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With your practice, you manage an enterprise on a daily basis. You are responsible for its financial outcome like every other businessperson. According to the latest financial forecasts, the global economy is declining, forcing many governments to revise their budgets and spending drastically.

You may wonder how we as dental specialists might be affected. Unlike many other business enterprises, our small- to medium-sized firms do not depend principally on the general economic situation. However, because of the sheer scale of the global financial and economic crisis, it will affect us too. Despite the crisis, we as employers are responsible for the cost-effectiveness and profitability of our practices. Our staff and suppliers expect to receive their salaries and payments every month. When the patients—our customers—stay away, we certainly have to react.

Every crisis presents a challenge. In tough economic times, we need a long-term vision, in order to brace ourselves for negative surprises. We have to develop our own strategies, just like politicians, managers or anyone bearing responsibility or aiming to achieve financial stability and success.

Your optimism and a high degree of flexibility are absolutely essential. A positive perspective and good prospects through innovations or new treatment concepts will ensure continued or even further growth of your practice. Give your practice a chance through fresh impetus! With your team, look for new strategies and develop an optimistic view on the future.

However, figures from the IDS 2009 in Cologne make me wonder whether the crisis has not yet affected the dental industry or rather whether dentists have already been acting as responsible businesspeople. In an area of 138,000 m², 1,820 exhibitors from all over the world presented over 1,100 product innovations. More than 100,000 visitors came to Cologne and placed a volume of orders that exceeded everyone’s expectations.

I invite you to inform us how your practice is being affected by the current crisis and, more importantly, how you are managing the crisis with regard to your practice.

Good luck to you!

Sincerely yours,

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Thinking ahead. Focused on life.
Preparing larger apical diameters: Clinical rationale and methods

Authors_ Dr Richard E. Mounce, USA & Dr Gary D. Glassman, Canada

One of the most common endodontic questions we encounter when lecturing for general practitioners surrounds uncertainty about the ideal prepared master apical diameter (MAD). In essence, these clinicians want to know when they have finished shaping canals properly and when it is appropriate to obturate. In addition, there is uncertainty about how differing anatomy plays a role in choosing the MAD. In other words, would an upper first bicuspid buccal root be prepared to the same size as a lower molar distal root? This article has been written to answer these questions by providing a clinically feasible and literature-based method for preparing larger MADs.

The ideal MAD is a blend of three different considerations:

1. the recommendations of the endodontic literature;
2. the avoidance of iatrogenic events in the efficient creation of larger MADs; and
3. having the technical means to prepare larger MADs predictably and safely.

These considerations are addressed in sequential order.

The recommendations of the endodontic literature

A properly created and enhanced MAD implies that dentine is being removed circumferentially at the minor construction (MC) of the apical foramen. The creation of enhanced MADs relative to smaller ones is consistent with greater volumes of irrigation, better debris removal and better master cone fit. It is virtually unanimous in the endodontic literature that larger MADs create cleaner canals than their smaller counterparts. There is no literature that we are aware of that argues that smaller MADs provide cleaner canals.

Avoidance of iatrogenic events in the efficient creation of larger MADs

Before presenting specific methods of MAD preparation, several practical considerations, principles, and concepts are elaborated upon to give context to the efficient creation of larger MADs.

1. The final canal shape should resemble a tapered funnel. The MC should be kept at its original position and size, i.e. it should be unaltered. The MC acts as a natural barrier to the extrusion of bacteria, pulp tissue, irrigants, sealer, and obturation material. The canal should remain in its original position and only be enlarged as described here. The taper and MAD should be appropriate, in order to achieve optimal irrigation and obturation hydraulics. The above goals should be achieved with a view towards avoidance of iatrogenic events. It is important to mention that the mutual goals of enhancing the MAD and leaving the MC at its original position and size are both technically possible and highly desirable. Enhancing the MAD means enlarging the canal preparation apically up to the MC (leaving the MC at its original position and size), but this enlargement does not extend beyond the narrowest diameter of the canal as it exits the root.

2. Mechanical canal enlargement should be recognised as one means of cleansing. Bactericidal
irrigating solutions are required along with the mechanical means to provide the optimal antimicrobial control. The endodontic literature fully supports the concept that irrigation is required to reduce bacterial counts beyond that which is possible by instrumentation alone. Optimal irrigation methods include the use of a heated solution; removal of the smear layer; alternating liquid EDTA with the primary antibacterial solution; ultrasonic activation; and use of an adequate volume, concentration and frequency of refreshment of the solutions.

3. Access should be straight line and all files, rotary nickel titanium (RNT) and hand K files (HKF) should be able to enter the canal without deflecting off the access walls. Leaving access walls that restrict insertion of RNT files predisposes the enlargement to blockage and iatrogenic events of all types. The cervical dentinal triangle should always be removed prior to canal shaping below the orifice level.

4. Patency must be achieved and maintained throughout the entire process of canal preparation. Loss of patency is the harbinger of iatrogenic events and less than optimal cleaning and shaping. Patency can be assured through the copious use of small hand files that are utilised as productively and efficiently as possible. HKFs should be pre-curved and inserted into the canal in the same direction of the expected root curvature. HKF curvature is optimally performed with EndoBender pliers (SybronEndo).

HKFs can be trimmed to a length that is clinically relevant for the indicated purpose; for example, if the HKF is too long for the given indication, the file will buckle, kink, bend and need to be replaced. HKFs that are not appropriate for the given canal do not allow the correct amount of pressure needed to break through blockages and traverse ledges. Pre-curved and trimmed HKFs create efficiency in canal negotiation compared with their longer and un-curved counterparts and can be reciprocated as described below.

5. We use the M4 Safety Handpiece (SybronEndo) attachment once the HKF reaches the estimated or true working length (Fig. 4). Reciprocation with the M4 is safe, efficient, and saves both time and hand fatigue. It is difficult to break files using this method. If the tip of the HKF is never more than 1 to 2 mm beyond the MC and the HKF size is #10 or less, transportation is virtually unheard of. The M4 reciprocates the HKF 30 degrees clockwise and 30 degrees counter-clockwise. The M4 is not used to drive the HKF to length to negotiate the canal and it is not used to break through a calcification. The placement of the HKF to the MC is done by hand after the HKF is pre-curved and cut to the appropriate length.

Clinically, a small HKF is inserted to the estimated or true working length and the M4 placed upon it under the rubber dam. The tip of the HKF should be taken to or slightly beyond the MC. This patency file is the only instrument that is taken beyond the MC. Deciding which HKF to reciprocate with the M4 is based on the degree of resistance that the canal gives to the advancement of the HKF; for example, the #6 HKF will easily reach the true working length, while the #8 will reach this depth but only with resistance. The #8 is placed to the MC and left at this level. The M4 is then placed onto the #8. With a vertical amplitude of 1 to 3 mm, the M4 is used in the canal for 15 to 30 seconds. As the M4 reciprocates the #8 (30 degrees clockwise and 30 degrees counter-clockwise), the canal will become minimally enlarged from the action of the file. The file will have progressively less resistance to vertical movement and reciprocate freely.

The M4 requires lubrication at all times, ideally a liquid solution of 2% chlorhexidine or 5.25% sodium hypochlorite. The use of a viscous EDTA gel in reciprocation is neither required nor advisable as removal of all the gel (particularly in the apical third) may not be possible using even the most strident irrigation protocol.
The M4 fits onto any electric motor with an E-type attachment and is used at 900 RPM on the 18:1 setting. After the #8 in this example has been used, the canal will become the diameter of a #10 HKF, and after irrigation and recapitulation a #10 HKF is inserted into the canal and reciprocated. Recapitulation of the M4 in the manner described will prepare the canal to the diameter of a #15 HKF, after which the canal is ready for RNT enlargement.

If the HKF is a size #15 or larger and particularly if the file is reciprocated short of the MC, transportation of the canal is a risk. Copious irrigation and recapitulation after the use of the M4, as well as working at the MC (i.e. at the true working length), will go far towards avoiding iatrogenic events of all types. It is noteworthy that the recommended use of reciprocation in this article is for the early enlargement of canals to make the glide path and not for the final canal preparation. Final canal preparation is made with RNT files in the manner that is suggested below. The use of reciprocation for the final canal preparation above a size #30 is consistent with apical transportation.

The correct working taper must be prepared for the given root anatomy. Roots that are more complex should be prepared to less taper than their simpler counterparts. Specifically, highly curved, calcified, and atypical anatomies are generally prepared to less taper than a root that is straight and appears easily negotiable radiographically. While a comprehensive discussion of what taper could and should be prepared in any given root system will be addressed later in this article, at this stage it should be remembered that different RNT systems have varying abilities to prepare larger tapers throughout the canal. Files that are manufactured by grinding have less flexibility and fracture resistance than those that are manufactured by twisting, such as the Twisted File (TF, SybronEndo; Figs. 1–3). Knowledge of the relative degree of taper that can be prepared with a given system is a prerequisite for choosing the desired taper, RNT file sequence and determining whether orifice openers might be used or are necessary.

The preparation of larger tapers in a complex root requires that the clinician always be aware of perforation risk. Removal of more dentine than necessary will weaken the root and place the tooth at excessive risk of subsequent vertical root fracture, even if the root is not perforated in the initial treatment.

The rationale for the final termination point of root canal irrigation, instrumentation and obturation varies greatly amongst clinicians. I use the MC for the final termination point in both vital and necrotic cases, with patency through the MC a paramount goal. Determining the position of the MC occurs as a function of correlating all of the different sources of information as to its position. For example, the clinician can estimate the initial working length from the preoperative radiographs. This initial length can be correlated to the place within the canal where the clinician feels a tactile ‘pop’ with the HKF as it passes through the MC. This length should be very close if not identical to the electronic length determined by using an apex locator. In addition, once the canal is prepared, if patency has been achieved and maintained, a paper point should be able to mark the exact location of the MC with a reproducible and small spot of moisture or haemorrhage. Correlating all of this evidence and taking electronic lengths at various junctures in the enlargement process can confirm the exact position of the MC. When enlarging canals, the working length gets shorter depending on the length of the canal and degree of curvature. It is important to check the working length frequently to avoid over instrumentation apically from this shortening.

8. Instrumentation sequences vary greatly depending on the clinician, the anatomy and the system being used. With RNT files, there are two primary canal preparation objectives, the ‘basic preparation’ (getting a .06 or .08 tapered #25 RNT to length) and then the ‘enhanced preparation’ (preparing a MAD larger than a size #25 in this example) that ideally should follow. It is noteworthy that the initial diameter of the MC as reported in the literature is approximately .28 mm on average across all root anatomy. Any MAD below this size is likely to leave portions of the apical canal untouched, resulting in a compromise in the ultimate canal cleanliness. Said differently, if the clinician stops apical preparation at the MC following achievement of the basic preparation and fills at this MAD, they are arbitrarily imposing onto the root a diameter that may be clinically irrelevant.

Crown-down instrumentation implies that the canal is prepared with larger tapers and tip sizes and decreasing progressively to smaller tapers and tip sizes. With the sequence, each successive file is inserted further apically than its predecessor. For example, after shaping the orifice, crown-down instrumentation is demonstrated by a sequence of .06 files that are used from #40 to 35 to 30 to 25 to 20 and finally #15 tip sizes. This sequence can be repeated until the desired taper and tip size is taken to the MC, be that a size #20 or 25.

Alternatively, the clinician could use a variably tapered sequence of files—using a pack of K3 VTVT (SybronEndo) RNT instruments, for example—moving apically. Such a sequence might be .10/25,
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Fig. 5. RealSeal bonded obturation material (SybronEndo).

0.08/25, 0.06/35, 0.04/30, 0.06/25 and 0.04/20. Using this technique, the taper and the tip size diminish sequentially.

After this initial basic preparation, the clinician can subsequently prepare an enhanced MAD. The preparation of enhanced MADs is generally done with a step-back sequence. Step-back instrumentation requires that the clinician use the files from smaller to larger tip sizes; for example, if the basic preparation took the canal to a 0.06/25, then the #30, 35 and 40 tip sizes would be used. Instruments of a smaller taper can be used to prepare the enhanced MAD. Smaller tapers are required because much like a small cup fits into a large cup, smaller tapered RNT files fit into larger tapered preparations. Clinically, if the basic preparation was made with 0.06 instruments, 0.04 RNT instruments will fit inside the 0.06 preparations. As a result, the 0.04 instruments only cut on their tips in the creation of larger apical diameters. If the clinician is using TF and the final taper is a 0.08, the 0.06 and 0.04 TF tapers (which can prepare enhanced apical diameters) can fit inside the 0.08 taper easily.

The creation of larger MADs through enhanced apical shaping is rapid and efficient. This added step, of obvious benefit as described in the endodontic literature, requires only that the clinician insert the increasing tip sizes to length, which is followed by irrigation and recapitulation. Then the next larger tip size can be entered until the clinician has prepared the desired MAD. The sequence for this enhanced shaping is detailed below.

9. Various RNT systems have inherent limitations and advantages relative to other systems in preparing enhanced MADs and larger tapers. Some RNT files cut more efficiently, some are more flexible and some allow the preparation of larger MADs, some do not. Some systems may not have tip sizes that allow enhanced MAD preparation; for example, some systems do not have tip sizes greater than a size #40, or if they do, the files are so stiff that preparing larger diameters is only possible in a relatively straight canal. In order to appreciate fully the ability of some RNT systems to shape canals to larger MADs, the clinician will optimally practise in extracted teeth. Such practice allows the clinician to determine the true functionality of various RNT systems with regard to the creation of enhanced MADs.

There are several viable clinical methods for creating larger MADs. TF is a viable and advisable choice for both the basic preparation and creating enhanced apical diameters. TF is available in .12/25, .10/25, .08/25, .06/25/30/35, and .04/25/40/50 tapers and tip sizes. With this variety of file sizes and tapers, virtually any tooth can be prepared irrespective of the degree of difficulty.

TF is fundamentally different from other RNT instruments manufactured by grinding. TF is never ground against the grain structure of the metal. Twisting nickel titanium creates cutting flutes. In order to twist nickel titanium, it must be converted from the austenite crystalline phase configuration (CPC) to the rhombohedral (R) crystalline phase configuration. R phase is an intermediate CPC between austenite and martensite. Austenite is the CPC of NT at rest; martensite is the CPC of NT when a stress has been placed upon it. The ability of NT to flex when a stress is placed upon it is a result of the martensitic transformation, a transformation that realigns the atoms of the CPC to allow the metal to exhibit super-elasticity. Up to the point that the NT has reached its elastic limit, the metal will return to its original shape.

After reaching the elastic limit, if the metal is stressed further, it deforms and is in the plastic range of function. It will not return to its original shape. For RNT files that have been manufactured by grinding, deformation is a clear indication for disposal. TF has a much wider plastic range of function than ground NT files. As a result, if there is some deformation (unwinding) of the file flutes, TF can still be utilised. Unwinding of TF is not an immediate indication for disposal as it would be with RNT instruments manufactured by grinding.

TF is never ground against the grain structure of the metal in its manufacture, there are no surface imperfections of metal roll over on its surface or at its cutting edges. These surface imperfections and defects are the preferred site of instrument fracture due to cyclic fatigue and torsional stress. The lack of these defects in part explains the clinical capabilities of the TF.

_The Twisted File_

TF has several advantages over traditional RNT instruments because it is not constrained by the limitations of ground files. Its attributes are the following:
1. TF can achieve the basic preparation in one or no more than two files in 90 per cent of the clinical cases encountered. The most common single-file basic preparation is taken to the .08/25 and when two files are used in tandem, the .06 and .08 are most commonly used.

2. TF can prepare larger tapers than those possible with ground RNT files; for example, with ground RNT files, .06 is the most common taper prepared. When using TF, the canals can be easily and safely prepared to .08 and .10 taper, assuming that the given root is not at undue risk for perforation or that these tapers risk excessive dentine removal that predisposes subsequent root fracture. For larger canals, such as the palatal canal of an upper molar, .10 taper can often be taken to the apex. For more intermediate canals, .08 taper can usually be taken to the apex (for example, in the mesial root of a lower molar). For narrow, curved and highly calcified complex canals, the .06 taper can usually be taken to the apex.

The .12-tapered TF is generally used as an orifice opener and not to the apex. The .04 TF is used to take a small canal (that has a glide path present) and makes a minimal canal enlargement to facilitate the bulk shaping that will follow. For example, if the glide path is created and the root is particularly complex, the .04 TF can make the canal slightly larger and make the subsequent bulk shaping more efficient and reduce the risk of file separation.

3. TF requires fewer insertions to prepare the canal relative to ground nickel titanium files. Generally, only three to four insertions of the TF are needed to reach the apex and perform the basic preparation of the canal prior to the enhanced preparations.

4. With practice in extracted teeth, the number of TF instruments used and the number of insertions needed by the clinician to achieve the same task will diminish. In essence, cases that once required two TF for the basic preparation may now require one, and what may have taken four to five TF insertions will require three to four.

**Canal preparation with the Twisted File and the creation of enhanced master apical diameters**

For the basic preparation phase of treatment, TF crowns down (as described above) from larger to smaller tapers. For the preparation of enhanced MADs, they are used step back, from smaller to larger tip sizes. The detailed steps of this process are described here.

1. After straight-line access and removal of the cervical dentinal triangle, the orifice is shaped. Orifice shaping is performed bearing in mind that whatever the initial size of the orifice preparation, the taper of the final shaped root canal must be continuous along the length of the root. As a result, in large and simpler roots (such as the palatal canal of an upper molar), the first file into the coronal third is usually the .10 TF. In roots of more intermediate complexity (such as the mesial root of a lower molar), the .08 TF is the first file into the canal. For highly complex canals, such as the lower anterior teeth, and canals of significant curvature and calcification the .06 TF should be the first file used.

If the clinician desires to create more taper later using TF, the given initial file can be used with a brushstroke up and away from the furcation, in other words towards the root with the greatest bulk of dentine. It is also noteworthy that it is possible to create greater tapers after first creating a smaller one. However, once the root is shaped, the taper cannot be made smaller. As a result, it is always safer to be more conservative when preparing the initial taper of canals. Dentine can always be removed; it can never be put back.

2. The canal is negotiated with HKFs to the estimated working length and a glide path created, optimally using the M4 as described above.

3. When the first HKF reaches the estimated working length, the electronic apex locator is used to obtain the true working length.

4. TF is used crown down from larger to smaller tapers until the basic preparation is created. Depending on the type of root being prepared, the first TF in the canal can, in many instances, be the final file in the sequence to create the basic preparation before enhancing the MAD. For example, in many canals, the .08 TF can be used crown down in repetitive insertions (irrigating and recapitulating between each insertion) to reach the apex as a single-file technique. If the single TF will not move apically without undue pressure with each succes-
sive insertion, the next smaller taper can be used in a two-file tandem to create the basic preparation. For example, the .10 and .08 can be used in a two-file technique in larger canals or .08 and .06 can be similarly used in canals that are more complex. It is noteworthy that when the .06 TF reaches the apex first, if indicated, it can generally be followed with the .08 TF in order to prepare a larger taper.

TF is used in our hands at 900 rpm with the torque control off. Insertion is passive and withdrawn after one continuous and controlled motion. Once resistance is met, the file is withdrawn and the canal irrigated and recapitulated after the TF reinserted. TF can be used in approximately two to three teeth if used with the gentle and passive insertion recommended here. It is not advised to pump TF up and down in the canal or use it with a pecking motion. The file should be turning on entry into the canal.

5. When the .08/25 or .06/25 TF reaches the true working length, the clinician can gauge the apex. Gauging is a simple means of determining an approximation of the initial diameter of the foramen to guide the final MAD to be prepared. For example, if a #25 HKF will not penetrate or move beyond the true working length when gentle pressure is applied, this is considered the initial diameter of the canal at the MC and gauges the apex. In this clinical example, if the #25 HKF binds at the apex, the canal can be prepared three to four sizes larger than the initial file to bind at the true working length. In this example, if the #25 HKF binds at the true working length, the .06/30 would be followed by the .06/30 and .04/40.

As described by the mechanism before, the smaller tapers of the .06 and .04 tapers fit inside the .08 taper and will cut only on their tips. If the clinician were to use a different instrumentation system to achieve larger MADs (K3, SybronEndo; LSX instruments, Lightspeed, Discus Dental), the principle employed would be the same with the smaller tapers fitting into the larger one.

6. After TF preparation, a cone can be fitted for obturation. While there are many ways of selecting master cones to fit a preparation, a general concept favoured by specialists is to pick a universal master cone that is then custom fitted for the particular canal. Such a universal cone is the .06/20, which is trimmed to fit the apical size. For example, the .06/20 is a size 50, 5 mm back from its tip. When a #50 MAD is prepared, the .06/20 cone is trimmed 5 mm from its tip and cone fit is attempted. The mathematics that underline this are simple: 1 mm back from the tip of a .06/20 master cone, the cone is .26 mm in diameter, 2 mm back it is a .32 mm, 3 mm back it is .38 mm, 4 mm back it is .44 mm and 5 mm back it is the aforementioned .50 mm. Other common universal master cones that can be trimmed in the same manner are the FM and M sizes.

We use RealSeal (SybronEndo) for obturation (Figs. 5 & 6). RealSeal is a synthetic polymer of polyester that binds to the sealer and canal wall to provide a statistically significant resistant reduction in leakage across the totality of the canal space when measured in vivo and in vitro. Alternatively, if the use of master cones is not preferred, RealSeal can be used in an obturator-based form (Figs. 7a & b).

In this article, a clinically relevant discussion of the rationale and preparation of enhanced MADs has been presented. Emphasis has been placed on patency, selecting the correct taper for the root anatomy and the clinical value of preparing larger MADs and doing so without undue iatrogenic risk in the process.

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Apical microsurgery—

Part I: Patient preparation

Author Dr John J. Stropko, USA

Surgery can never replace solid endodontic principles and should always be a last resort. Apical microsurgery consists of nine basic steps that must be completely performed in their proper order, so the desired result can be achieved:

1. Instruments, supplies and equipment (including the operating microscope) ready;
2. Patient, doctor and assistants positioned ergonomically;
3. Anaesthetic and haemostasis staging completed;
4. Incision and atraumatic flap elevation;
5. Atraumatic tissue retraction;
6. Access, root-end bevel (RER and REB) and crypt management;
7. Root-end procedures: root-end preparation (REP);
8. Root-end fill (REF) techniques and materials; and
9. Sutures, healing and post-operative care.

Predictable microsurgery requires the use of an operating microscope (OM) and a team committed to operating at the highest level. The six-handed team approach optimises the instruments, equipment, techniques and materials that today’s level of technology presents for the benefit of all, especially the patient (Fig. 1).

Dr Berman, an old retired general surgeon, one of my senior-year dental school instructors, would begin each general surgery lecture by tapping the lectern with his pencil, and when he got our attention, he would say: “Treat the tissues with tender loving kindness and they will respond in a like manner.” I have heard those very words many times while performing apical microsurgery; it is truly a gentle technique when the steps are followed in the proper order.

A thorough past medical history and dental examination, using as many diagnostic aids as possible, is a requirement for a predictable microsurgical event. Thoroughness can help one avoid unfavourable experiences. For example, if the patient, or their physician, states they are sensitive or allergic to epinephrine to any degree apical
microsurgery should not be performed. One of my golden rules of thumb is: No Epi, No Surgery ... Period! Should the doctor choose to proceed with the microsurgical procedure, it will be exceptionally more difficult for both the doctor, and the patient.

Today's technology presents us with much more pre-surgical information than was available even a few years ago; thus, recent advances should be included in the diagnostic process whenever possible. A good example of current technology is cone-beam computed tomography (CBCT). The radiological images we used for many years were the best we had but were very limited. Now CBCT enables the microsurgeon a view of all angles of areas of concern in the maxillofacial region and supplies much of what was missing in the field of dentistry.¹

The preparation of the patient takes not only the patient into consideration, but also the entire surgical team. The microsurgical protocol we teach involves four people: the doctor (pilot), the ‘scope’ assistant with the co-observer oculars (co-pilot), the surgical assistant using the monitor as a visual reference (flight director) and the patient (first-class passenger; Fig. 2).

The medical history and all necessary pre-medications are reviewed with the patient to ensure they are taken at the appropriate times before the surgery appointment. The patient is also instructed to rinse with Peridex and take an anti-inflammatory (preferably 600 mg of Motrin if no allergies are present) the night before and on the morning of the surgery. At the time of the appointment and before the patient is seated, they are again asked to rinse with Peridex.

The dental chair should allow the patient to recline comfortably and even allow the patient to turn to one side or another. Small Tempur pillows placed beneath the patient’s neck, small of the back or knees make a big difference when used (Fig. 3). After the patient is completely comfortable in the chair, they are coached on making slow and small movements of their head, if necessary during surgery. The patient is appropriately draped for the surgery. It is especially important to wrap a sterile surgical towel around the head and over the patient’s eyes for protection from the bright light of the microscope and any debris from the surgical procedure (Fig. 4).

An important psychological point is not to tell the patient that they may not move. To an already tense patient, telling them they may not move would probably cause unnecessary apprehension, stress or panic. In over 500 surgeries, I’ve only had one patient who didn’t hold still during the procedure once they were relaxed and had profound anaesthesia.

The surgical team must now become comfortable with the position of the patient, the microscope, endoscope and associated equipment. The modern OM has many features to enhance comfort and proficiency during its use. Accessories like beam splitters, inclinable optics, extenders, power focus and zoom, variable lighting and focal length all contribute to ease of use, ergonomics and proficiency for the entire surgical team. The mutual comfort of the patient, the surgical assistants and the doctor is of the utmost importance. The microsurgical procedure may take an hour or more, so unnecessary movements or adjustments for comfort’s sake during the operation may cause considerable inconvenience.

The doctor’s surgical stool must have adjustable arms to allow the elbows to support the back and serve as a reference point, or fulcrum, if the doctor has to reach for an instrument during the procedure. Ideally, neither the doctor nor the ‘scope’ assistant are to remove their eyes from the oculars of the OM during the entire operation. The task of directing the whole operation belongs to the surgical assistant. The surgical assistant is the choreographer for the procedures viewed through the OM. He or she is in a position to observe, coach and/or pass instruments to either the doctor or the ‘scope’ assistant. The surgical assistant can see the entire surgical environment and is the only one on the team that has an overview, to keep track of everyone’s needs.
is important that all possible surgical instruments be organised for ease of access during the operation.

While the anaesthesia is becoming profound, the needles that will be placed into the tips of the Stropko Irrigators for use during the surgery can be modified. The notched ends of 25-gauge Monoject Endodontic irrigating needles (Ultradent/Vista) are removed by bending with Howe Pliers and placed into the end of the Stropko Irrigators. One tip is used with an air/water syringe, and the other tip is used with the dedicated air-only syringe (DCI). The endodontic irrigating needles are then bent in the same configuration as the ultrasonic tip that is used for the root-end preparation (Fig. 5a). After the needle has been bent, the ergonomics of the bend can be verified quickly and easily because the patient is in the proper position and so is the doctor.

Optima1ly, three Stropko Irrigators should be available for any surgical procedure: one three-way syringe fitted with a larger tip (Ultradent/Vista), for more general flushing of the surgical area (we call it the Big John); another three-way syringe fitted with a modified 25-gauge needle, for more precise cleaning and drying (Little John); and one with an air-only syringe also fitted with a modified 25-gauge needle, for precise and dependable drying of the area without worry of moisture contamination (Fig. 5b; Note, air pressure to the syringe must be regulated.)

Also, as the lumens of the high-speed evacuator tips (Young’s Surgical) are so small, extra tips must be available if one should become clogged. A beaker of water should be available, so that the ‘scope’ assistant can occasionally clear the evacuator system of blood and tissue debris from the evacuator tip.

After topical anaesthetic has been placed, local anaesthesia is begun using less than one carpule of warmed 2% lidocaine containing 1:50,000 epinephrine. This small amount is used to anesthetise the injection sites that will be used next for the blocks and infiltrations. The 1:50,000 lidocaine is used prior to the 0.5% bupivacaine (Marcaine) because the Marcaine tends to cause a burning sensation upon injection, whereas the lidocaine is much more comfortable to the patient. This is then followed with one or two 1.8cc carpules of warmed Marcaine for nerve blocks and/or infiltrations. All anaesthetic is warmed and injected very slowly to avoid any unnecessary trauma to the tissue and to create much less discomfort for the patient.

After administering the local anaesthetics, haemostasis staging is performed using 2% lidocaine containing 1:50,000 epinephrine. It has been shown that 2% lidocaine containing 1:50,000 epinephrine produces more than a 50% improvement in haemostasis compared with 2% lidocaine containing 1:100,000 epinephrine. While keeping the bevel of the needle towards the bone and directed apically towards the root ends, small amounts of 2% lidocaine 1:50,000 are slowly injected into the free gingival tissue in two or three sites to the buccal of each tooth (MB, B, DB), approximately 3mm apical to
the muco-gingival line. Slow injection of just a few drops of the anaesthetic causes a slight ballooning and blanching of the tissue in the immediate area. This is an important step as it causes the muco-gingival line to become more pronounced, allowing the doctor to have better vision, which results in more accuracy with the following haemostasis injections (Fig. 6a).

As the anatomy of the tissue unfolds during the injections, the doctor should continue visualising and planning the incision (Fig. 6b). The amount and nature of the attached gingiva is an important consideration whether a full sulcular or a muco-gingival (Leubke–Oschenbein) flap is used. In general, a full thickness sulcular flap is routinely used unless aesthetics is a concern and there is an adequate zone of attached gingiva present.

In order to ensure haemostasis, the lingual tissues should also be infiltrated to reduce blood flow during the surgical procedure more completely. When performing surgery on the posterior quadrant of the mandible, special attention should be given to the apical region of the mandibular second molar. On occasion, a small foramen, called the foramen coli, may be present. The f. coli contains an ascending branch of the mylohyoid nerve. Lingual haemostasis staging can contribute to more profound anaesthesia, will enhance crypt management and will contribute to a more predictable event with less stress for the entire team as a result.

If the surgery is to be performed on the maxillary, the patient is instructed to close on approximately eight layers of sterile gauze, (four 2 x 2s folded over once) for stability of the jaws and keeping any debris from inadvertently entering the oral cavity. A single piece of a sterile 2 x 2 is also gently placed distal of the tooth/teeth to be operated on. If the surgical procedure is to be performed on the mandible, especially if a full sulcular flap is to be used, the doctor may want to make the incision with the mouth slightly open before placing the gauze.

In either case, with the aid of the OM and using a pre-filled 3 ml syringe fitted with a 20-gauge needle the entire surgical site is rinsed with Peridex, to ensure the area is free of debris and plaque before the incision is made (Fig. 7). The surgical site is now ready for the next important step in the procedure: Flap design, the incision and atraumatic flap elevation.

Stropko Irrigators are available from SybronEndo or Obtura Spartan in the United States, from Clinicians Choice in Canada, or directly from www.stropko.com.


References
Cutaneous sinus tracts: An endodontic approach

Author_ Dr Philippe Sleiman, Lebanon

Misdiagnosis of an extra-oral sinus tract usually leads to a destructive invasive treatment of the local skin lesions that is not curative and often mutilating (Fig. 1). Attempting to treat such lesions with a circular incision of the orifice of the cutaneous fistula and excision of its entire tract with all the ramifications is not consistent with the present standard of care. Unfortunately, cutaneous fistulae are sometimes treated as though they are independent dermatologic lesions with the pathogenic characteristics and treatment prognosis typical for mucosal fistulae. However, even skin biopsy may produce unnecessary scarring.

Correct diagnosis is the key to treating this kind of lesion. A gentle digital finger pad pressure on the apical region of the area suspected can create a discharge of pus. A DentaScan can provide reliable information that will help with the final diagnosis and the subsequent treatment plan. A correct diagnosis will lead to a simple, yet effective treatment—the removal of the infected pulp canal tissue from the root canal space—resulting in minimal cutaneous scarring.

Cutaneous sinus tracts of dental origin have been well documented in the medical literature, dental literature, and dermatological literature. However, these lesions continue to be a diagnostic dilemma. Patients suffering from cutaneous fistulae usually seek treatment from a physician or a plastic surgeon instead of a dentist and often undergo multiple surgical excisions, multiple biopsies and antibiotic regimens with eventual recurrence of the cutaneous sinus tract because the primary dental cause is frequently misdiagnosed.

The evaluation of a cutaneous sinus tract must begin with a thorough patient history and awareness that any cutaneous lesion of the face and neck could be of dental origin. The patient’s history may include complaints of dental problems. However, patients may not have any history of an acute or painful onset. There may also be complaints of episodic bleeding or drainage from the cutaneous site with persistence of the cutaneous lesion. Occasionally, there is a history of injury to the tooth.

Correct diagnosis of the cutaneous sinus tract of dental origin should be suspected by the gross appearance of the lesion. These cases typically present as erythematous, symmetrical, smooth, non-tender nodules of 1 to 20 mm in diameter with crusting and periodic drainage in some cases. The most characteristic feature of the nodule is its depression or retraction below the normal surface. This cutaneous retraction or dimpling is caused by the fixation of the tract to the underlying tissues and may be secondary to the healing process or a late finding in active disease. Lesions that previously underwent biopsy and treatment are usually characterised by the absence of at least part of the nodule and frequently by an orifice of draining sinus at the base of the fixed depression.
Endodontic infection, the product of cellular degeneration—bacterial toxins—and, occasionally, the bacteria themselves within the canal spread through the apical foramen into the surrounding tissue. Thus, a slow inflammatory process begins in the tissue contained within the periodontal ligament. Left to itself, it may manifest in a variety of ways, ranging from simple widening or thickening of the ligament to granuloma or cyst. Sometimes a fistula may develop, with the patient reporting intermittent discharge of pus.

The fistula provides a means of continuous drainage of the lesion. The opening of the fistula may be found on the mucosa overlying the tooth that sustains it, but often it may also be found at a considerable distance from the diseased tooth. In some cases, the fistula may run in the space of the periodontal ligament of the same tooth. It may even traverse the periodontal ligament of the adjacent healthy tooth, thus simulating a lesion of periodontal origin. In such cases, negative pulp tests performed on the crown of the tooth, indicated by a gutta-percha cone inserted into the fistula, assist in making the correct diagnosis.

If the drainage of the fistula is not continuous but intermittent, it is preceded by a slight swelling of the area as a result of the increased pressure of pus behind the closed orifice. When the pressure becomes strong enough to rupture the thin wall of soft tissue, the suppurative discharge issues externally through the small opening of the fistulous orifice. This orifice may heal and then re-close, only to re-open later. The discharge of pus is never accompanied by intense pain. At most, the patient will complain of slight soreness in the area prior to reopening of the external orifice. The pus creates a tract in the surrounding tissues, following the \textit{locus minoris resistentiae}. It may exit, at any point, in the oral mucosa or even in the skin. It is not uncommon, particularly in young patients, to find a cutaneous fistula at the level of the mental symphysis, if lower incisors are involved, or in the sub-mandibular region, if a lower first molar is involved. Also, it may be found in the floor of the nasal fossa, if a central incisor is involved.

Attempts to treat cutaneous fistulae with a circular incision of the orifice of the cutaneous fistula and excision of its entire tract with all the ramifications cannot be considered to comply with the present standard of care and should be regarded as highly undesirable. Most of the time, root canal therapy is the ideal treatment for such lesions. However, Grossman\cite{Grossman} states that such tracts are lined by granulation tissue. In his study, Grossman was unable to identify any epithelium at all. Bender and Seltzer\cite{Bender} also conducted histological studies of numerous fistulous tracts without finding an epithelium lining. Given the current state of knowledge and scientific data, there is no reason to recommend surgical removal of such tracts, just as there is no reason to believe that even epithelium-lined fistula tracts should not heal after appropriate endodontic therapy.

Obviously, these fistulae must be distinguished from congenital fistulae of the neck, both lateral—arising from the second brachial cleft—and medial—arising from rests of the thyroglossal duct—which
are lined by an epithelium. Such fistulae are of a different pathogenesis and definitely do not resolve spontaneously but only after careful surgical excisions of the tract.

The differential diagnosis of the case in question included the following:

- Localised infection of the skin, such as pyoderma, pimples, ingrown hairs and obstructed sweat glands;
- Traumatic or iatrogenic lesions;
- Osteomyelitis;
- Tuberculosis; and
- Actinomycosis.

**Case presentation**

The patient was referred to me from overseas with a large mandibular fistula, which had previously been misdiagnosed as an infection of the sub-mandibular gland. Surgery had been performed and his sub-mandibular gland had been extracted. The wound had not healed and the clinical situation was fast worsening. Thus, the wound had opened and sub-infected with a heavy discharge of pus.

A dentist invited to see the patient immediately telephoned me and sent a photo of the wound to me via his mobile phone. Following my recommendation, the patient was immediately put under double antibiotic therapy (Amoxicillin 1000mg twice daily, Metronidazole 500mg twice daily). The patient presented to my clinic the following day, where we started with a detailed questionnaire to collect all the information about the history of the wound. The patient reported that he had been suffering from this fistula for quite some time already with intermittent phases of discharge of an exudate and numbness of the lower lip. No dental pain was reported.

A panoramic X-ray showed some bone rarefaction under teeth 47 and 46, but no invasion of the mandibular nerve tract was evident (Fig. 2a). A dental scan with 0.5 mm increment was performed in order to gain a better idea of the clinical situation. One of the sagittal slides (013) clearly shows the lesion around the distal root of tooth 47, surrounding the apical part and destroying the cortical bone invading the lower soft tissue (Fig. 2b). Furthermore, the mesial root of tooth 46 showed apical radiolucency, invading the tract of the lower mandibular nerve (014; Fig. 3). This pathology explains the numbness of the lower lip, while the pathology around the distal root of tooth 47 explains the extra-oral fistula.

Careful review of the axial slides in the area of tooth 47 (006) offers an idea about the amount of bone destruction in the lower lingual area. The axial slide under tooth 46 reveals the communication between the lesion under the mesial root and the mandibular nerve tract (Fig. 4).

Next, we established a clear diagnosis that the lesion was an extra-oral cutaneous fistula of dental origin. The patient was suffering from a large, infected open wound and a suitable treatment plan had to be established quickly. The following solutions were presented:

1. Extraction of the teeth and curettage of the area, with extra attention paid to the mandibular nerve: This plan could provide the patient with a solution for eliminating the infection and allowing the wound to heal. Yet, two strategic molars would be lost with this solution and a replacement would not be an easy job with this amount of bone destruction in the infected area.
2. More conservatively, a root canal treatment in order to clean and disinfect the root canal systems of the two molars, followed by an internal medication and a 3-D obturation capable of blocking the bacteria from reaching the apical part and trapping the remaining bacteria inside the root canal system: This approach would allow the patient to keep his molars and would provide an environment in which the healing process could begin. The risk would be the establishment of an external biofilm that cannot heal by itself and may require microsurgical removal.

The patient and I decided to preserve the two molars. Immediately, root canal treatment, cleaning and shaping of the canal space using TF files (SybronEndo) with copious and alternate irrigation of Chlorhexidine, SmearClear (SybronEndo), distilled water, and sodium hypochlorite with ultrasonic activation in a well-established sequence, was performed. An apical enlargement to size #40 in .04 taper was performed after crown down with K3 files (SybronEndo), to disturb the biofilm mechanically and to help reduce the colony formation unit (CFU).

An intermittent paste was injected inside the shaped root canal system. The paste of two different antibiotics (Augmentin and Metronidazole) was manually mixed and injected with a paste filler. A hermetic temporary filling was placed for a week. The wound was covered with a dressing of steroids and antibiotic paste to prevent further external infection. A week later, the patient was already showing good progress. The wound had started to close and less inflammation and swelling were observed (Fig. 5). The root canal was reopened and cleaned, and no internal fluids were coming from the peri-apical region. RealSeal material was used as obturation material in a vertical condensation using RCPCL (Hu-Friedy) and an immediate build-up was performed. Thereafter, the patient was invited for regular control check-ups. A few weeks later, a post-op X-ray (Fig. 6) and photos were taken. The wound seemed to be in good condition and some skin and fibrous tissues were forming.

While I was writing this article, the patient visited Beirut and decided to come in for a check-up. He complained of a muscle disturbance of his lower lip, but all the previous numbness had disappeared. He agreed to perform an i-Cat scan in order to find out what was going on and to detect any pathology. I was amazed by the bone formation and complete healing (Figs. 7–9). The wound had also healed very well (Figs. 10a & 10b). I contacted a plastic surgeon and asked his opinion regarding the muscle disturbance. He posited that such symptoms may be caused by the tremendous loss of structure.
An important diagnostic modality is the determination of the nature of fluid draining (if any) from the cutaneous sinus. During palpation, an attempt should be made to milk the sinus tract. Any discharge obtained should be scrutinised to determine its nature (saliva, pus or cystic fluid). Culture and sensitivity testing of the fluid should also be performed to rule out fungal and syphilitic infection.

Laskin elaborates on the physiological and anatomical factors that influence the spread and ultimate localisation of dental infections. Stoll and Solomon also emphasise that the ultimate path of the sinus (irrespective of the source) depends on several factors: most importantly, the anatomy of the tooth involved, muscular attachments to the jaw, fascial planes of the neck, and involvement of permanent or deciduous teeth. Cutaneous rather than intra-oral lesions are likely to occur if the apices of the teeth are superior to the maxillary muscle attachments or inferior to the mandibular muscle attachments.

A pustule is the most common of all purulent draining lesions and is readily recognised by its superficial location and short course. Actinomycosis exhibits multiple draining lesions and characteristic fine yellow granules in the purulent discharge. The tooth is often not involved radiographically. If a sinus tract does not close after appropriate removal of the primary cause, the most common alternative cause is actinomycosis.

The challenge in these kinds of cases is to assemble all the pieces of the puzzle and build up a full idea of the clinical situation. Assembling the pieces means that all the diagnostic materials, such as a history questionnaire, X-rays, CT scans, and sometimes biopsy and bacteria culturing, must be provided in order to establish a correct diagnosis. Most of the time, the solution will only be a simple routine that must be performed in certain conditions. Turning to solutions that are more complicated—and that certainly can be more profitable—is not always the right choice, nor the most ethical one.

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Editorial note: A complete list of references is available from the publisher.

Dr Philippe Sleiman received his DDS from the Lebanese University School of Dentistry in 1989. He conducted a DES in the endodontic programme at St Joseph University and a PhD at the Lebanese University Dental School. He has authored several international articles. He has his own line of instruments with the Hu-Friedy company and contributed to several project developments, and he has lectured internationally. Dr Sleiman is an instructor at the Lebanese University and an international trainer for the University of North Carolina. He is a fellow in the ICD and the AAE. Dr Sleiman maintains a private practice in Beirut, Lebanon, and in Dubai, UAE and can be reached at phil2sleiman@hotmail.com.
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Leakage resistance of a self-etch sealer-cone obturation system

Authors: Dr Gregori M. Kurtzman & Prof J. Anthony von Fraunhofer, USA

Introduction

Leakage is often a hidden factor in endodontic failure. It is recognised that virtually all endodontic restorations leak to some degree, although a recent study has demonstrated that the amount of detectable leakage varies with the penetrant. Unfortunately, when teeth are treated endodontically, the ability to sense bacterial breakdown is lost; consequently, the patient can no longer detect a need to seek dental care. In fact, percolation at the restoration’s margins may be long standing before the dentist becomes aware of it. As a result, damage can occur before adequate dental care is sought; therefore, the leakage behaviour of endodontic restorations is a matter of concern to both the treating dentist and the patient.

The use of adhesive obturation materials is known to significantly slow or stop coronal-apical bacterial migration but significant dye and bacterial leakage may occur within two days following exposure of obturated root canals to artificial and natural saliva. This can lead to complete bacterial leakage. Other studies confirm that dye leakage can occur in as few as three days.

Gutta percha and various sealers have traditionally been used for endodontic obturation. This despite gutta percha not offering an effective barrier to crown-down leakage when exposed to the oral environment because of its inability to bond to various sealers.

Recently, resistance to leakage has been improved through application of adhesive dentistry technology to endodontic obturation. The present study compares the leakage behaviour of the Resilon-Epiphany self-etch adhesive (R-SERS) and Resilon-Epiphany Resin Primer Sealer (R-RPS) obturation systems with that of gutta percha with both AH26 and zinc oxide eugenol (ZOE) sealants using an electrochemical methodology (Figs. 1a & b). This approach was adopted because of its accuracy, convenience and high correlation with traditional dye leakage studies.

Methods and materials

Ten human single-rooted teeth with 20 mm average working length were used in this leakage study. Coronal access was prepared in each tooth and patency confirmed with a hand file. The canals were then instrumented to apical size ISO #40 with a .06 taper and irrigated with a 5% NaOCl solution. The canals were dried with paper points, rinsed with 17% EDTA, and then re-dried with paper points. A Resilon cone (Pentron) corresponding to the final canal size of ISO #40 with a .06 taper was placed into each specimen tooth, and a radiograph was taken to verify fit of the cone. Epiphany self-etch sealer (Pentron) was placed onto the fitted cone, and the cone was inserted to

Table I. Mean leakage currents (and their standard deviations and coefficients of variation) at 30 days.

<table>
<thead>
<tr>
<th></th>
<th>GP-AH26</th>
<th>R-RPS</th>
<th>GP-ZOE</th>
<th>R-SERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>404.6</td>
<td>6.9</td>
<td>271.3</td>
<td>53.7</td>
</tr>
<tr>
<td>S.Dev</td>
<td>313.7</td>
<td>8.9</td>
<td>204.5</td>
<td>27.6</td>
</tr>
<tr>
<td>CofV in %</td>
<td>77.5</td>
<td>129.1</td>
<td>75.4</td>
<td>51.5</td>
</tr>
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working length into each tooth. Excess coronal Resilon cone was removed to the level of the canal orifice using a Touch ‘n Heat (SybronEndo). Specimens were then allowed to self-cure for 30 minutes before being placed into a container with a 100% humidity atmosphere.

After endodontic obturation, a Class I preparation was placed in the occlusal surface of the teeth and a PVC-covered copper wire was inserted and placed in contact with the endodontic sealer cone and sealed in place using sticky wax. Thereafter, all external surfaces were coated with three layers of nail varnish to seal them and prevent leakage. The apices of all teeth were left uncoated and patent.

The teeth were immersed up to the CE junction in 0.9% NaCl solution, with a stainless steel counter electrode that was placed in the specimen container. A 20V DC voltage was connected between the stainless steel and each tooth in turn, and current flow was determined in accordance with Ohm’s Law by voltage drop across a standard resistor (100\(\Omega\)) in the circuit (Fig. 2).

The leakage behaviour of the test specimens (R-SES) was compared with the behaviour of teeth obturated with gutta percha and ZOE (GP-ZOE) sealer, gutta percha and AH26 (GP-AH26) sealer, as well as teeth obturated with the Resilon-Epiphany Resin Primer Sealer (R-RPS) system in a previous study. These three groups were used as controls.

Current flow in the circuit was observed for 30 days. At 30 days, one-way ANOVA and Scheffé’s Method were used to compare and identify any statistically significant differences in the leakage behaviour at an \(\alpha\) priori \(=0.05\).

**Results**

The leakage behaviour of the four groups of specimens over the test period is shown in Figure 3, while the 30-day data are summarised in Table I and Figure 4. It was found that the teeth obturated with the Resilon-Epiphany self-etch system (R-SES) showed a slow but progressive leakage with time, while the R-RPS obturated teeth exhibited minimal leakage until
research

leakage resistance

about 20 days. In contrast, the GP-AH26 and GP-ZOE obturated teeth showed a continuous and relatively rapid increase in leakage current until 20 to 25 days when the current appeared to plateau until the end of the study.

All four groups of specimens showed the customary scatter found in endodontic leakage studies, as shown by the coefficients of variation and the current ranges. However, the variability within both the R-SES and the R-RPS obturated teeth was markedly lower than for the GP with sealer-obturated teeth.

Statistical analysis indicated that the leakage of the GP-AH26 specimens was significantly greater (p<0.001) than that of the R-RPS and R-SES groups of specimens. There were no differences (p>0.05) between the leakage currents found for R-RPS and R-SES obturated teeth. The variability within the GP-ZOE group was such that no statistically significant differences (p>0.05) were found between it and the R-RPS, R-SES and GP-ZOE groups.

_Discussion_

It is generally believed that all endodontically treated teeth undergo leakage, and this view is supported by the literature. Ideally, all obturated teeth should show zero leakage, but this is a situation does not exist even for cavity restorations, which poses the question of how much leakage is acceptable.

While the ideal may never be attainable, the data presented here indicate that while teeth obturated with Resilon with resin sealer (R-SERS and R-RPS) do exhibit leakage, the observed leakage is almost of an order of magnitude less than that found with conventional obturation materials. Further, the variability within the data appears to be much lower.

While the technique and the obturation system both affect the restoration leakage behaviour, recent work suggests that resin obturation systems may exhibit superior resistance to endodontic leakage.2 The present study, which evaluated a self-etch adhesive and cone system, indicates that rapid progress is being made in reducing leakage to minimal levels and that the reported self-etch methodology with its inherent convenience and speed is a significant advance in endodontic therapy.

An interesting finding, and one that has been observed in other studies, is the onset or increase in leakage at approximately 20 days for obturated teeth that show initially very low leakage behaviour. This behaviour at three weeks is paralleled by the plateau that occurs with obturated teeth exhibiting high initial leakage rates. The reason for this behaviour is unclear; possibly, it is an inherent aspect of endodontic leakage behaviour.

_Conclusion_

The leakage of endodontic restorations has long been recognised but only in recent years has it been considered a serious cause of endodontic failure. In particular, marginal breakdown over time will lead to leakage with its consequent failure through apical bacterial migration. The findings presented here suggest that the new technology of self-etch adhesive obturation materials can slow this leakage, representing a significant advance in endodontic therapy._

Fig. 3

Mean leakage currents (μA) for teeth obturated with R-RPS, R-SES, GP-AH26 and GP-ZOE.

Fig. 4

Mean leakage behaviour at 30 days (standard deviations shown as tie bars).

Fig. 3

Mean leakage behaviour at 30 days (standard deviations shown as tie bars).

Fig. 4

Mean leakage behaviour at 30 days (standard deviations shown as tie bars).
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SafeSiders instrumentation and EZ-Fill obturation

Authors_ Dr Barry Lee Musikant & Dr Allan S. Deutsch, USA

We have introduced two new endodontic systems, one for shaping and one for obturation. There is in our opinion a need for both, given the unpredictability in gaining safe consistent results with rotary NiTi shaping, rotary NiTi’s requirement of a glide path shaped with K-files and the shrinkage that occurs with all thermoplastic obturation techniques.

Early on, we understood that we simply had to shape canals more efficiently than K-files. Our answer is a system essentially built around relieved K-reamers.

_K-files versus K-reamers_

In a comparison of K-files with K-reamers, the following distinctions can be made:

1. K-reamers have about half the number of flutes along the 16 mm of working length compared with K-files.
2. The fewer the flutes there are, the less the engagement along the length.
3. The fewer the flutes there are, the less work-hardened the shaft and the more flexible the instrument.
4. The early K-reamers accurately record any curvature that they traverse better than the stiffer K-files, letting the dentist know where a curve may exist, the degree of the curve and the orientation of the curve.
5. The less the engagement along the length, the less the resistance in negotiating apically.
6. Because there are fewer flutes along a K-reamer, they are more vertically oriented than K-files.
7. When used with a watch-winding motion, K-reamers with their more vertical flutes are far more effective cutting instruments than K-files.
8. The horizontal flutes along the length of the K-file tend to engage and disengage without cutting when a watch-winding motion is used.
9. The K-reamers with their more efficient cutting and lower resistance along their length produce a superior tactile perception of what the tip of the instrument is encountering.
10. This superior apical tactile perception allows the placement of a cutting tip.
11. The cutting tip differentiates between a tight canal and hitting a wall.
12. The K-reamers are powered by a 30-degree reciprocating handpiece that prevents the cutting tip from penetrating dentin, while allowing it to pierce soft pulp tissue.

The resistance of the instrument along its length, its efficiency at cutting laterally, its flexibility and its superior apical tactile perception were all improved further by placing a flat along the entire working length of the shaft. The modified K-reamer then had more flexibility and less engagement along length, meaning resistance along length was further reduced. In addition, two columns of chisels were created (where the flat meets the flutes) that cut efficiently with one column cutting when the reciprocating handpiece is going in the clockwise direction and the other cutting in the counter-clockwise direction. The flat creates an asymmetric instrument that can dif-
ferentiate between a round and oval canal. When the flat is lined up with the long diameter of an oval canal, the resistance decreases. When the flat lines up with the short diameter, the resistance increases.

The tactile perception of more and less resistance lets the dentist know that he/she is in an oval canal, which tells him/her to widen the canal to better shape the likely buccal and lingual extensions of the canal and open it further for improved irrigation. The 30-degree reciprocating handpiece oscillates at approximately 3,000 cycles per minute, representing a high-frequency, low-amplitude envelope of motion, which shapes canals with minimum apical pressure and minimum resistance.

Because the arc of motion is limited to 30 degrees, virtually all the torsional stress and cyclic fatigue that rotary NiTi instruments are subjected to is eliminated, which in turn eliminates the two factors that are most responsible for rotary NiTi separation. This frees dentists of a tremendous burden as they negotiate and shape canals of increasing curvature. Having used rotary NiTi, we understood the advantages of greater tapered shaping but never felt comfortable with the increased likelihood of fractured instruments. With the SafeSider system, we can shape canals to a taper greater than we would have dared with rotary NiTi without any concern for instrument separation. The result is a cleaner case with a minimum taper between 0.05 and 0.06 mm.

Because the reciprocating motion virtually eliminates torsional stress and cyclic fatigue, the instruments can be effectively used six to seven times (canals) without any concern for fracture. In fact, the downside of excessive use is dullness, a luxury when compared with the fear of separation. Yes, they will become less efficient over time and should be replaced, but they will not break even if used beyond their recommended number of canals. It should also be noted that even the thinnest SafeSiders can be used in the reciprocating handpiece with virtually no fear of separation.

Abruptly curved canals present no problems because the earlier relieved reamers record the curve that exists, letting us know where and when we must pre-bend them and place them manually into the canal to the initiation of the curve. Once relieved reamers reach this point, they are reattached to the reciprocating handpiece and guided the rest of the way to the apex in a non-distorted fashion. Given their ability to be pre-bent and oriented manually so that the instrument correlates to any curvature in the canal that may exist, there are no limitations to where these instruments may be used. If a canal is very large and has to be opened to a wider diameter than the reamers in the system, we use regular non-relieved reamers sizes 45 to 140 in a step-back manner to create any tip size and taper we need.

The above is a general description of the common sense reasoning behind the reamers’ design and the way they are powered in the canal. Included here are several examples of cases that have been shaped with SafeSiders and filled with the EZ-Fill obturation technique (Figs. 3–5). The lower molar that was sent to us with a fractured instrument in the distal canal is a good example of what we wish to avoid. Please note that while we were unable to remove the fractured rotary NiTi fragment, we were able to instrument along its side to achieve a final fill in the distal that obturated a lateral canal. The even more curved mesials were shaped and obturated safely and without distortion using the SafeSider technique. The other cases presented show the SafeSiders’ ability to shape even the most challenging anatomy in a consistent fashion. Because they are highly resistant to fracture, the technique is far easier to learn, making the knowledge of using them well highly transferable.

**Guidelines for use**

Below is a step-by-step guide for their effective use:

1. Work the #08 reamer to the constriction with it attached to an apex locator for accurate length.
control. Then instrument through a 25 to 0.5mm beyond the constriction.

2. Once the length is determined, set a rubber stop to the proper length and place the subsequent reamers in the reciprocating handpiece set so that it runs at approximately 3,000 cycles per minute. We recommend the use of our rubber stops because they abut against the plastic handle and will not ride up the shaft.

3. Using the reciprocating handpiece with a firm pecking motion, negotiate 0.5mm beyond the constriction with #10, 15 and 20 SafeSiders. This usually takes only about two to three strokes. If some resistance along the length is encountered, take the instrument out of the canal and wipe the shaft, removing any debris that may be in the flutes.

4. After the #20 is to 0.5 mm beyond the constriction, straighten the coronal curve (when in a molar) using the tapered peeso (Pleezer). Usually we go apically about 6 mm from the apex, but if significant resistance is encountered you can go 7 or 8 mm from the apex. Please note that straightening of the coronal portion of the canal always occurs at the expense of the outer wall, leaving the important dentine on the furcation side intact.

5. Shape the canals with the #25 beyond the constriction.

6. Shape the canals to the constriction with the 30, 30/04 and 35 using the reciprocating handpiece.

7. Shape the canal 1 mm short with the #40.

8. Finally, shape the entire length of the canal to a 25/06.
There are some additional points to be noted. Six per cent NaOCl is continually used by irrigating with a 30-gauge needle under low pressure. We define low pressure as four to five drops expressing out of the tip of the needle when hand pressure is applied. We never want to create a stream because it could lead to significant extrusion of NaOCl over the apex causing harm.

If any of the early instruments hit absolute resistance, then a wall has been encountered, which is the signal to take the instrument out of the canal, pre-bend it at the tip about 45 degrees and search for the proper pathway to the apex. Once found, take note of the orientation of the curve so that it can be duplicated with the subsequent instruments. Once the bent instrument has negotiated the curve, the reamer should be reattached to the reciprocating handpiece and guided the rest of the way to the apex. At no time is there any danger of separating the instrument even when the canals are quite curved.

The canal is now ready to be filled with a medium point (EDS).

The canals are coated thoroughly using the bi-directional spiral, which has the ability to coat all but the most apical 2 mm of the canal without driving any cement over the apex with the applicator. The pre-fitted gutta percha point is then thoroughly coated with cement and placed into the canal. Unless the canal is highly elliptical, one point is generally sufficient to obturate the canal thoroughly. If it is highly elliptical, there is no problem in using a spreader to create a lateral space for the placement of a second or third well-coated auxiliary point. Our philosophy of obturation is that the gutta percha is nothing more than a carrier and a driver of the cement, which is what truly seals the canals. Of course, the master point should have excellent tugback, which is routinely achieved using this technique.

Characteristics

The cement is an epoxy-resin that has the following superior characteristics:

1. As it is placed at room temperature, it does not shrink because there is no cooling.

2. In fact, both the gutta percha and the cement expand as they warm from room temperature to body temperature.

3. The cement at room temperature has far lower viscosity than thermoplasticised gutta percha, allowing it to penetrate the dentinal tubules, as well as any nooks and crannies that may be present.

4. The cement bonds both chemically and physically to the gutta percha and the dentinal walls.

5. Because the cement is placed lateral to the gutta percha, the case could easily be redone if required or if a post-hole was needed either immediately or at a later date.

6. The cement’s chemistry has been known for over 55 years and it is well documented in the dental literature as an excellent sealer.

Dr Musikant was asked at a lecture he gave to be honest and tell the audience the negative aspects of the system. He honestly replied that he was one of the inventors of the product and that we purposely designed the system to exclude anything that we could conceive of as a potentially negative aspect. For us as practicing endodontists who have several partners who all use the system, we have found no negatives. That does not mean that a practitioner will not get better the more he uses the system but rather when learning to use the system will not be filled with moments of anxiety due to the fear of breaking instruments. Furthermore, because separation is not an issue, we can teach anyone how to use these instruments to negotiate the most complex canal anatomy.

No system should restrain a dentist from tackling increasingly challenging cases simply because he/she is worried about the impact of the canal anatomy on the integrity of the instruments he is using. That was our problem with rotary NiTi. We designed our system to exclude that particular feature. As for the EZ-Fill obturation, hopefully the completed cases that we have included in this presentation speak for themselves.

Editorial note: A complete list of references is available from the publisher.
When I designed the GT Series X Files (GTX), I was unwilling to compromise on the four main advantages of standard GT files: first, landed-blade instruments’ ability to maintain the fidelity of a canal’s original path; second, the maximum flute diameter (MFD) limitation that assures conservative shapes coronally; third, the predefined and reproducible tapered shape unique to GT files; and fourth, the true system-based approach in which all associated products fit the shapes ideally.

The GTX File Set has been designed to retain all of these advantages while optimising its functional characteristics. Beyond geometry changes, this file is made of a new NiTi wire called M-Wire, which was developed by Dr Ben Johnson, the inventor of carrier-based obturation. Through a series of thermal cycles applied during the drawing of the wire, the resistance to cyclic fatigue—one of the most common causes of rotary file separation—has been greatly enhanced.1 This is intended to reduce the chance of breakage significantly when instruments are used as before, and should not be understood to mean that files made of this advanced metal can be used repeatedly.

GTX Files have the same radiused tip geometry and the same limited MFD as standard GT files, and are still landed instruments but with a significant improvement: the land widths vary along the length of the file and the flute space has been doubled. Because transportation is a function of blade sharpness and the rigidity of the instrument at a given position along the file, testing showed that the tip flutes, in the most flexible part of the file, could be safely narrowed to gain cutting speed without

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**Fig. 1** GT Series X File. Note the maximum shank diameter at 1 mm, the radiused tip, the consistent, wider blade angle and the variable-width lands. At the tip and shank ends, the land widths are half the size of the lands in the middle region of the flutes, allowing rapid cutting without transportation.

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1 While landed-blade instruments are known for safety in terms of following the original canal path, both mid-root and apically, the perception was that they were not as efficient in terms of cutting speed—until now.
transportation in the highly curved apical regions of canals. At the shank end of the file, the lands could also be thinned without danger, in spite of the stiffness of that part of the file, because the shank end cuts through the straightest region of roots. With these efficiencies at hand, it became apparent that the degree of stiffness in the middle third of root canals required maintenance of the original land width, to prevent straightening of the mid-root canal curves. The outcome of this optimisation was at least a doubled increase in cutting speed, as well as less taper lock during apical progress.

The final blade change is that the blade angles have been opened to a consistent 30 degrees along the length of the GTX Files, thereby nearly doubling the chip space between flutes. This increases the flexibility of these files and significantly extends the length of each cutting cycle (Fig. 1).

The final two changes are a latch grip handle that has been shortened from 13 to 11 mm and a reduced file set (Fig. 2). The shorter handle is a no-brainer when considering the small interocclusal distance between posterior teeth. The reduced file set however needs a short explanation: a common cause of rotary file breakage is the selection of a taper size that is inappropriate for the canal curvature being shaped, and the consistently ideal preparations created by landed rotary instruments require resistance form that is less tapered, to achieve apical accuracy of obturation. Virtually any canal, short of those with open apices, can be ideally shaped with this eight-instrument file set. For bigger apical sizes and greater coronal enlargement, clinicians can use a standard GT file, for instance the 40-.10 or the GT 0.12 accessory files with tip diameters of 0.5, 0.7, and 0.9 mm.

_GT Series X shaping technique_

The technique for the use of GTX Files is remarkably simple. After the canal has been negotiated to a size #15 or 20 K-file at full length (in the presence of a lubricant), the canal is rinsed out and filled with full strength NaOCl, and rotary shaping commences (always starting with the 20-.06 GTX File). Owing to the sophisticated geometry of these files, they cut in steady 10- to 12-second cutting cycles at the recommended 300rpm. Pecking motions are inappropriate for landed-blade instruments. The rule of thumb is that if the file is advancing in an apical direction, it is allowed to continue cutting.

_The initial shape and ideal tapers for root forms_

In small roots, the objective is to achieve a 0.06 taper. Small roots are classified as: mandibular incisors, two- and three-canal pre-molars, mesial roots of lower molars and buccal roots of upper molars. Shaping these canals begins with the 20-.06 GTX
Once GTX File of at least a 0.06 taper has been cut to length, the apical geometry of the canal must be determined, in order to ensure that the taper of the preparation extends to the terminal point (apical continuity of taper), thereby confirming adequate cleaning and apical accuracy during obturation. One technique that I use to shorten the procedure is what I call visual gauging. I have found that if I carefully examine the apical 2 mm of the first GTX File that reaches full length in the canal, I can immediately tell whether a #30 or 40 tip size will be needed. If packed with debris, a #20 tip size may be sufficient to create apical continuity of taper. If the last 1 to 2 mm of the file’s chip space is vacant, it will need a 30 or 40 Series GTX File to finish.

Another technique is tactile gauging. In this procedure, NiTi K-files are used as feeler gauges, with a straight in-and-out, non-cutting motion—not even a wiggle—to determine the apical diameter. Whichever K-file size binds at length (#20, 30 or 40 Series) will indicate the apical diameter.
constriction not typical for that root. In these in-
a hidden curvature not seen on a radiograph or a
the time. In any root form, there is a possibility of
every time’ is using good clinical judgment ‘all of
40-.10 rotary file when finishing medium and large
canal preparations.
30 Series GTX File or larger. If a #20 drops through and a #25
binds at length (an in-between size), I always take the
terminus up to the next full size—a 30 Series
GTX File in this case. I used to do tactile gauging in
all preparations between initial and final shaping;
however, I now rely on visual gauging between
these procedures, thereby saving a step if the canal
obviously needs a final shape larger than the initial
file that cut to length. For those using a cone-fit ob-
turation method, I recommend that tactile gauging
be used to check the final shaping result, as these
filling techniques require resistance form that is
more certain than carrier-based obturation. Those
clinicians who fill canals with GTX Obturators can
dispense with tactile gauging altogether.

_Final shaping decisions

I have described how I choose the final file to
complete the preparation. For clinicians who prefer
preparations with larger apical diameters, however,
it is a simple matter to cut the end of the canal to
the next larger GTX File tip diameter. This technique
is eminently safe even in canals with apical curves,
as the variable-land blade geometry resists apical
transportation in even these larger, stiffer sizes. I
like to keep the terminus as small as is practical; so
in virgin canals, I usually finish the shape to the size
to which it was gauged. However, in re-treatment
cases, I usually cut the terminus at least one GTX tip
size larger, as there is much filling debris that needs
to be removed before irrigants can accomplish their
anti-microbial and digestive functions.

For canals with very large apical diameters, the
standard GT 0.12 accessory files, with a 0.12 taper
and tip sizes of 50, 70 and 90, remain the ideal choice
of clinicians worldwide. These create significant
apical tapers, despite the large tip diameters—an
impossible proposition without the MFD limitations
that are unique to the GT and GTX lines. Lastly, when
a coronal shape that is a little larger (1.25 mm) is
desired in these canals, clinicians may want to
consider a hybrid technique—using the standard GT
40-.10 rotary file when finishing medium and large
canal preparations.

_Conclusion

The caveat to any technique that ‘works nearly
every time’ is using good clinical judgment ‘all of
the time’. In any root form, there is a possibility of
a hidden curvature not seen on a radiograph or a
constrictor not typical for that root. In these in-
stances, it is critical that you accept that the file you
normally take to length will not get there, and drop
down in file size. The purpose of creating shape is to
allow the irritants to reach all the apical and lateral
extents of a root so that the micro-organisms can
be killed. After a quick rinse with EDTA to remove
the smear layer, I use full strength NaOCl for at least
30 minutes in necrotic cases and 45 minutes in vital
cases to accomplish this task. This is very important
to remember when the whole shaping procedure
takes less than a minute—it may be shaped, but it’s
not clean. When an operator where the patient can
sit during the irrigation soak is not available, the
canals must be filled with calcium hydroxide, the
access temporised, and the case finished two weeks
later, after the calcium hydroxide has had time to
clean things up.

For most of the clinicians providing endodontic
therapy for their patients, less is more. Thus, faster,
simpler, fewer files, fewer steps and a moderate
learning curve are all advantageous. However, I
think some endodontists will be a bit nonplussed by
the new GTX Files—some of us really do revel in the
artistry and complexity of a technique that few can
do well (I was one of those).

For the diehards out there, just bring in one of
every type of file and do a different technique for
every canal you enter—you will be amazed at the
variety of shapes that will result. For me and my
like-minded peers, there is a certain grace to a one
three-file shape that looks exactly the same (perfect)
every single time (Figs. 3–6).

Reference

in ProFile and ProTaper Systems after Clinical Use. Journal of

Dr L. Stephen Buchanan is a Diplomate of the
American Board of Endodontics and a Fellow of both the
International College of Dentists and American College
of Dentists. Clinicians interested in his DVD series,
The Art of Endodontics, and his hands-on laboratory
workshops in Santa Barbara, CA, can call +1 805
899 4529. For more information related to this article
and for GTX updates and answers to frequently asked
questions, please visit www.endobuchanan.com. Free
CE online courses are also available on the GTX System
and other topics. Questions concerning challenging
cases can be directed to info@endobuchanan.com.
Vibringe: The next level of endodontic hand irrigation

Vibringe is the first endodontic irrigation device that enables easy and safe manual delivery and activation of the irrigation solution in only one step. A patented microprocessor inside the handpiece delivers precisely tuned sonic energy to the irrigation solution to be injected in the root canal. The sonic flow within the solution enriches and completes the irrigation procedure, improving the success rate of the conventional irrigation procedure and, therefore, the endodontic treatment. Initial user studies have shown that more than 80 per cent are convinced of the product’s benefits.

Conventional irrigation techniques may seem easy, but they are hindered by a lack of visibility and the always complex and unique root canal structure, which makes the outcome of endodontic treatments less predictable. The average endodontic failure rate is still over 40 per cent and, in 50 per cent of these cases, the failure is caused by poor irrigation.

The Vibringe can be used for all endodontic irrigation procedures and is compatible with all the irrigation solutions available on the market. When used correctly with endodontic needles (side-end opening), it can also prevent solution and debris being expressed through the peri-apical foramen.

With its aesthetic appeal and an LED light for patient comfort, the lightweight and cordless design makes the Vibringe a handy device for the endodontic practice. The sonic flow technology ensures that air and debris blockages are removed effectively, and aids the irrigation solution in reaching and disinfecting all portions of the canal to the apex. Owing to the downward and upward motion of the irrigation solution, tissue residues and debris in the finest lateral canals and tubules are loosened and transported out of the canal.

**contact info**

Dr Alexander Sijpkens
Marketing & Sales Director
Tel.: +31 20 345 38 46
E-mail: alexander@vibringe.com
www.vibringe.com
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An ultrasonic device with a focus on endodontics

Why is an ultrasonic device necessary in endodontic treatments? Today's endodontists are aware of the advantages the ultrasonic technique provides for their endodontic treatments and this has led to an increase in demand from practices that are either interested or specialised in endodontics. Therefore, VDW has developed an ultrasonic device especially for root canal treatments: the VDW.ULTRA.

The benefit of the ultrasonic irrigation is currently a hot topic: vibrations create micro air bubbles in the irrigating solution, which implode and remove tissue and biofilm. Dentine tubules and lateral canals are cleaned more effectively, thus reducing the risk of infection significantly. As mere mechanical preparation reaches only about 70 per cent of these areas, effective irrigation is crucial for a successful root canal treatment.

VDW.ULTRA specifically offers a low power mode for this application. Most interesting is the passive ultrasonic irrigation with smooth wire irrigation files, which avoid uncontrolled preparation during the irrigation phase. Additional applications, such as refinement of the access cavity, retreatment as well as removal of metal posts and fractured instruments, can also be carried out. The VDW.ULTRA is practical and convenient for high-comfort treatments.

Thanks to the patented auto-balance-system ensuring reliable automatic regulation, the VDW.ULTRA is able to deliver a constant and efficient performance for every application. The piezo-electric handpiece weighs only 50g and can be sterilised in an autoclave. Classic periodontal and scaling applications can also be carried out efficiently.

VDW provides a high-quality, tailor-made tip assortment for use in endodontics: irrigation files for thorough ultrasonic disinfection and the removal of biofilm, diamond-coated tips for efficient refinement of the access cavity, fine tips made of the innovative titanium-niobium alloy for delicate retreatments, as well as a robust tip to remove metal posts at high intensity.
Innovative products aid dentists in a worthy goal

An interview with Mark Clineff, SybronEndo

Mark Clineff has been General Manager of SybronEndo since July 2007. Though relatively new to endodontics, he is no stranger to the dental industry. He began his career with Ormco, the orthodontic division of Sybron Dental Specialties, in 1975 as a sales representative calling on orthodontists in the Chicago area. Over the next 30-plus years, Clineff held numerous positions in sales and marketing with Ormco, the last as executive vice-president of global sales.

roots: Let’s start with the topic at the top of everyone’s mind these days: the economy. How is the current downturn affecting dentists?

Mark Clineff: A common challenge for endodontists and general dentists alike is reduced production in a downward economy. Many endodontists I speak to tell me they’re seeing fewer referrals from their traditional sources. Patients are putting off procedures for as long as they possibly can, and with unemployment at near record levels, many patients just don’t have the money or the insurance to afford necessary dental procedures. Attracting new business via promotional ideas and offering more services are two ways doctors are tackling this challenge.

General dentists will likely keep more endodontic procedures in-house during this downturn. Root canal therapy (RCT) requires a high level of continuing education and technical skill. The challenges for the GP will be in diagnosis and knowing when to refer to a specialist. A correct diagnosis, combined with the right choice of endodontic materials and techniques, will increase the likelihood of a healthy apical periodontium for the patient.

What are some of the other challenges faced today by endodontists and general dentists who perform root canal therapy?

The challenges for the endodontist and the GP are really quite different. The services endodontists offer will have to expand in the coming decade. This is due in large part to the use of implants, as well as improvements in endodontic materials and methods that now allow GPs to do more endo. Endodontists will have to stay on the cutting edge through continuing education and early adoption of new technologies, to distinguish themselves from their peers. Those who take courses on sedation, implants, endodontic surgery and re-treatment will rise to these new challenges. Those who adjust to this new reality will be the most desirable referral sources in the future.

How is SybronEndo addressing these challenges?

SybronEndo’s purpose is to assist the clinician in preserving natural dentition while eliminating patient pain. We are fortunate that our products can help the clinician save the natural tooth through endodontic treatment before considering replacement with an implant or extraction. Our tag line as an organisation is “Safe files, superior fills.” If we can continue to develop breakthrough products, such as the exceptionally safe Twisted Files (TF) and superior filling methods like the Elements Obturation Unit (EOU), then we are on the right track. Our clinicians have a very worthy goal, and we are fortunate to be able to help them ensure higher endodontic success rates now and in the future. SybronEndo must remain committed to developing technology and products that drive patient and doctor satisfaction, increased efficiency, and reduced patient discomfort. In addition, we remain committed to offering hands-on courses around the world to enhance the understanding of endodontic treatment and the use of modern materials.

SybronEndo introduced its Twisted Files instruments in April 2008. What feedback have you received from your clinician customers who have begun using TF?

When clinicians talk, we listen. The message was clear: the customer wanted a rotary NiTi file that separates less, cuts better, and is more flexible than what was available. After several years of research and development, our engineers created a file that delivers everything asked for. Pre-market demand for this file was the highest we have seen for any SybronEndo product in history. Once the files were available, demand far outstripped supply. Today, TF is our fastest-growing file system, and the potential for 2009 is even greater. In response to this high demand, we are increasing our production capabilities and will be
introducing additional sizes in 2009. The bulk of these customers switched from competitive file systems. Many have told us that the TF is the strongest file they have ever used and that they are using considerably fewer files in the shaping process. You can’t go online to talk about endodontics without hearing some new convert raving about the TF.

The biggest hurdle is that doctors have to learn a new technique that requires less pressure, fewer files and fewer separations. But once they get the feel of the TF, they become converts. We are proud to have introduced a first-class file system that actually over-delivers on its promises. The TF is an innovation that will help define the future of endodontic shaping for years to come.

Where does all the excitement surrounding TFs leave K3 files?

As I indicated earlier, a large number of our TF customers came on board from competitive file systems. That, combined with significant international demand for rotary files this year, was a key driver of double-digit growth for the K3 line. This bodes well for the K3 franchise, as many clinicians feel it is the most durable ground nickel titanium file on the market. K3 is a great alternative for those looking for value and safety.

What can you tell us about the RealSeal 1 Bonded Obturator featuring Resilon technology? How is this product going to make treatment easier for clinicians and outcomes better for patients?

On 1 August 2008, Pentron joined the Sybron Dental Specialties family. One of Pentron’s best products is Resilon, a synthetic alternative to gutta percha that has been proven superior to gutta percha through clinical review and scientific investigation. Since then, SybronEndo developed and has now launched RealSeal 1 Bonded Obturator (RS1), which is the next generation in carrier-based filling for the root canal.

All the components of RS1 (made with Resilon)—sealer, filler and core—are resin-based materials and bond with each other to form a superior seal inside the patient’s tooth. This seal is important for the patient because it keeps bacteria from reinfecting the tooth. The result is an RCT that can potentially last a lifetime! Clinicians like RS1 because it’s easy to use and increases the likelihood of patient satisfaction, by reducing the chances of a failed root canal. Endodontic specialists like it because it’s easier to re-treat than competitive products, and the dual radiopacity enables them to see the core/material interface on their diagnostic radiograph.

What is SybronEndo doing to improve demand for endodontics in a world where implants are gaining increasing popularity?

Both procedures have similar success rates over the long-term. However, RCT clearly requires fewer follow-up treatments and gives the patient a result that can last a lifetime. Recent data suggest that implants have a higher percentage of postoperative complications.

While implants have their place and purpose, they cannot improve upon natural dentition. The cost of implants, both long-term and short-term, is significantly higher than traditional endodontic procedures. In today’s economic climate, and for the near future, I believe that SybronEndo is in a significant position for growth. As long as we can create products that drive clinician satisfaction in three key areas—clinical satisfaction, increased efficiency and reduced patient discomfort—we believe we will be a key player in developing and marketing innovations that improve success rates of and increase demand for endodontics.

The general consensus during and after the recent IDS was surprisingly positive. What general trends in endodontics were noticeable?

This was the first IDS meeting that I personally attended, and I was amazed at the size and scope of the meeting. It almost belies the fact that we are in a global recession. The message I came away with is that dentistry continues to have a very positive future in spite of economic challenges. Though we may have to adapt strategies in response to present conditions, the future of dental health is positive. With the increasing demand for the preservation of natural dentition, opportunities will continue to present themselves for our industry.

I would have to say that the increasing demand for high quality NiTi rotary files that demonstrate a resistance to separation would be the most obvious. I know this is an area in which we as an organisation continue to invest our resources. I think that most doctors are looking for safe files and superior fills that will increase their success rates. I also observed numerous innovations that were introduced at this strategic meeting. At SybronEndo, innovation defines our future, and we are committed to a steady flow of new products through our innovation funnel.

With IDS ticked off your list, what are your plans for the rest of the year?

With the introduction of two breakthrough products introduced over the past 12 months—TF and RealSeal 1—we have a very full agenda in bringing these products to market. We are conducting numerous hands-on courses throughout the world to introduce doctors to this new technology. We are also busy with a variety of other new product developments that we plan to bring to market in the very near future.

SybronEndo Corp.
1717 W. Collins Ave.
Orange, CA 92867 USA
Tel.: +1 800 346 3636
www.SybronEndo.com
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2009
The old landlady is waving to visitors from afar. In Lionas Bay, however, no further invitation is needed to indulge in dolmades and tsatsiki, followed by a serving of grilled fish. During the off season, the remote beach strip in the northern part of Naxos is only inhabited by a dozen people, all making their living at the local taverns. The few visitors, who stray from the main roads and wander down the narrow, dusty path, are treated to a delicious meal and homemade wine bottled in plastic water bottles—one of the many provisional arrangements you are certain to fall in love with.

Upon exploring the Hellenic civilisation, the famous German writer Johann Wolfgang von Goethe remarked: “Of all peoples, the Greeks have dreamt the dream of life best”; on Naxos, this dream is still much alive. According to the myth, Dionysus and Ariadne were married here. Like the gods, the island combines opposites that make it attractive: white sandy beaches cover the southern coast, while sparse mountain ranges and solitary villages dominate the northern regions. Roman Catholic and Greek Orthodox churches along massive Venetian castles and Hellenic cult sites tell of the island’s multicultural history. Greeks, Persians, Italians, and Turks long fought for dominance in the Aegean, and only since 1832 has the island been part of Greece.

Naxos lures locals, as well as tourists, with a more peaceful ambience nowadays. Visitors are greeted by the iconic Portara, the entrance to an unfinished...
temple from the 5th century BC. Although Chóra—as the capital is called by locals—has an airport, most visitors take the ferries that leave from Piraeus in Athens three times a day. On the airy decks, weekenders unite with backpackers and Greek grandmothers, who occasionally feed tourists with cookies and fruit. Security instructions should always be followed, since the ferries here tend to be overcrowded. Only recently have ferry workers protested against their poor working conditions.

With an area of 500 square kilometres, Naxos is the largest island of the Cyclades; yet, it managed to resist the mass tourism that swept through Greece in the 1980s and 1990s. As a result, you will not be able to find resorts or big holiday complexes that are common on other islands, like Crete and Rhodes. Instead, the island offers a vast number of decently priced apartments that will make you forget the buffet when you can enjoy breakfast on your sea-view balcony. The tourism business has brought moderate wealth to Naxos, which was formerly known only for its marble mining industry and its excellent citrus liqueur.

There is plenty to explore on the island: the still intact, picturesque Castro in Naxos-City with the Venetian Museum; the Temple of Demeter in the Naxos-City centre; the unfinished Kouros statue of Apolonas; the Dimitra temple near Sangri; and the Dionysus temple at Glinado, to the centre and north of the island. Agia Anna and Plaka, just outside Naxos-City, are the most well known beaches. But only a few kilometres south, each remote and beautiful beach is followed by another, connected only by twisting dirt tracks that challenge even the most experienced drivers.

A dusty road meanders invitingly down to Lionas Bay, and the journey is absolutely worth it as the landlady is sure to be expecting you already._
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The world’s largest dental show has defied the economic gloom. According to a preliminary report released by the organiser Koelnmesse at the end of March, the number of visitors this year increased by 6.9 per cent to over 100,000. The number of exhibitors also rose by 4.5 per cent to 1,820. International companies held a 65 per cent share, an increase of 10 per cent compared with the previous show in 2007.

The results confirm a slight decline in the German domestic market, which is significant for the local dental industry. Sales have dropped by 2.6 per cent to €1.58 billion compared with 2007; this is attributed mainly to financial constraints in the dental and dental technology sectors in the last quarter of 2008. Although dental physicians are the group of medical specialists who are the most willing to invest in the establishment of clinics, according to the latest results of the Institute of German Dental Physicians (IDZ), the overall investment trend has fallen significantly.

However, a survey conducted by the Association of German Dental Manufacturers (VDDI) found that export business expectations for 2009 are positive overall in spite of varying business development in individual regions. VDDI Chairman, Dr Martin Rickert said that 83 per cent of the member companies surveyed expect a rise in, or at least consistent, overseas sales for 2009. The export quota of the companies traditionally operating as ‘global players’ is 57 per cent.

“It is good news that in spite of the turbulence in the financial market, the dental industry and the health economy can, overall, sustain as solid markets,” Dr Rickert said during a press conference in Cologne. “IDS has confirmed its status as the international leading trade show in dentistry. We are certain that the show’s outcome will give positive signals for the global dental market and international health markets as well,” he added.
Endo events

2009

AAE Advanced Programs in Clinical Endodontics Symposium
Where: Seattle, WA, USA
Date: 7–9 August 2009
Tel.: +1 800 872 3636
E-mail: info@aae.org
Web site: www.aae.org

FDI Annual World Dental Congress
Where: Singapore, Singapore
Date: 2–5 September 2009
Tel.: +33 450 4050 50
E-mail: congress@fdiworldental.org
Web site: www.fdiworldental.org

Annual General Meeting
Canadian Academy of Endodontics
Where: Niagara-on-the-Lake, Ontario, Canada
Date: 26–30 August 2009
Tel.: +1 204 942 2511
Web site: www.caendo.ca

14th Biennial ESE Congress
Where: Edinburgh, Scotland
Date: 24–26 September 2009
Tel./Fax: +44 1494 581542
E-mail: info@eseedinburgh.com
Web site: www.eseedinburgh.com

145th Midwinter Meeting Chicago Dental Society
Where: Chicago, IL, USA
Date: 25–27 February 2010
Tel.: +1 312 836 7300
Web site: www.cds.org.mwm

1st Joint Scientific Congress of the German Endodontic Associations
Where: Wiesbaden, Germany
Date: 12–14 November 2009
Tel.: +49 341 484 74 202
E-mail: sekretariat@dgendo.de
Web site: www.dg-endo.de

Greater New York Dental Meeting
Where: New York, NY, USA
Date: 27 November–2 December 2009
Tel.: +1 212 398 6922
Web site: www.gnydm.org

2010

IADR 88th General Session & Exhibition
Where: Barcelona, Spain
Date: 14–17 July 2010
Tel.: +1 703 299 8095
Web site: www.iadr.org
submissions:

formatting requirements

Please note that all the textual elements of your submission:

- the complete article,
- all the figure captions,
- the complete literature list, and
- the contact info (bio, mailing address, E-mail address, etc.)

must be combined into one Word document. Please do not submit multiple files for each of these items.

In addition, images (tables, charts, photographs, etc.) must not be embedded into the Word document. All images must be submitted separately, and details about how to do this appear below.

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Article lengths can vary greatly—from a mere 1,500 to 5,500 words—depending on the subject matter. Our approach is that if you need more or less words to do the topic justice then please make the article as long or as short as necessary.

We can run an extra long article in multiple parts, but this is usually discussing a subject matter where each part can stand alone because it contains so much information. In addition, we do run multi-part series on various topics.

In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

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Please do not ‘center’ text on the page, add special tab stops, or use underlining as all of this must be removed before layout. If you require a special layout, please let the word processing programme you are using help you to do this formatting rather than doing it by hand on your own.

If you need to make a list, or add footnotes or endnotes, please let the Word processing programme do it for you automatically. There are menus in every programme that will help you to do this. The fact is that no matter how careful one might be, errors have a way of creeping in when you try to hand number footnotes and literature lists.

Image requirements

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- Images cannot be any smaller than 80 KB in size (or they will print the size of a postage stamp!).

Larger images are always better, and something on the order of 1 MB is best. Thus, if you have an image in a large size, do not bother sizing it down to meet our requirements but send us the largest file sizes available. (The larger the starting image is in terms of bytes, the more leeway the designer has in terms of resizing the image to fill up more space should there be room available).

Also, please remember that you should not embed the images into the body of the text document you submit. Images must be submitted separately from the textual submission.

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Please do not forget to send us a head shot photo of yourself that also fits the parameters above so that it can be printed along with your article.

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Please contact us for our Author Kit, or if you have other questions:

Managing Editor
Claudia Salwiczek
c.salwiczek@dental-tribune.com

about the publisher _submissions_
roots
the international magazine of endodontics

Publisher
Torsten R. Oemus
t.oemus@dental-tribune.com

Editor-in-Chief
Dr Karl Behr
k.behr@dental-tribune.com

Managing Editor
Claudia Salwiczek
c.salwiczek@dental-tribune.com

Product Manager
Bennhard Moldenhauer
b.moldenhauer@dental-tribune.com

Executive Producer
Gernot Meyer
g.meyer@dental-tribune.com

Designers
Yodit Tesfaye Walker
y.tesfaye@dtamerica.com

Nadine Ostermann
n.ostermann@dental-tribune.com

Copy Editor
Sabrina Raaff

International Media Sales
Europe
Antje Kahnt
a.kahnt@dental-tribune.com

Asia Pacific
Peter Witteczek
p.witteczek@dental-tribune.com

North America
Humberto Estrada
h.estrada@dtamerica.com

International Offices
Europe
Dental Tribune International GmbH
Contact: Nadine Parczyk
Holbeinstr. 29
04229 Leipzig, Germany
Tel.: +49 341 484 74 302
Fax: +49 341 484 74 173
www.dti-publishing.com

Asia Pacific
Dental Tribune Asia Pacific Ltd.
Contact: Tony Lo
Room A, 26/F, 389 King’s Road
North Point, Hong Kong
Tel.: +852 3113 6177
Fax: +852 3113 6199
www.dti-publishing.com

The Americas
Dental Tribune America, LLC
Contact: Anna Wlodarczyk
213 West 35th Street, Suite # 601
New York, NY 10001, USA
Tel.: +1 212 244 7181
Fax: +1 212 244 7185
www.dti-publishing.com

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