Minimally invasive and biomimetic endodontics: The final evolution?

By David J. Clark, DDS

Traditional endodontics has been based on feel, not sight. Tactile proprioception was the only guide as burs and files were blindly inserted into pulp chambers and root canal systems. Together with radiographs and electronic apex locators, this blind approach has produced surprising success, that, in the words of Dr. Eric Herbransen, “the endodontics succeeds often in spite of us.”

There is, however, a significant failure rate, especially long-term failure, that is driving mainstream dentistry to aggressively extract natural teeth in favor of implants. The sting of clinical failure is a powerful motivator for change. In this article, I will describe the rationale and techniques involved in minimally traumatic endodontic access and shaping (Part I). In my upcoming Webinar I will discuss obturation techniques for smaller and non-round endodontic shapes, which will also appear as a follow-up article in this publication (Part II).

Ribbons, sheets & laminate

One of the most distressing “hangovers” of the era of blind endodontics and endo-restorative is the belief that canal systems are round endodontic shapes, which will also appear as a follow-up article in this publication (Part II).

The evolution of endodontic shaping

The original endodontic shape was established based on mostly hand filing and filling with either silver points or cold lateral condensation of gutta-percha. Sargenti later introduced a more rapid approach that involved machine-driven instruments (rotary files) creating larger shapes with significantly more dentin removal. As of late, a crown-down approach is now popular. The roots are rapidly and blindly machined. This can result in better obturation of the apical half because of improved penetration of irrigation during instrumentation and improved hydraulics during obturation. But at what cost (Fig. 2)?

Is crown-down endo actually better than lateral condensation?

The outcome studies are inconclusive, but what we do know is that the success rate today is no better than it was 40 years ago (Fig. 5). The advantages of crown down are often offset by the weakening caused by Gates-Glidden burs and orifice shapers. The short-term thrill of the radiographic “puff of sealer” at the apex is lost when the tooth implodes a few years down the line. Residual dentin is directly related to long-term strength and has indisputably been shown as the key to long-term tooth retention.

In contrast, the supposed strengthening of the root from a “monolith” of bonded resin obturation, bonded core and fiber post is proving to be inconsistent. Another startling revelation is that the dentin in an endodontically treated tooth is not more brittle than in a vital tooth. In short, preservation of peri-cervical dentin and ferrule girth trump all other factors.

Ovoid canal systems & roots are non-round for a reason

Rotary instruments and obturating gutta-percha are round because of the limitations of their mechanical nature. They create anatomically appropriate shapes in round roots, but fail in ovoid roots. Over the ages, the dynamics of occlusion and arch form have guided the development of human tooth roots such that at least half have ovoid roots.

Smaller and/or ovoid shaping: Why and how?

Why? Biomimetics is a treatment approach that has, as its ultimate goal, to retain as much of the natural tissue as practical, and to mimic the physics and structures of the human body. There is nothing biomimetic about a stiff, round rod (prefabricated post) running through the center of an ovoid root.

The natural ovoid root is essentially a semi-rigid pipe deriving its strength from without, not within. The endodontic and endo-restorative goal should be to mimic the pulp space that was present when the tooth was young. From that point, it can be argued that any secondary dentin that is deposited adds little additional strength because of the amorphous and irregular deposition pattern. This point is supported by the robust strength of young teeth with large pulp chambers and large radicular pulp spaces.

If a small round access that does not disturb primary dentin can allow instruments to engage potentially significant complex anatomy (e.g., a second or third major system and corresponding portals of exit), then the round access is acceptable. The See ENDODONTICS, Page 8
reality of ovoid roots would seem to disagree with this approach.

Creating a large round access that results in removal of primary dentin of the delicate, narrow portion of the root is the common approach today. While this can allow access to complex branching of systems that occurs further apically, it does not satisfy the more appropriate goals of anatomic, biomimetic dentistry. Additionally, the single large round endodontic shaping pattern often encroaches upon a fluting in the center of the root.

How? Visually shaping ovoid systems. The three components of ovoid shaping are:
1) the operating microscope with powerful coaxial shadowless lighting,
2) ultrasonic instruments, and
3) an understanding of the anatomy of ovoid roots.

Anatomic, biomimetic shaping cannot occur safely “by feel” (Figs. 7, 8a, 8b).

**Summary**

Although no two roots are the same, general anatomic patterns allow the microscope-equipped clinician to search for major pulpal regions that will yield a high probability of cleaning and shaping the clinically available pulpal zones.

shapes that were introduced during the Schilder era have served as a transitional technique to allow the first real three-dimensional compaction of gutta-percha. Endodontics is, in reality, a restoratively driven procedure; and to be minimally invasive and to apply biomimetic principles will require different skills and materials to shape, pack and restore these non-round canal systems.

**References**


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**Attend Dr. David Clark’s Webinar!**

On March 14 at 1:45 p.m. E.S.T., Dr. Clark will present a one-hour Webinar, “World Class Obturation for General Dentists,” followed by a live question-and-answer session with the online audience.

Can endodontics be minimally invasive? Biomimetic? Last as long as implants?

The implant era has raised the bar for endodontics serendipitously as new tools and techniques allow for the next level of endodontic excellence. Instead of “blindly poking around” the pulp chamber and “maching” the delicate root with Gates-Glidden and large rotary files, there are other options! Once we have created the new shapes, then how can we perform ideal obturation? Join us to find out!

This is one Webinar in a five-part Webinar series that will be running over the course of the entire day to launch the brand new Dental Tribune Study Club. Participants will receive C.E. credits and attendance is free for the first 100 registrants. After the first 100 spaces are filled, the cost of the full-day symposium is only $49. Live attendees have 30-day access to the recorded Webinars to review at their convenience. Attendees require an online computer with audio capabilities. Please register at www.DTSTudyClub.com. Upon registration, you will be provided with a pass code. However, if you cannot attend the live Webinar, you may access the archived version for $49 by signing up on the site.
Beam may someday be the standard all over the country. While the cone and these centers are sprouting up together to create imaging centers and Gendex are now below $100,000 each, although new units from Kodak average around $170,000 to $200,000 in a single scan. It can take the maxilla and mandible nerve is relative to an impacted tooth filled with bones, if irregularities exist to determine the width of edentulous ridges, whether or not cancellous bone exists between cortical plates, and dentin preservation (Fig. 9). Guesswork is removed when it is critical to determine the width of edentulous ridges, whether or not cancellous bone exists between cortical plates, and canines, the new CK endo access burs provide optimum safety and dentin preservation (Fig. 9).

### Table 1: New microscope-enhanced protocol

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
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<tbody>
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<td>1.</td>
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<td>2.</td>
<td>Gross de-roofing with tapered diamond burs, retaining a small “soft fit.”</td>
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<td>3.</td>
<td>Provide straight-line access sweeping away from high-risk anatomy with the CPR-2D.</td>
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<td>Sweep the coronal ½ of the ovoid system with the CPR-2.</td>
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<td>5.</td>
<td>Sweep the next ½ or ¾ with the CPR-2D (Fig. 10b).</td>
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<td>6.</td>
<td>Irrigate, dry with the Sputnik syringe and then evaluate at 16–24x for multiple systems that branch in the apical half.</td>
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### Patient scheduling

Of all the duties and responsibilities of your staff, we hear more complaints about needing to fill the schedule than any other. The truth is that using the phone and paper-based systems is time-consuming, expensive and doesn’t allow for much interaction from our patients. Wouldn’t it be nice if there were some newer systems that could handle these chores with minimal input and time from us and, at the same time, involve the patient in the process? (You already know the answer to this!)

There are two basic types of systems out there: electronic and phone-based. The electronic systems all work in the same manner: once a patient is entered into the practice management software’s scheduler, it automatically generates an e-mail to the patient (you are selecting e-mail addresses, aren’t you?) that he or she can click to confirm the appointment. Reminders can then be sent at intervals you designate, such as two weeks and four days before the appointment.

The companies that use these systems include DemandForce, Lappoin and Smile Reminder. Smile Reminder also has a feature where you can send text message reminders to patients on their cell phones, such as reminding them to premedicate before appointments.

The other option is to use a phone-based system like the one used by Flexity. If you’ve used phone systems in the past, these are nowhere near as advanced as Flexity, which uses central software to track the calls and uses the hygienist’s or doctor’s voice. All of these systems run a couple of hundred dollars per month, but when you think about how much time and money is typically spent on phone calls, postcards and postage, etc., they are a real bargain.

### Patient activation

In the same vein, don’t you find it annoying when a patient shows up for the first appointment and has not filled out the forms that the practice sent weeks ago? That can really play havoc with a 45-minute hygiene visit. That’s why I love a program like Dentforms. Not only does it allow you to have the patient sign forms in the office that normally require signatures (HIPAA, insurance forms, etc.), but you can also direct patients to an online site where they can fill in all of their medical and dental information. That information is then automatically sent to the practice’s computer server so that the information is in your system long before the patient arrives.

Dentistry is evolving rapidly and being aware of the latest technologies will always put you one step ahead!

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### About the author

**Dr. David Clark**

Founded the Academy of Microscope Enhanced Dentistry and is a course director at the Newport Coast Oral Facial Institute. He lectured for Clinical Research Associates in the “Update Series.” In addition, Clark authored the first comprehensive guide to enamel and dentinal cracks based on 16 power magnification, and numerous articles relating to minimally invasive dentistry, biomimetic endodontic shaping, diastema closure and advanced magnification. Clark helped pioneer the concept of “biomimetic micro-endodontics.”

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