



# Endodontic canal preparation

## Rotation vs. reciprocation

**B**y far, the vast majority of commercially available files utilized to shape root canals are manufactured from NiTi and are mechanically driven in continuous rotation. On the other hand, reciprocation, defined as any repetitive back-and-forth motion, has been clinically utilized to rotate stainless steel files since 1958. Initially, all reciprocating motors and related handpieces rotated files in large equal angles of 90° clockwise (CW) and counterclockwise (CCW) rotation. Over time, virtually all reciprocating systems in the marketplace began to utilize smaller, yet equal, 30° angles of CW/CCW rotation.

When shaping canals, it should be appreciated that there are both advantages and disadvantages associated with utilizing a continuous rotating vs. a reciprocating movement. The greater tactile touch and efficiency gained when continuously rotating NiTi files in smaller diameter and more curved canals must be balanced with the inherent risks associated with torque and cyclic fatigue failures. In the endodontic world of continuous rotation, the ProTaper® system (Dentsply Tulsa Dental Specialties) offers a unique, progressively tapered design on each single file that has virtually eliminated these risks.

On the other hand, a mechanical reciprocating movement has merit because it somewhat mimics manual movement and reduces the various risks associated with continuously rotating a file through canal curvatures. However, current motors that drive reciprocating shaping files through small equal CW/CCW angles generally require multi-file sequences to adequately prepare a canal. Further, compared to continuous rotation, reciprocation methods utilizing equal CW/CCW angles decrease cutting efficiency, require undesirable inward pressure, and reduce the capacity to auger debris out of a canal.

To mitigate these clinical limitations, both WaveOne™ (Dentsply Tulsa Dental Specialties and Dentsply Maillefer) and Reciproc® (VDW®) were internationally launched as single-file shaping techniques. Unlike all reciprocating market version files that utilize equal CW/CCW angles, a new dedicated motor, termed e3™ (Dentsply Tulsa Dental Specialties), was developed for WaveOne that utilizes proprietary unequal CW/CCW angles. Because WaveOne has a reverse helix design, the CCW engaging angle is five times larger than the CW disengaging angle. There are three critical distinctions with this novel, unequal bidirectional movement.

One, a large CCW engaging angle does not compromise safety, as the angle utilized is always smaller than the elastic metallurgical limit of the file. Two, opposed to all other reciprocating systems that utilize equal CW/CCW angles, any given WaveOne file will more readily advance toward the desired working length (WL). This easier inward movement is because, after three engaging/disengaging cutting cycles, the file will have strategically turned one full CCW circle. Three, compared to equal bidirectional angles, unequal bidirectional angles strategically enhance augering debris out of the canal, which in turn, promotes the biological objectives for 3D disinfection and filling root canal systems.


Although, there are three WaveOne files available to effectively address a wide range of endodontic anatomy, generally only one file is required to fully shape canals, regardless of their length, diameter, or curvature. The WaveOne single-file shaping

technique can commence within any canal that has a smooth, reproducible glide path equivalent to a loose size 10 file. It is remarkable how a single WaveOne file can safely transition a secured canal from a size 10 file to a final shape that resembles a 25/08 file. The secret to this single-file concept is a unique file design, M-wire technology, and the reciprocating movement just explained.

Several studies have shown that a single-file reciprocating shaping technique utilizing unequal CW/CCW angles is over four times safer and almost three times faster than using multiple rotary files to achieve the same final shape. Pundits should not concern themselves with whether one file or multiple files are utilized to prepare canals, whether the movement is continuous rotation vs. reciprocation, or if the files are manufactured from stainless steel or NiTi, as long as the final shape fulfills the mechanical and biological objectives for shaping canals. The WaveOne concept represents a solution for any dentist who has concerns about any of the following:

- Using stainless steel files for shaping canals
- Breaking mechanically driven files
- Ledging curved canals
- Transporting the prepared foramen
- Using too many shaping files
- Mastering hybrid techniques
- Spending too much time preparing canals.

Because I am a co-inventor of both the ProTaper and the WaveOne systems, I am frequently asked the question, do I use continuous rotation or a reciprocation method to shape canals? The answer is, I use the ProTaper system in continuous rotation to prepare canals. My preference for ProTaper is attributable to the fact that this rotary shaping system is the safest and most efficient, and uses the fewest number of files to create a deep shape of 8 to 10%. The market has recognized the ProTaper advantages, as this system is taught in over 950 international dental schools to undergraduate dentists and is by far the number one file system utilized in the world today.

I helped develop the WaveOne system for those dentists who experience and report one or more of the problems previously identified. Whether you choose to prepare canals using continuous rotation vs. a reciprocation method, the three sacred tenets for shaping excellence are safety, efficiency, and simplicity. Regarding WaveOne, skeptics would be wise to remember, "A new idea is first condemned as ridiculous and then dismissed as trivial, until finally, it becomes what everybody knows." Keep this quote by the philosopher, William James, on your radar. 



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