

REVIEW ARTICLE

WAVE ONE SINGLE FILE SYSTEM

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ABSTRACT : The root canal system is an arborizational, anastomotic, byzantine, labyrinthine complexity, morphologically comparable to a mosaic. While primary canals exist, the tributaries, accessory branches and lumina of dentinal tubules harbour extensive tissue and microflora which if left untreated remains vector for persistent and refractory pathology. Therefore root canal shaping and cleaning is of utmost importance in the success of root canal treatment. Number of systems are available for effective shaping accounting from hand files to nickel titanium rotary files to the new single file concept "WAVE ONE"

KEYWORDS : Wave One, Reciprocating Motion, Nickel Titanium, Reverse Balanced Force Technique, vCJD

INTRODUCTION

The concept of reciprocation was given in 1958 which utilised stainless steel files. A further later, in 1984 Roane and Sabala¹ demonstrated that if an instrument is rotated counter clockwise (CCW) it is more resistant to fracture as compared to the same instrument rotated clockwise (CW). Thereafter in 1985 Roane et al published an article on "Balanced Force Concept".² The advantage of reciprocation using unequal bidirectional motion was emphasised by Dr Ben Johnson in 1998. It was in 2008 that single file concept came to existence under the guidance of Ghassan Yared in 2011 both WAVE ONE and RECIPROC were internationally launched as single file shaping systems. We in this article will discuss about wave one.

WAVE ONE

Wave one file system follows concept of "less is more"³ as it is a single file system using reciprocating motion for shaping majority of the canals irrespective of their length, diameter or curvature (fig:1). It utilises unequal CW and CCW rotations based on the reverse balanced force technique.⁴ It is made up of M-Wire Nickel titanium alloy accounting to its increased strength, flexibility, shape memory and fracture resistance. The resistance to cyclic fatigue is 400% more than the commercially available Nickel Titanium files. The wave one system consists of wave one files, matching paper points, gutta percha master cones, carrier based obturators and carrier free gutta core obturators.

FILE DESIGN

Wave one file reciprocating system is available in lengths of 21, 25, 31 mm respectively. Each file system has 3 Wave one files termed as, Small 21/06 color coded yellow, Primary 25/08 red in color, Large 40/08 black in color. (fig:2)

The small Wave one file has a fixed taper all over

its length whereas the primary and the large Wave one files have fixed taper of 8% from D1- D3 and the taper decreases from D4- D16. This design improves flexibility and conserves remaining dentin in coronal two third of the finished preparation. All Wave one files have non cutting modified guiding tips with changing pitch and helical angle along the active portions. The blank design is unique with two distinct designs along its length. D1- D8 is modified convex triangle and D9-D16 is convex triangle (fig: 3). The files have left handed threads⁵ instead of usual right handed threads and reversed helix so CCW rotations engage the file whereas CW rotation disengages the file.

RECIPROICATION

Wave one utilises reciprocating movement with unequal bidirectional movement utilising unequal CW/CCW angles which is 4 times safer and almost 3 times faster than using multiple rotary files to achieve the same final shape.⁶⁻⁷ The engaging angle is 5 times the disengaging angle. The reciprocating movement minimises torsional and flexural stresses thus decreasing the cyclic fatigue⁸⁻¹⁰, increases canal centering ability (fig: 4) and reduces taper lock.¹¹⁻¹² It also preserves the original canal shape lacking canal aberrations resulting in increased antimicrobial and sealing efficiency, thus reducing the weakening of the tooth. Whereas the unequal bidirectional rotation increase the cutting efficiency, requires less inward pressure and results in better augering of the debris out of the canal.¹³⁻¹⁶

INFECTION CONTROL

There is a possibility of cross contamination associated with the inability to completely clean and sterilise endodontic instruments¹⁷ therefore, Department of Health in UK in 2007 recommended single use of dental instruments¹⁸ to reduce the risk of prion (vCJD) transmission¹⁹ as it was noted that the decontaminated instruments cannot be cleaned through NaOH, NaOCl or

guanidine thiocyanate immersion for 24 hours or through steam sterilisation. Therefore to make sure the single use of the files, the files are made of plastic color coded handle which becomes deformed once sterilised preventing the file from being placed again into the handpiece.

FILE SELECTION

Which wave one file to use for preparation?

This is decided by inserting a 10-K file into the canal using a glide path³(fig: 5).

- ♦ If the 10-K file is very resistant, use small wave one file.
- ♦ If the 10-K file moves to the full canal length easily, it lose or very lose, then use primary wave one file.
- ♦ If the 20-K file or larger goes to the canal length, use large wave one file.

METHOD OF PREPARATION

Shaping of the canal is directed towards flaring, flattening and finishing of the internal axial walls. The e3 motor (Dentsply Tulsa Dental Specialities) is specially engineered and programmed to drive wave one file system in reciprocating manner. Brushing motion is utilised to eliminate the hindrances to get a tapered preparation. With the estimated working length, in the presence of chelator 10 K file is inserted using a glide path which can “slip and slide” and “slide and glide”²⁰ over the apical one third of the canal. Accordingly, the file to be used for preparation is decided.

In 90% of the cases primary file is used for shaping of the canals (fig: 6). Gentle apically directed pressure is applied to run the file 2, 3, 4 mm inwards. After every few mm of advancement remove the file and inspect its flutes. Clean the flutes with gauge soaked in saline or NaOCl. Irrigate with 5% NaOCl, recapitulate using 10- K file and the re-irrigate to maintain the patency of the canal and to prevent apical extrusion of the debris.

The small wave one file is used in the canal that is narrow, longer and apically curved. In certain canals first the preparation is done with small wave one file and if more preparation is desired the primary wave one file is used. In this case, the small 21/06 wave one file is called as the “Bridge File” because it promotes safety when transitioning back to primary 25/08 wave one file.

Large 40/08 wave one file is used in larger diameter and straighter canals. The optimal preparation is checked by checking the file loaded with dentinal debris or with the snug fit of the corresponding hand K file. In cases where the diameter of the apical foramen is larger than 0.4mm then other shaping methods should be followed.

As we know cleaning and shaping are intertwined so focus should be towards obtaining clean foramens rather than round foramens. Wave one seems to be promising in fulfilling all the three tenets of shaping safety, efficiency and simplicity. Apart from reduced procedural errors, foramen transportation, ledge formation wave one file

system is easy to learn and teach. It also results in a canal which is better smoother and without zip, elbow or ledge formation.

But every object has a shadow, so do this system. No intermediate file system is available ranging between primary 25/08 wave one file to large wave one file 40/08. So this leaves no choice for the operator than to indiscriminately shave off the dentinal walls making the preparation too large. Moreover there is no wave one file system available beyond the apical diameter of 0.4mm.

CONCLUSION

Wave one file system is an exciting new concept in root canal preparation which seems to be promising. William James has rightly said” A new idea is first condemned as ridiculous and then dismissed as trivial until finally it becomes what everyone knows”. So, before incorporating this system into main stream of our practice it is important to self evaluate the pro’s and con’s of this system for best results.



Fig 1: A μCT image demonstrates the importance of treating root canal systems. (Courtesy of Dr. Frank Paque of Zurich, Switzerland.)



Fig 2: The small, primary, and large WaveOne files (DENTSPLY Tulsa Dental Specialities and DENTSPLY Maillefer)



Fig 3: This image depicts 2 different cross-sections on a single WaveOne

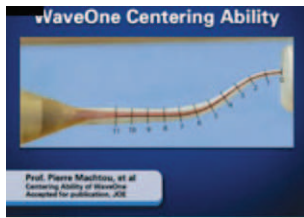


Fig 4: This image is a superimposition of the shaped canal over the original canal. Note the 25/08 Wave One file precisely followed the original pathway.
(Courtesy of Dr. Pierre Machtou of Paris, France.)



Fig 5: This graphic image is to emphasize that shaping can commence once any region of a canal has been secured with a size 10 hand file.



Fig 6: This graphic image shows the primary 25/08 Wave One file inside the glide path and following the secured portion of the canal.

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