



## CONTINUOUS V/S RECIPROCATING FILE MOTION – A REVIEW

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**Cite This Article:** Samrithi Yuvaraj & Dr. S. Delphine Priscilla Antony, "Continuous V/S Reciprocating File Motion – A Review", International Journal of Multidisciplinary Research and Modern Education, Volume 3, Issue 1, Page Number 262-264, 2017.

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### **Abstract:**

**Aim:** To review the continuous and reciprocating file motions in endodontics

**Back Ground:** The first endodontic file was crafted in the mid 1800's. This was basically a rudimentary k-file. K-files are, to these days. The most commonly used hand files in clinical practice. Automated instrumentation of the root canal was an early objective of clinical endodontics. Around 1992-1993, the first rotary NiTi instrument was introduced. These rotary NiTi instruments have undergone various modifications over the years to make them more effective and also to enhance their performance. But this system is not without drawbacks. Rotary files were always used in continuous motion. In order to overcome these drawbacks, reciprocation was introduced. This led to increase in the working life of these instruments. This study aims at reviewing both continuous and reciprocating file motion.

**Reason:** This review will give an idea about the advantages and disadvantages of both continuous and reciprocating file motion, thus helping to decide which offers the better treatment outcome.

**Key Words:** Continuous Motion, Reciprocation, Endodontic Files & Efficiency

### **Introduction:**

Earlier the shaping of the root canals was done using stainless steel hand files. This was followed by rotary instrumentation, which resulted in more successful and predictable outcomes during endodontic treatment. These rotary instruments were made of an alloy of nickel and titanium. This alloy had the properties of shape memory and super elasticity which made it superior to stainless steel. This is because stainless steel files underwent permanent deformation. The NiTi files on the other hand were more flexible and better able to follow canal curvature. These files also had a better resistance to fracture when compared to stainless steel files. But this does not mean that the NiTi files were without drawbacks. They were also prone to fracture when subjected to excess cyclic rotation. These files would also occasionally cause over preparation of canals.

Modifications of instruments continued beyond this, in order to make the instruments more effective and to improve on their drawbacks. Thus a slow but sure revolution has taken place with regard to endodontic instruments.

### **Wave One:**

The Wave One NiTi file system is a single use, single file system used to shape the root canal. Shaping the root canal is an extremely important step as it helps to completely remove all bacteria from the canal and also provides the perfect shape for obturation of the root canal. These files work with a reciprocating motion. Reciprocation is defined as any repetitive back and forth motion that has been clinically utilized<sup>[1]</sup>. These instruments have the advantage of flexibility, less debris extrusion and maintaining the canal shape. Wave One files also have an increased resistance to cyclic fatigue. There are three files in the Wave One single file reciprocating system. They are available in three lengths – 21, 25 and 31mm<sup>[2]</sup>.

- ✓ The Wave One small file is used in fine canals. The tip size is ISO21 with a continuous taper of 6%
- ✓ The Wave One Primary file is used in the majority of canals. The tip size is ISO25 with an apical taper of 8% that reduces towards the coronal end.
- ✓ The Wave One Large file is used in large canals. The tip size is ISO40 with an apical taper that reduces by 8% that reduces towards the coronal end.

These files work at a speed of 300rpm and a torque of 5Ncm. They have a triangular cross section at the tip.

### **Reciproc:**

The Reciproc system also includes three instruments – R25, R40 and R50<sup>[3]</sup>.

- ✓ The Reciproc R25 instrument has a diameter of 0.25mm at the tip and an 8% taper over the first 3mm of the tip
- ✓ The Reciproc R40 has a diameter of 0.40mm at the tip, 6% taper over the first 3mm from the tip.
- ✓ The Reciproc R50 has a diameter of 0.50mm at the tip and a 5% taper over the first 3mm from the tip.

These instruments have a S shaped cross section and demonstrate a progressive taper<sup>[4]</sup>. These files also have increased flexibility and a higher resistance to cyclic fatigue. The Reciproc file system works on the principle of reciprocating motion. It is suitable for preparation of curved and narrow canals.

**One Shape:**

The One Shape file system is a single file system that is used in continuous clockwise rotation. It has a design that incorporates different cross sections along the length of the file. This offers an efficient cutting action across all three zones of the root canal<sup>[2]</sup>. The instrument has a diameter of 0.25mm at the tip and a continuous taper of 6%. These files have a rotational speed of 400rpm and a torque of 4Ncm. These files have a minimal resistance to cyclic fatigue and are extremely flexible.

**Komet F360:**

The Komet F360 files are NiTi files with a taper of 4% along the length of the file. They have a double S cross section. The instrument is designed for single use in a patient. It works in continuous rotation at a maximum speed of 500rpm and a torque of 1.8Ncm. These files have increased resistance to cyclic fatigue. They are not as flexible as the One Shape files but have extremely sharp cutting edges. One of the major drawbacks of this file system is that they cannot be used in root canals with abrupt curves in the apical region.

**Protaper:**

The Protaper file system is an alternative to all other file systems. This is because unlike the other systems, it has a changing percentage of taper over the length of its cutting blade. This file system has a triangular cross section and a non-cutting modified guiding tip. It also has increased cutting efficiency and flexibility<sup>[5]</sup>. The Protaper file system has 3 shaping files

- ✓ 2 primary shaping files – S1 and S2
- ✓ 1 auxiliary shaping file – SX

and 5 finishing files – F1, F2, F3, F4 and F5.

**Protaper Next:**

The Protaper Next file system consists of five types of files – X1, X2, X3, X4 and X5. The X1 and X2 files have increasing and decreasing percentage tapered design on a single file, whereas PTN X3, X4 and X5 have a fixed taper from D1 to D3, then a decreasing percentage tapered design over the rest of their length. This type of taper design enhances the flexibility and cutting efficiency of the files. It also helps to conserve radicular dentin during shaping procedures<sup>[6]</sup>. These files work at a speed of 300rpm with a torque ranging between 2 to 5.2Ncm.

**Protaper Gold:**

This file system has increased flexibility and greater resistance to cyclic fatigue when compared to ProTaper Universal. These files are also extremely durable. It is the most efficient and versatile rotary system in the world<sup>[7]</sup>. This file system has both shaping files as well as finishing files. The ProTaper gold rotary shaping files are – SX, S1 and S2 and the rotary finishing files are – F1, F2 and F3.

**Hyflex:**

This file system has a double fluted Hedstrom design with a non-cutting tip. They are available in twenty nine sizes. The unique NiTi wire treatment makes these files extremely flexible without any rebound. This also provides higher fatigue resistance than standard nickel titanium files. For maximum efficiency the files are operated at a speed of 500rpm with a torque of 2.5Ncm.

**Mtwo:**

The cross section of this file system is an italic S with two cutting blades. The tip is non cutting. This file system has good cutting efficiency and good mechanical resistance. The Mtwo system has three rotary files designed for apical preparation – the Mtwo A and two files that are used specifically for retreatment – the Mtwo R. The three apical files vary in tip size and taper<sup>[8]</sup>.

- ✓ The A1 instrument has a tip diameter of 0.20mm and a 15% taper along the first millimeter.
- ✓ The A2 instrument has a tip diameter of 0.25mm and a 15% taper along the first millimeter
- ✓ The A3 instrument has a tip diameter of 0.25mm and a 20% taper along the first millimeter

The remaining portion of the instruments presents a 2% taper. These files are used at a speed of 300rpm.

The two files designed for retreatment are

- ✓ Mtwo R tip size 0.15mm with a taper of 5%. This file is used at a speed of 250 to 300rpm.
- ✓ Mtwo R tip size 0.25mm with a taper of 5%. This file is used at a speed of 600rpm.

**Heroshaper:**

These files have a triangular cross section with a non cutting tip. The blade shows a triple helix cutting edge. This file system provides an excellent combination of efficiency and flexibility. They have a varying taper along their length. The files are used at a speed of 450 to 600rpm with a torque of 1.2Ncm.

**K3 (Sybron Endo):**

The K3 rotary nickel titanium file system was introduced in North America in 2002. It has a wide range of applications and has significant resistance against cyclic fatigue. These files have 3 asymmetric surfaces with a non-active tip design. This asymmetric design makes the file flexible while still maintaining strength. They

range in sizes from 15 to 60 and have fixed tapers of 2%, 4% and 6%. They have maximum efficiency when operated at speeds of 300rpm. The K3 files have a variable core diameter which enhances their flexibility over the entire cutting length<sup>[9]</sup>.

**Trace:**

Race stands for reamer with Alternative cutting edge. The trace instruments have a triangular cross-sectional design with alternating sharp cutting edges, but the tip is non-cutting. These files are usually operated at a speed of 350 to 600rpm with a torque of 1.5Ncm. These files have excellent cutting efficiency and increased resistance to torsion and cyclic fatigue. This file system consists of three rotary files

- ✓ R1 – it has a tip diameter of 0.15mm and a taper of 6%
- ✓ R2 – it has a tip diameter of 0.25mm with a taper of 4%
- ✓ R3 – it has a tip diameter of 0.30mm with a taper of 4%

In addition to these two files, two more flexible instruments are available that allow treatment of highly calcified or extremely narrow canals. They are

- ✓ R1a – it has a diameter of 0.20mm at the tip with a 2% taper
- ✓ R1b – it has a diameter of 0.25mm at the tip with a 2% taper

**Flex Master:**

These instruments have round passive tips and a triangular cross section with sharp cutting edges<sup>[10]</sup>. This file system has tapers of 2%, 4% and 6% except the intro file which has a taper of 11%. These files have high cutting efficiency and improved torsional resistance. They are extremely flexible and are safe for use. They are used at a speed of 150 to 300rpm.

**Twisted Files:**

These files are extremely flexible and have great resistance. They have a triangular cross section with a non-active tip. They are available in two working lengths – 23 and 27mm and a variety of tapers -4%, 6%,8%, 10% and 12%. They are usually operated at a speed of 500rpm.

**Self Adjusting File:**

The self adjusting file adapts itself to the canal anatomy and shape. It is a hollow file with a diameter of 1.5 or 2mm with a 120mm thick Nickel Titanium lattice<sup>[11]</sup>. The lattice portion is abrasive and helps in removing dentin. These files have high torsional resistance and fatigue resistance. For maximum efficiency of action, they are operated at the speed of 3000 to 5000rpm.

**Conclusion:**

There has been much advancement in the field of endodontics over the last two decades. Some of these advances have been readily accepted while others have met with either resistance or doubt. This inability to accept change may be due to lack of proof or knowledge. While selecting file systems for clinical practice, there is no file system that is far superior to any other system. All the systems have their individual advantages and drawbacks. The selection of the files depends purely on the experience of the operator and the individual requirements of the patient being treated. It is important to remember that at the end of the day, our aim is to perform procedures that are safe and satisfying for the patient.

**Conflict of Interest:**

We declare that we have no conflict of interest related to the publication of this paper.

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