Creation of Larger MADs: The "Hybrid" Technique

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The endodontic literature is unequivocal that the creation of larger master apical diameters (MADs) is consistent with cleaner canals post instrumentation.[1–10] Achievement of larger MADs might be thought of as one piece of a larger set of "best practices" in endodontics. There is a strong argument to be made that traditional MADs are too small. This article was written to describe an easily achieved method for the creation of larger MADs as practiced by the authors.

Traditionally, there has been very little attention given to matching the size of the apical preparation to the anatomy of the specific root being treated. Virtually all of us were taught a "step back" (SB) sequence in dental school, and that we should instrument canals to three sizes larger than the first file to bind at the apex. Globally, this technique is still the educational norm. The basis for such technique is empirical, not supported by the literature.

In this technique, anterior teeth are generally taken to about a 40 ISO tip size (or larger) and the mesial roots of lower molars to a 25, etc. Arbitrary tapers and tip sizes are unrelated to individual canal anatomy and have more to do with the limits of older instrumentation systems and little if anything to do with modern

Fig. 1: Under prepared and transported canal.

capabilities. SB instrumentation methods often leave debris or push it apically, potentiate iatrogenic events, give reduced tactile sense, create less than ideal canal shapes and reduce effectiveness in obturation.

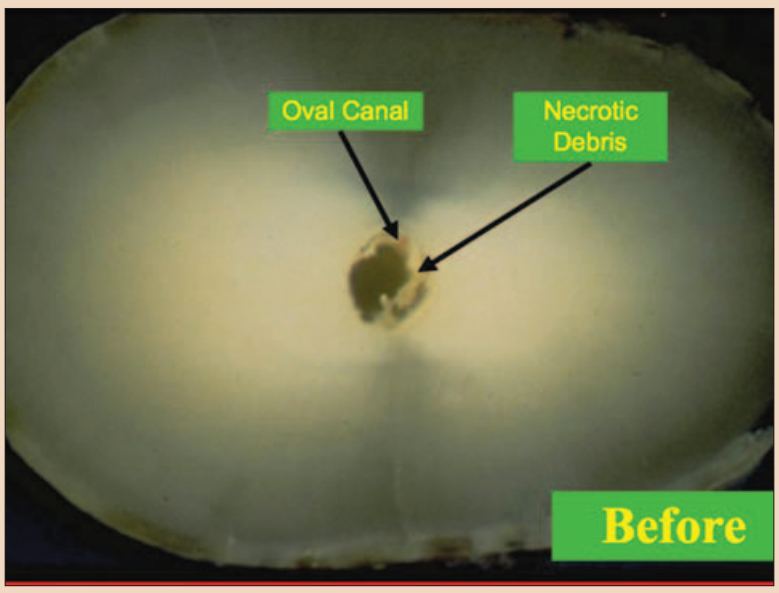
Preparation of larger MADs consistently removes necrotic tissue and circumferential dentin in the apical third allowing greater volumes of irrigation. More irrigation, especially in the apical third, produces cleaner canals by flushing of debris, antibacterial action and tissue dissolution. Enhanced debris removal reduces the frequency and severity of potential iatrogenic events. Larger MADs also make cone fit simpler (Figs. 1, 2).

There are three primary methods available (as practiced by the authors) to safely and efficiently prepare canals to larger than traditional MADs:

1) with the K3 system (SybronEndo, Orange, CA, USA) alone (Fig. 3),
2) with the LightSpeed system (LS) (LightSpeed Endodontics, San Antonio, TX, USA) (Fig. 4), or
3) a combination of these two systems.

Due to space limitations, it is not possible to describe all three methods in detail, but the third approach, a combination or "hybrid" technique, will be described in detail. The reader is directed to MounceEndo.com, SybronEndo.com and www.LightSpeedEndodontics.com for a variety of articles and information about these systems as well as references 11–40.

It is noteworthy to mention that LS files are fundamentally different in concept than other systems, including K3. LS files are not formed by grinding, the metal is stamped. Smooth shafted, the file cuts only on its end, which is ISO tip sized. Having no taper in its design, it generally drops easily to the true working length as one moves up the sequence from the smaller sizes to larger. Due to its non-tapered design, when LS is over stressed, failure occurs coronally (non-tip end), making the separated fragment much easier to retrieve. The "spade" end of the instrument design, without flutes or helical angles, eliminates clogged flutes, allows significant room to accommodate cut debris, reduces stress on the shaft and prevents self-threading. The LS is used with a slow continuous push.



Figs. 2a, b: Creation of a larger master apical diameter in cross section.

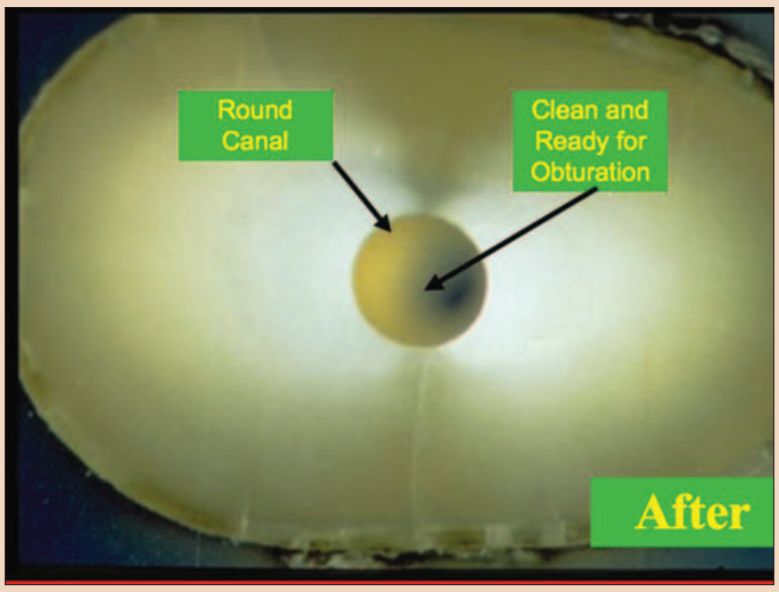


Fig.2b

Clinical technique described:

1. Creation of straight-line access and location of canals is accomplished first.
2. Irrigation is copious at all times during instrumentation with sodium hypochlorite and/or 2% chlorhexidine.
3. The tooth is instrumented "crown down" (the coronal third first, middle third second and the apical third last). Hand files precede rotary files, virtually always. Canals are first, in whichever third, negotiated by hand, the patency of the canal assured and a glide path created (the canal third is taken to at least a 15 K file) before rotary files are placed.
   Rotary nickel titanium (RNT) instrumentation follows glide path creation. The clinician instruments with RNT files from larger tapers to smaller and from larger tip sizes to smaller. Such a sequence is inherently crown down in that each instrument is able to progress further down the canal than its predecessor. Irrigation and recapitulation follow instrument insertion and the sequence is repeated as many times as necessary. The clinician does not move into the middle third of the canal until the coronal third is ideally instrumented, etc.
4. The coronal, middle and apical third are instrumented one after another to the true working length (TWL) in the manner above. Typically, using this sequence in average roots, the clinician will achieve approximately a .06-tapered preparation that will be approximately a 25 or 30.
5. Before creating a larger MAD, the canal must be gauged—the diameter of the minor constriction of the apical foramen determined. The K file that binds and resists displacement at the TWL is the diameter of the canal at the minor constriction. The clinician can then determine the size down to which he choses to instrument the canal. It must be mentioned that all irrigation, instrumentation and obturation should ideally be kept above the level of the minor constriction of the apical foramen. Transporting, ripping, tearing or oth-

Fig. 3: The K3 rotary nickel titanium file (SybronEndo, Orange, CA, USA).

Fig. 4: The LightSpeed rotary nickel titanium file (LightSpeed Endodontics, San Antonio, TX, USA).

erwise altering the apical foramen will lead to untoward clinical outcomes, which diminish clinical success. Canals can be gauged with hand K files or with LS files. Using the same LS files for gauging that are used to perform the final shaping can reduce the number of files needed.

6. After gauging, the clinician can take the preparation to the chosen MAD by simply enlarging the diameter of the gauged canal with LS (the Hybrid technique). If the canal gauges to a 30, the clinician would simply insert the LS files from a 30 to a 50 or 60 (clinician decision dependent) using them in order. It is possible to alternatively use K3 to finalize the preparation by simply taking the canal to successively larger file sizes at the TWL. For example, if the canal gauges to a 30, then a .02 tapered 35, 40 and 45 could be taken to TWL followed by a .04 tapered 40, 45, and 50 or a similar sequence until the desired tip and taper is achieved. K3 is more than sufficiently flexible to negotiate curvatures of all types if used with the correct tactile touch during its insertion.
7. SmearClear is the final irrigation rinse used to clear the smear layer and allow bonding the canal with a material like RealSeal (both materials SybronEndo, Orange, CA, USA), which diminishes to a statistically significant degree the potential for coronal microleakage.[41–50] Cone fit and obturation follow. While the authors do not utilize the Simplifil system for obturation (LightSpeed Endodontics), it is a valid technique for obturating canals instrumented in this manner, albeit a cold one.

Common Questions

If I create a given taper (.04 or .06), how does that influence the size to which I instrument the canal?

It doesn't. The creation of a larger MAD is simply a method to circumferentially enlarge the canal in the apical 3–4 mm of the root. The entire root does not have to be enlarged in taper to compensate for the minor enlargement in the apical 3–4 mm.

Does such preparation create a parallel shape in the apical 3–4 mm and in essence not create a continuous tapering funnel with narrowing cross sectional diameters?

If the canal is prepared with K3 in the coronal and middle thirds and finished off with LS apically, yes, in fact several millimeters of the canal in the apical third might be more parallel than it otherwise would be. This is not of any consequence clinically. Cone fit is far easier when a canal is instrumented to a larger MAD. If the clinician insists on creating ideal taper in the apical 3–4 mm, successively larger LS files can be taken short of the TWL in .5 mm increments.

How do I know to what size to instrument a canal once I've created the basic preparation and gauged the canal?

Determination of ideal MAD is not an exact science. That said, if a canal gauges to a 25-hand K file, it can easily and quickly be taken to a 50 apically with a LS file in less than a minute by advancing successively larger LS files. A canal that gauges to a 30 can be taken up to a 60 at the TWL in a similar time frame. In clinical practice, if a .06 K3 is taken to TWL to a 30-tip size, a 30 LS will immediately drop to the same length and is followed by a 35, 40, 45, 50, 55 and 60. Usually, these successive LS files will drop to the TWL with minimal resistance even though debris will come out on the head of the LS file.

What do I need to get started?

K3 files (.12, .10, .08 Shapers, .06 15-60, .04 15-60) 25 mm length and LS files in sizes

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25–70 in a 25 mm length. The 25 mm files are recommended because the clinician can read the laser markings without the use of a rubber stopper. Rubber stoppers can move during insertion and thus allow inaccuracy for the measurements taken. It is also noteworthy that LS files are rotated at higher speeds than their K3 counterparts (2,000 rpm versus 350 rpm, respectively) and the clinician will need to have electric motors and attachments that can make this change seamlessly.

Figs. 5, 6: Clinical cases treated with a hybrid technique utilizing K3 and LS files.

Fig. 6

Will I need to use all these files in every case? Isn't that a lot of files?

No, the clinician will not need to use every file in the above recommendations in every case. Alternative systems are often sold on the basis of having a limited number of files (as if that is a positive attribute of the given file system, which in the authors' empirical opinion it is not). In reality, the clinician may only use a few K3 files, less than five or six in alternative systems, the difference being that one is limited in clinical cases by a system that has a fixed and often restrictive number of files. K3 is a complete system that can handle any anatomy and can do so to a larger MAD as needed, there is no limitation.

In actual fact, the clinician often uses no more than five to six K3 files and, similarly, it is not necessary to use all the LS files either. In essence, even though the files may be packaged differently, the actual number of files used in either system (K3 and LS combination) or other systems is very much the same with the big advantage being that either the K3 alone or a K3-LS combination is a complete system suitable for all canal anatomies whereas many of the other systems, especially those with a limited number of files, are not.

How do I choose the taper to which I will instrument the canal?

Most canals encountered in clinical practice will be instrumented to a .06 taper. Bigger roots may be prepared to larger tapers and smaller and more curved roots to smaller tapers. If a canal can be enlarged to a 15-hand file, with RNT files it can enlarged beyond that diameter, irrespective of the curvature. It is not necessary to instrument especially curved canals by hand with the vital caveat to that statement being that the correct sequence, rotational speed, touch and RNT system is used.

The endodontic literature is very clear that the creation of larger MADs is correlated with cleaner canals. This paper has demonstrated one method of creating cleaner canals that is safe, effective and reproducible. DT

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