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

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

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

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

**Fig. 3.** Photo of a relieved reamer that negotiated easily to the apex in a highly curved canal.
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Yet, most dentists would admit that achieving that level of perfection is quite challenging using the tools Schilder had to work with. So, while it was possible to attain perfection with what previously existed, the incorporation of rotary NiTi made it possible for more dentists to achieve results approaching the excellence of Schilder.

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

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

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

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

To make this judgment, one would have to appreciate the beneficial effects of a reamer design in comparison to a K-file. Certainly, Schilder did have that appreciation. He noted in his papers that reamers engaged less along length reducing the resistance to apical negotiation. He noted the superior tactile perception, their greater flexibility and the increased ability to shave dentin from the canal walls.

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

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

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

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

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

All the rotary NiTi systems make sense if the premise for their use is based on the K-file, an instrument Schilder clearly understood to be a poor design for the function asked of it. None of the rotary NiTi systems make sense, if the better designed reamers — both unrelieved and relieved — are utilized with a short arc of motion either generated manually or in the reciprocating handpiece. Rotary NiTi addresses

Fig. 5a  Fig. 5b

Fig. 6  Fig. 7

Figs. 5a, 5b. Radiographs showing endodontic case performed with relieved reamers in a reciprocating handpiece.

Figs. 6, 7. Radiographs showing two more endodontic cases performed with relieved reamers in a reciprocating handpiece.
‘Once the relieved reamer records the curve, it is in effect a passive instrument with the blades shaving the dentin along the length of the canal walls on the downstroke and removing dentin on the upstroke wherever the dentist directs the length of the instrument to contact the canal walls.’


_S References_

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