodontics. Dr. Ronald I. Deblinger received the President’s Award, which has been bestowed only eight times in the award’s history. Dr. Ove A. Peters received the Louis I. Grossman Award. Dr. Richard E. Walton received the I. B. Bender Lifetime Educator Award. Dr. George A. Bruder III was honored with the Edward M. Osetek Educator Award. Dr. John W. Gillan received the Spirit of Service Lifetime Award for his impact on dental communities in Third World countries.

The theme of the 2012 meeting was “History & Heritage — Forging the Future.” Next year’s AAE Annual Session is scheduled for April 17–20 in Honolulu.

Fig. 4. Brant Miles of SS White
Fig. 5. James Johnsen of Jordco
Fig. 6. Meeting attendees take part in a lecture.
The collaboration between endodontists and restorative doctors to preserve dentin . . .

What’s next?

Author_Fred Michmershuizen, Managing Editor

In an interview conducted at the recent American Association of Endodontists Annual Session in Boston, Tom Gallop, CEO of SS White, discussed the collaboration between endodontists and restorative dentists to preserve dentin and therefore improve outcomes for patients.

Your company is making a big splash here at AAE with a new, expanded booth and presence. What are you trying to accomplish?

To me, with a “me-too” idea, you need to play it low-key to be authentic, but with an ability to execute on a big idea, having a major presence is more appropriate.
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So, what’s the big idea?

Doctors tell us that what we do is help them to preserve the maximum amount of healthy tissue, in a very efficient manner that increases the life of the restoration and allows for more endodontic treatments. Increasing the collaborative effort between the restorative dentist and the endodontist is one key byproduct we have seen as a result.

In some ways we have had the endodontist looking at the lower apical third and the keys to achieving great clinical outcomes there, and the restorative dentist has been looking at the pericervical dentin and how can they create a long-life crown. We worked with each group to look at both facets. That is the big idea.

What’s new and exciting for endodontists?

SS White has always been known within the endodontic community for very specific products, like Great White Burs for faster endodontic access through metal, Great White Z Diamonds for access through zirconia and recently EndoGuide Burs for more precise endodontic access.

This year we are introducing a full line of endodontic products driven around our passion toward conservation and efficiency. Those products include the redevelopment of the very popular V-Taper File System, V-Glide Path File, V-Fill Obturation system and other unique endodontic instruments that are all designed to create more conservative and more efficient endodontic procedures.

What sets the V-Taper file apart from other, similar files?

V-Taper is unique because of the variable taper design, which allows for the preservation of cervical dentin to a higher degree than any other file system on the market. It also allows less instrumentation than most systems and more efficiency.

Most endodontists want an 06 taper down at the apex to allow them to get better irrigation, better obturation, better three-dimensional fill. But when they have to negotiate around tight curves, often times they have to compromise and use an 04 tapered file. So they are either compromising by not getting the shape they want at the apex, or they are compromising by having to remove too much structure to get the 06 taper down to the apex. With the unique design of the V-Taper system, it allows for the endodontist to have the best of both worlds: get that 06 taper but with much more ease in negotiating those tight curved canals, so they can get the best results.

SS White is in a unique position in that we are looking at the tooth as a whole. I think that perspective is different from most other endodontic companies, who mainly focus on the endodontic side of the procedure and do not take into account the needs of the restorative dentist.

What about access techniques to preserve more of the dentin?

SS White originally developed the standard round carbide bur, which unfortunately has not been the ideal instrument for use during endodontic access procedures. When we developed the round bur, it was intended for use in cutting cavity preparations. To effectively cut a cavity preparation, you need a bur that cuts both laterally and vertically. Up until the launch of the EndoGuide Burs, no other manufacturer listened to the endodontist and general dentist on their need to design an access-specific bur that would allow for greater precision in gaining access to the root canal. Rather, the manufacturer said this is what we have on the shelf already available for you to use for your access preparations.

At SS White, we asked clinicians: How can we design a product specific to procedure challenges and anatomy? We focused on the conical shape and small tip diameter as two of the defining features that create more precise access and control. Doctors tell us EndoGuide Burs are better than existing products when they are contending with calcified canals or trowing. They also indicate that the product helps them reduce perforations and conserve vital pericervical dentin. EndoGuide Burs were developed with our team of endodontic and restorative specialists, which include Dr. David Clark, Dr. John Khademi and Dr. Eric Herbranson.

EndoGuide is the first truly endodontic-access-specific-designed product that has been developed with collaboration and input from the manufacturer, endodontist and restorative dentist, allowing for a more precise, efficient and conservative pathway for gaining proper endodontic access.

The dental market worldwide has given EndoGuide Burs a very warm welcome. Key opinion leaders and leading universities in such diverse markets as Mexico, the Netherlands, Italy, Germany, Russia and India, to name a few, have implemented the use of EndoGuide in their teaching, training and other forms of education. The drive and passion that has been put forth worldwide in creating more conservative endodontic access has truly been astonishing.

What came next?

The next challenge SS White undertook after the launch of EndoGuide Burs was that of creating more refined and conservative root canal shaping procedures. The shaping of the root canal procedure has
significant value to the quality of the final restoration. Research has shown that preserving dentin has a direct correlation to creating longer lasting restorations. Our challenge was to develop a system that will shape the root canal without eliminating key segments of dentin at the same time, such as the dentin triangle, which is vital to the strength of the tooth. One school of thought is that the dentin triangle should be removed to create proper visibility and to effectively irrigate and obturate the canal. Following this philosophy causes the removal of dentin that could strengthen the tooth if left intact. The system that had the most appeal to us to accomplish our goal of effective shaping, while preserving dentin when possible, was the V-Taper 2 NiTi File System, which has been redeveloped and relaunched here at the AAE meeting in Boston.

Can you talk more about how endodontists and GPs can collaborate to preserve tissue?

The industry has done a remarkable job in the development of more efficient file systems that allow for greater numbers of patients to gain treatment. This has been a step in the right direction. Advances in diagnostics have also taken a major step forward over the past 10 years as well. We have seen a rapid adoption of microscopes, cone-beam and digital X-ray. The combination of increased visibility, better diagnostics and the preservation of dentin is now in place, with the goal of creating better patient outcomes. As a result, the patient benefits from the developmental and collaborative effort with longer life and stronger teeth.

In closing, what would you like to say to both endodontists and restorative dentists?

Thank you for bringing your thoughts and ideas to us. We will continue to listen and develop more effective instrumentation. With what we have done already, we are confident that both the restorative doctor and the endodontist can achieve faster, stronger and longer-life restorations. When this happens, we have seen the relationship and collaborative effort between GPs and endodontists continue to grow...
COLTENE ENDO launches CanalPro Irrigation System

COLTENE®ENDO, the recently formed endodontic business unit of Coltene/Whaledent, is pleased to announce the launch of its CanalPro™ Endodontic Irrigation Line. The convenient, color-coded system offers highly efficacious solutions and innovative delivery instruments for root-canal therapy. COLTENE®ENDO solutions are engineered to optimize the time spent on irrigation, giving the clinician the best approach to cleansing canals and the best outcomes. CanalPro™ EXTRA, used for irrigation and debridement of root canals, is two times wetter than standard sodium hypochlorite, enabling it to penetrate into lateral canals and isthmuses and reach more hard-to-reach surfaces within the canal. CanalPro NaOCl EXTRA is two times more digestive than standard sodium hypochlorite, resulting in faster tissue dissolution.

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Fig. 1. Seiler has a new Plasma light source. (Photos/Provided by Seiler)

Fig. 2. A close-up view.
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