To oversimplify the complicated, the gist of endodontics is getting bacteria out of teeth and sealing them to prevent bacterial recurrence. Shape, clean, pack—the endodontic triad. Decades of research by smart, thoughtful clinicians and researchers have led us to an understanding of our procedural goals, and completing those goals is believed to lead to our highest possible rates of success.

When we talk about an endodontic shape, we’re talking about the hollow shape that we impart in the root by drilling and scraping the walls of the naturally existing canal, making it larger. The evolution of common endodontic shapes is the product of both research and clinical convenience. It’s our belief that we must create a certain amount of shape to physically debride the canal walls and to create room for the penetration of irrigants and proper obturation.1–6

The degree to which we enlarge the canal at the apex has been debated among endodontists for decades, but the consensus is that the apical canal should be enlarged at least to some degree, and then the remainder of the canal should be increasingly enlarged coronally to create a continuous taper to the orifice.1–5 This approach allowed better access for irrigants and obturation instruments available at the time, such as spreaders and pluggers, to reach to the apical preparation. Greater taper is also advocated to increase lateral obturation forces with warm vertical compaction of gutta percha. This design was well thought-out, but doesn’t come without risk.

Bacteria are the main cause of endodontic pathosis,7,8 so eliminating them and preventing their recurrence becomes the goal of endodontics. It makes sense to use bacteria removal as a metric in an attempt to predict clinical outcomes. A simple study design used is to inoculate extracted teeth with bacteria, then compare the efficacy of different techniques in their ability of removing the bacteria.3 The conclusions are used to predict that the superior technique will lead to superior success rates, and the technique is adopted clinically.

This type of inference is problematic when we realize that many endodontically treated teeth are lost because of structural failure, not just persistent infection. Root durability doesn’t appear to be a significant variable within the relative short scope of our outcome studies, but it may be more important than we realize for long-term success.
One size shouldn’t fit all

Our root-canal shaping objectives have evolved based on the results of bacterial removal and irrigation penetration studies, as well as clinical guidelines to facilitate obturation. Many clinicians base their go-to endodontic shapes on this literature, on popular opinion or even on “radiographic aesthetics.” Endodontic shapes are less often determined by the root canal anatomy of the individual tooth being treated.

Cookbook recipes are available for standardized root canal shapes. We now have one-file-does-it-all rotary systems that can shape every canal to the perfect universal shape. Shape, clean, pack … done!

But what if the perfect shape is simply not universal, or flat-out wrong? Is it necessary to hollow out a root as much as we’ve been doing to predictably save a tooth? Is it possible that too much shape can be detrimental in some cases—or in all cases? What if there was more than one way to skin a cat, and the cat might live a longer, happier life the other way?

This tooth, which I evaluated in 2008, had a major impact on the way I view shaping teeth. Tooth #4 presented with a previous RCT with a chronic apical abscess. Accepted and appropriate root canal shapes were used in this tooth, but the case had failed. It turned out that a longitudinal root fracture was present.

The fracture may or may not have been a direct result of the root shapes. Other factors influence root fractures, including propagation of existing coronal fractures, postspace preparation, metal posts and occlusion. The eye-opening finding was the strip perforation into the furcal concavity of the buccal root, created by a root shape that is typically accepted as “appropriate” for this tooth. This case is an example of an unforeseen iatrogenic failure. I believe that with today’s technology, the hazards of this type of case can be recognized and treated successfully.

Check out Dr. Boehne’s award-winning practice!

This issue’s Office Visit feature gives readers a peek at Dr. Daniel J. Boehne’s endodontics practice in Dana Point, California, which won a national design competition. Take your tour starting on page 36.

Case 1

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Next case study on p. 48
By the time I completed this case in 2015, I was taking preoperative CBCTs on many cases. Tooth #18 presented with a necrotic pulp and chronic apical abscess. Periodontal probing depths in the furcation were 15 millimeters. Root canal therapy was indicated to remove the infection and save the tooth, but the CBCT revealed that the root was only 0.3mm wide on the furcation side of the mesial root—a very dangerous danger zone. This means that there is almost no room for shaping without strip perforation and potential immediate loss of the tooth. But without adequate shaping, would it be possible to adequately clean and pack? Other than extraction, I didn’t have a choice but to try.

I shaped the mesiobuccal and mesiolingual canals to a #20 K-file with a balanced force technique. No attempt was made to create apical taper or push-pull file. A Tulsa ProGlider was used to shape the coronal third of the canal for a little bit of convenience form. EDTA and NaOCL were actively irrigated with an EndoActivator with a small (15/02) tip for 15 minutes, refreshing the NaOCL between canals. Ultradent Ultracal calcium hydroxide was placed with a NaviTip and brought to length with the EndoActivator. To prevent coronal leakage between visits, a double-layer temporary, consisting of Temp-it and bonded composite, was used to seal the access.

The patient was seen again in two months to repeat the irrigation steps and to place calcium hydroxide for another two months. The case was obturated at the third visit, after confirming healing of the periodontal defect with a 2mm probing measurement and bone regeneration radiographically. The periapical radiograph and CBCT showed excellent healing at the one-year recall.

Before this case, I’d seen cases even more conservative than this work in the hands of clinicians more skilled than I. The cognitive dissonance from all I knew about endodontics made it hard to believe that such conservative shapes could work on completely infected cases. This case didn’t prove to me that this technique was the best way to treat a root canal system—it certainly wasn’t the most convenient—but it did prove that successful endodontics is possible with minimal instrumentation.

I’m not here to say we’ve been doing it all wrong. Millions of root canal-treated teeth last a lifetime. The unfortunate reality is that millions also do not. In my practice it’s rare that a tooth can’t be saved just because of infection, no matter how severe. Conversely, it’s very rare that I can actually save a tooth with a fractured root. It’s the teeth with broken roots that patients end up losing.

It already is possible to complete successful endodontics with less impact on tooth structure; new systems and techniques can help us to better preserve tooth structure and disinfect teeth simultaneously. Two endodontic rotary file systems that I like to use are S.S. White V-Taper files and Dentsply Sirona TruShape files. Both systems will conservatively shape a canal and have an available maximum wire diameter of 0.8mm (compared with the common 1.2mm of many other systems). Both will create deep apical shapes while conservatively preserving dentin in the remainder of the root.

When using such conservative shapes, thorough active irrigation becomes critical. I use a combination of negative pressure irrigation with EndoVac and sonic irrigation with EndoActivator.
Conclusion

Advocating minimally invasive endodontics should absolutely not be misconstrued as license to be a lazy clinician; in fact, the opposite is true. Using conservative root shapes is a more arduous path to canal disinfection because extra steps need to be taken to supplement instrumentation. By relying less on instrumentation for debridement, extra emphasis must be placed on irrigation or the use of an interappointment medicament to make up for the difference. Remember, the goal of endodontics is not to get white lines to the apex on a radiograph, or to achieve radiographic aesthetics; it’s to eliminate bacteria to cure or prevent apical periodontitis. Advancements in imaging, magnification, instrumentation, irrigation and obturation have made endodontics predictable with conservative shapes ... as long as clinicians are willing to properly embrace the technology to thoroughly and thoughtfully treat these teeth.
Even complex root canal anatomy can be effectively treated with a conservative root shapes, as this case demonstrates. Tooth #29 presented with a necrotic pulp and symptomatic apical periodontitis. Note how the finished endodontic shape lacks a continuously tapering funnel shape. With this conservative shape, it was still possible to instrument, irrigate and obturate the complex apical anatomy. The PA radiograph and CBCT at the one-year recall show excellent healing. Also note how #32 was extracted as a result of a vertical root fracture in the mesial root.

The side-by-side images show that we’re fighting for only fractions of a millimeter of dentin, but this is a relatively large proportion of the root’s structure. The goal is to complete our endodontic objectives with less impact on the root’s strength. By preserving this strategic tooth structure, leaving stronger roots, we can retain functional endodontically treated teeth for a lifetime.

References
3. www.septodontusa.com