



## The shaping movement Wave of the future

### Dr. Clifford J. Ruddle describes the latest advancements in endodontic files

Since the beginning of endodontics, there have been numerous concepts, strategies, and techniques for preparing canals. Over the decades, a staggering array of files has been produced for negotiating and shaping canals. In spite of the brand name, number of instruments required, and the surprising number of techniques advocated, endodontic treatment has been typically approached with optimism for probable success. Each new generation of files has advanced canal preparation methods through innovations in design, material, and movement.

From the outset, all instruments used for negotiating and shaping canals were manufactured from stainless steel, carbon steel, or related alloys. In 1988, Walia proposed Nitinol, a NiTi alloy, as it is 2 to 3 times more flexible, in the same file sizes, compared to stainless steel. A game-changing outcome of files manufactured from NiTi was that curved canals could be mechanically prepared utilizing a continuous rotary motion. By the mid-1990s, the first commercially available NiTi rotary files had come to market.

To appreciate the evolution of instruments, it is useful to know that all first-generation NiTi rotary files have *passive* cutting radial lands, fixed tapers over the length of their blades, and require a considerable number of files to achieve the preparation objectives. In 2001, the next generation of NiTi rotary files came to market. The critical distinctions of this generation of instruments are that they have *active* cutting edges and reduce the sequence of instruments required to fully prepare a canal. This generation of NiTi files includes the ProTaper® (Dentsply Tulsa) rotary files which, unlike all other passive or active NiTi cutting instruments, have multiple *increasing* or *decreasing* percentage tapers on a single file. This unique and revolutionary design feature has made ProTaper® the world's number one choice for shaping and finishing canals. Importantly, the ProTaper® system affords the shortest sequence of files to produce the most optimal deep shape.

During this period, manufacturers began to focus on other ways to improve the manufacturing process in order to increase the resistance to file separation. Some manufacturers electropolished their files to remove surface irregularities caused from the traditional grinding process. However, it has been clinically observed and scientifically reported that electropolishing dulls the sharp cutting edges. This requires the clinician to apply a more dangerous inward pressure, undesirably increasing the torque on the rotary file during work.


In 2007, manufacturers began to focus on utilizing new methods to manufacture NiTi instruments. This third generation of NiTi instruments reportedly provides greater flexibility and resistance to cyclic fatigue. Sybron Dental Specialties introduced R-phase heat treatment, a nongrinding process, and a so-called special-surface conditioning. Dentsply Tulsa Dental (DTDS) introduced a new proprietary thermal process, which resulted in a new metallurgical technology termed M-wire™. Research is now available that

shows M-wire™ has superior mechanical properties compared to files manufactured from traditional NiTi alloy.

Recently, there has been an increasing interest and renewed focus on reciprocation, which may be defined as any repetitive up-and-down or back-and-forth motion. However, all current market version reciprocating motors produce a file movement where the clockwise (CW) and counterclockwise (CCW) degrees of rotation are equal. Equal bidirectional movement requires undesirable inward pressure, limits cutting efficiency, and does not optimally auger debris out of the canal.

The latest advancements in canal preparation techniques have moved toward the long-hoped-for *single-file* concept. ReDent-Nova (Israel) recently introduced the Self Adjusting File (SAF), available in the United States through Henry Schein Dental. This file has a compressible open-tube design that is purported to exert uniform pressure on the dentinal walls, regardless of the cross-sectional configuration of the canal. The SAF is mechanically driven by a handpiece that produces both a short 0.4-mm vertical amplitude stroke and vibrating movement with constant irrigation.

A more promising single-file concept has been recently developed by Dentsply International. This single-file concept will launch in March 2011 and is termed WaveOne™ (DTDS and Maillefer) and Reciproc® (VDW). This new file represents a convergence of a unique design, M-wire™, and a newly designed reciprocating motor that produces the mechanical version of Roane's manual Balanced Force concept from 1985. The motor has been designed so the engaging or cutting angle is less than the elastic limit of the file. Strategically, the bidirectional angles are not equal, which means the file will rotate 360 degrees after a few CCW and CW cutting cycles. This novel reciprocating movement allows the file to more readily progress, efficiently cut, and effectively auger debris out of the canal. To address the full range of anatomy, the clinician selects a single WaveOne™ file from among three different apically sized and tapered files to shape and finish small, medium, and large diameter canals, regardless of their length and curvature.

Over the last 50 years, our profession has envisioned preparing canals utilizing a single-file technique. The future is now! The reality is that virtually all canals can now be optimally prepared using a single-file technique. You will definitely want to keep WaveOne™ on your radar so you can catch this remarkable wave. 



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