Single file endodontics: boon or myth?

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ABSTRACT

In past, the stainless steel (SS) hand files were used for shaping and cleaning of root canals. These stainless steel (SS) hand fileshad number of drawbacks like canal transportation, more preparation time. This lead to introduction of a single file technique that has been developed for shaping the immense bulk of canals, irrespective of their diameter, length or curvature. They have made the root canal procedures safe,simple and less time consuming.

Key words: Stainless Steel Files, Single File System

Introduction

The term Endodontics is not complicated. The reality is, the more we know about the curvatures and innovations of the root canal systems, the more we are attentive of nature's anatomic complications. From the beginning of the modern era of endodontics, there have been many techniques, notions and strategies for preparing canal. The clinical endodontics step forward was succeeding from utilizing the long series of stainless steel hand files and various rotary gates glidden drills combined with nickel titanium files for negotiating or shaping the canal [1].The mechanical objectives of the root canal when properly performed, endorse the biological objectives for shaping canals, filling and three dimensional disinfection of root canal systems. Over the decades, numerous display of files has emerged for negotiating and shaping files. Every new file has a more developed canal preparation techniques through novelty in design ,movements and materials Now a days our profession has visualized preparing root canal using "single file technique". Recently the advances in endodontic root canal preparation focuses on the idea that "less is more". Subsequently a single file technique has developed for shaping the majority of canal, irrespective of their diameter, length and curvature. Single file endodontic concept has fundamentally changed everything in endodontics, conceptually, procedurally and economically as well [2].

Milestonesin the Development of Single File Concept Are

1980: Roane developed balance force technique, this was followed by development of passive radial lands, fixed taper. In **2001** active cutting edges with changing taper were introduced.In 2001**:** In there was development of active files, changing taper, changing cross section and unique movements

2007: New Ni-Ti metallurgy (i.e science of refining metals) was introduced.

VARIOUS FILE SYSTEMS

SELF ADJUSTING FILE [SAF]:

The self-adjusting file (SAF), a new concept in cleaning and shaping, is developed to overcome the problems of the nickel-titanium instruments. The SAF is a hollow file system, that is designed as an elastically compressible, thin-walled pointed cylinder, having 1. 5 mm diameter, composed of 120- mm-thick nickel-titanium lattice. It has high torsional and fatigue resistance. It is a single file that is used to achieve complete 3D root canal shaping and cleaning.

The SAF is available in following three standard lengths:

- 21mm
- 25mm
- 31mm

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The SAF is extremely flexible and does not impose its shape on the canal but rather complies with the canal's original shape. This innovative instrument consists of a hollow file having lattice threads that are lightly abrasive and allow dentin removal with a back-and-forth grinding motion.

As reported by Metzger *et al*. the SAF system has high mechanical durability, which overcomes the problem of file separation. The 1.5 mm and 2.0mm files may easily be compressed to the extent of being inserted into canal previously prepared with respectively a # 20 K-file. The file will then attempt to go back to its original dimensions, thus applying a continuous delicate pressure on the root canal walls. In a round canal, it will shape a round cross-section, whereas it will get shape a flat or oval cross-section in an oval or flat canal.

The SAF file allows for continuous irrigation throughout the procedure. The irrigation is performed by a special irrigation apparatus (VATEA Irrigation Device, ReDent-Nova). A irrigation device is attached by a silicon tube to the irrigation hub on the shaft of the file and having flow rates of 1 to 10 mL/min. [3].

WAVEONE

The Wave One Ni-Ti single-file system has been introduced by Dentsply Maillefer. The system is designed to be used with a reciprocating motion motor. The Wave One single-file reciprocating system is available in lengths of 21, 25 and 31mm:

1. The Wave One Small file (**Yellow**) is used for fine canals. The tip size is ISO 21 and continuous taper of 6%.
2. The Wave One Primary file (**Red**) is used for the majority of canals. The tip size is ISO 25 and apical taper of 8% that reduces towards the coronal end.
3. The Wave One Large file (**Black**) is used for large canals. The tip size is ISO 40 and apical taper of8% that reduces towards the coronal end.

It shapes the root canal to a tapering funnel shape that not only fulfills the biological requirements for adequate irrigation but also provides the perfect shape for 3-D obturation. The Wave One concept provides a single file shaping technique, irrespective of the length, diameter, or curvature of any canal.

In fact, it has been proved that a single-file reciprocating shaping technique that utilizes unequal CW/CCW angles is over 4 times safer and almost 3 times faster than using multiple rotary files to get the same final shape.The counterclockwise (CCW) movement of Wave One file is greater than the clockwise (CW) movement. CCW movement advances the instrument, by cutting the dentine and CW movement disengages the instrument from the dentine before it can lock into the canal. Three reciprocating cycles completes one complete reverse rotation and thus the instrument gradually advances into the canal with little apical pressure required. The specially designed Ni-Ti files works in a reverse "**Balanced Force**" action using motor to move the files in a back and forth "reciprocal motion". The files are manufactured using M-Wire technology, that improves strength and resistance to cyclic fatigue by nearly four times in comparison to other brands of rotary NiTi files [4].

Advantages

1. Only one NiTi instrument per root canal.
2. Better control of file breakage and thus increased patient safety. Less instrument separation is due to unique reciprocating movement that will prevent the instrument advancing from plastic deformation to its plastic limit.
3. Eliminates procedural errors by using a single instrument rather than using multiple files;
4. Simplicity: There is no need for disinfecting, cleaning, sterilizing and organizing the Wave One NiTi files.
5. Optimal cutting efficiency

RECIPROC FILE

It is manufactured by VDW, Munich, Germany. The nickel-titanium (Ni-Ti) file Reciproc completely prepares and cleans root canals with only one instrument. These files are made of M-Wire that is created by an innovative thermal-treatment process. The M-Wire Ni-Ti increases flexibility of the instruments and improves resistance to cyclic fatigue. These files are used in a reciprocal motion.

Reciproc files are available in following sizes:

- 25, taper 08;
- 40, taper 06;
- 50, taper 05

The reciprocating movement relieves the stress on the instrument and, hence reduces the risk of cyclic fatigue caused by compression and tension.The reciprocation motion consists of a counterclockwise (cutting direction) and a clockwise motion (release of the instrument).The angle of the counterclockwise cutting direction is greater than the angle of the clockwise direction that continuously progresses the instrument towards the apex of the root canal. The manufacturer of Reciproc instruments does not recommend creating a glide path when using these files. Reciproc instruments

possess sharp cutting edges, having a continuous taper over the first 3 mm of their working part followed by a decreasing taper until the shaft. They have S-shaped cross-section that is used for the entire working part of the instruments. The use of Reciproc decreases the preparation time by nearly up to 60% [5].

ONE SHAPE

Simplifying endodontic procedures with safety and effectiveness is the primary goal. MICRO-MEGA introduced One Shape. It is a Ni-Ti instrument used in continuous rotation. It has a non-working (safety) tip that ensures an effective apical progression, avoiding obstructions which are often preceded by instrument separation. A root canal treatment is approximately 4 times faster compared to conventional treatment which results in overall less treatment duration. The risk of separation is eliminated due to minimal fatigue along the length of the file. One Shape has three zones of cutting. The first zone presents a variable 3 cutting – edge design. The second has a cross-section that progressively changes from 3 to 2 cutting edges. The last (coronal) is provided with 2 cutting edges.It is a Ni-Ti instrument used in continuous rotation for quality root canal reparation 6% taper, 400 RPM, 4 N/Cm^2 torque [6].

F360

F360 is a single instrument used in continous rotation. The F360 (Komet, USA) endodontic file systemprepares most root canals with a simplified, time-saving sequence requiring only two files. The files have a unique S-curve design and a thin instrument core that delivers a high level of cutting efficiency maintaing natural root canal morphology. F360 files are available in two sizes 025 (Red F360) and 035(Green F360) that are required for most root-canal preparations. They have 0.04 taper providing optimal debridement of the canal, maintains file flexibility and thus reduces preparation errors and permitting ideal shaping of the root canal.

In addition the F360 files are offered in sizes 045 (White F360) and 055(Red F360) to meet clinical situations such as wide roots, and all files are available in three lengths L21, L25 and L31.They are available as pre-sterilized, single-use filesthat prevents cross contamination, eliminates the need to sterilize the instruments and reduce the risk of fracture due to cyclic fatigue [7].

The advantages of F360 are

- highly flexible
- Minimize canal transportation

T File

This file was introduced in the year 2014, by miraculous dental solution in India. The file is available in tip size of 21, 25, 30 and 40 with a taper of 8% having length of 21, 25 and 31 mm. This file has a convex triangular design which provides better rotation and proficient cutting.The file has no screw in effect and is capable in debris removal efficiently. T-Files has nano coating, which makes them supple and resists them to wear and tiredness breakage [8].

Reciprocation and Rotary Motion

Single file system (reciproc and wave one) utilizes a reciprocating movement of unequal CW and CCW cutting angles versus purely rotating movement of NiTi files in order to overcome the complication of torsional fracture. The reciprocating movement aims to reduce this risk by engaging the file in a cutting motion, and then immediately disengaging it in a non-cutting motion. The cutting/engaging motion is designed to be below the elastic limit of the file, so that torsional fatigue is minimized or avoided all together. One of the key advantages of reciprocating motion is that it reduces the effects of torsional fatigue on the instrument, which thereby increases the cyclic fatigue life of the instrument when compared to instruments used in rotational motion. This ultimately leads to a safer endodontic instrumentation because file fracture is avoided or the time required before the instrument fractures is prolonged. One of the many reported advantages of Ni-Ti rotary instrumentation is that the action of the rotary motion augers debris up and out of the canal space minimizing the amount of debris that is extruded into the apical tissues. Extrusion of debris, which may include dentin chips, necrotic pulp tissues, microorganisms, and intracanal irrigants, may cause increased inflammation, postoperative pain, and a delay in healing of the apical tissues after endodontic therapy.

Conclusion

The Single File System is an exciting all new concept in the preparation of the root canal. Normally while preparing root canal the multiple NiTi files of different diameter and taper are used to gradually enlarge the root canal. But with the introduction these single file system only one file is required to prepare the canal to an adequate size and taper, even in narrow and curved canals. These files not only shape the canal, but

decrease the working time too by preparing the canal extremely quickly in many instances. Further research and clinical results are required for better application of these file systems. Is single file system ,the solution for every canal encountered? If you ask a salesperson, the likely answer is "yes". Inside the operatory door, my answer is "no". If these and other technologies and materials are all superior, why are there so many options, and why do some manufacturers sell so many different systems within the same category, for example, multiple instrumentation systems? I suspect in large measure, because at the present time, none is truly superior. If any one system or method were truly superior, we would all be using it, and all the time! Regardless of which clinical space one lives in, endodontist or generalist, the best procedure is one where the materials and techniques employed are chosen individually for the specific indication, not made to fit from limited options. Patient and doctor, and ultimately the profession, will all be the better for it.

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