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USE OF ROTARY INSTRUMENTS FOR BEGINNERS IN ENDODONTICS

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ABSTRACT
In the field of endodontics revolution transpired over the years. The modern endodontic specialty practice has little resemblance to the traditional means. There is a lot of transformation, in the materials used and the type of instrumentation. Initially, stainless steel was the material of choice and manual instrumentation was the only means of cleaning the root canals. However, there is a tremendous change in the modern endodontics, due to introduction of NiTi (Nickel Titanium) files and rotary instrumentation. NiTi was developed 40 years ago in the Naval Ordinance Laboratory (NOL) in Silver Springs, Maryland. Therefore, the acronym Nitinol is used worldwide for this unusual type of alloy with better flexibility and fracture resistance. Rotary systems that evolved over years in to different generations differ in the series of instruments included. Hence, it is essential for the beginners to understand the differences among all the available systems and their usage which are highlighted in this review article.

KEYWORDS: Acronym Nitinol, Naval Ordinance Laboratory (NOL).

INTRODUCTION
The introduction of automated instrumentation in endodontics represented a major advance in progress for this specialty, with improvements in the quality and predictability of root canal preparation and a significant reduction in procedural errors. In recent years, endodontic instruments have undergone a series of changes brought about by modifications in design, surface treatments, and thermal treatments. In addition, new movements have also been incorporated to offer greater safety and efficiency, optimizing the properties of the NiTi alloy, especially through eccentric rotary motion. An understanding of the mechanical properties of these new NiTi instruments and their effect on the clinical performance of root canal preparation is essential if dental practitioners are to select the instruments that provide optimal clinical outcomes, especially in curved or flattened canals.

Nickel-titanium (NiTi) rotary files to endodontics nearly two decades ago has transformed the system of root canal preparations, permitting complicated root canals to be shaped with fewer practical errors. In 1889, William H. Rollins developed the first endodontic hand piece for automated root canal preparation and used specially designed needles with a 360 degree rotation and 100 Revolutions Per Minute (RPM) limited speed to avoid instrumentfracture. The first description of the use of rotary devices seems to be given by Oltramare in 1892, he used fine needles with a rectangular cross-section, mounted them into a dental hand piece and passively introduced into the root canal up to the apical foramen and initiated rotation.

The Cursor filing contra-angle was developed in 1928 by W&H (Burmoos, Austria) which combined rotational and vertical motion of the file. In 1958 W&H company started marketing the Racer-hand piece in Europe which worked with a vertical file motion. Later in 1964, MicroMega (Besancon, France) started marketing the Giromatic in Europe with a reciprocal 90 degree rotation. Endodontic handpieces such as the Endolift (Kerr, Karlsruhe, Germany) with a combined vertical and 90 degree rotational motion and similar devices were marketed during this period. A period of modified endodontic handpieces began with the introduction of the Canal Finder System (now distributed by S.E.T., Grobenzell, Germany) by Levy. Hand instruments made from NiTi were first described by Walia. NiTi rotary instruments which were introduced later are with low speed and 360 degree rotation, follow the mechanical principles given by William H. Rollins.

One Shape Single Rotary File System[4]
One Shape, the one and only Nickel Titanium instrument in continuous rotation for quality root canal preparations. One Shape allows for curved canal negotiation with an instrumental and easy dynamic. Its non-working (safety) tip ensures an effective apical progression avoiding obstructions which are often preceded by instrument

separation. The instrument is with a variable cross-section. It has an original and innovative instrument design. A micro-mega innovation. i.e. the instrument presents with a variable cross-section along the blade. One Shape principle: 3 different cross-section zones are present. The first zone presents a variable 3-cuttingedge design. The second, prior to the transition, has a cross-section that progressively changes from 3 to 2 cutting edges. The last (coronal) is provided with 2 cutting edges.[5]

ProTaper NEXT[6]

The ProTaper Next files offer improved efficiency with fewer files when compared with the ProTaper Universal files. It has following features:

- Variable taper like ProTaper Universal files.
- Rectangular off-center cross-section design for greater strength.
- Unique Asymmetric Rotary (AR) Motion that further enhances ProTaper canal shaping efficiency.
- The patented design's axis of rotation differs from the center of mass. As a result, only two points of the rectangular cross section touch the canal wall at a time.
- PROTAPER NEXT's AR Motion allows you• to achieve a fully tapered canal with fewer files. The result is the predictable ProTaper shape you expect — with greater procedural efficiency.
- Proven M-Wire Nickel Titanium alloy for• increased flexibility and resistance to cyclic fatigue as compared to traditional NiTi.

REVO-S[7]

Revo-S, is a unique and innovative system which uses only 3 instruments. It is meant for initial endodontic treatment. It has asymmetrical cross section. Initiates a snake like movement inside the canal. It has 3 cutting edges, all located at 3 different radiuses, R1, R2 and R3. The smaller section allows more flexibility and offers a better ability to negotiate curves.

The asymmetrical cross section increases the available volume for upward debris removal. Its protocol is follows:

Initial penetration[8]

- The first step consists of an initial penetration of the canal using a conventional stainless steel hand instrument (usually a K file No10 – MMC No10 L21 mm) which provides information about the canal anatomy complementary to that obtained by the pre-operative X-rays.
- The use of ENDOFLARE is recommended (The MICRO-MEG A +).
- The G-File safely enlarge the glide path in preparation for RCT with rotary instrumentation system (The MICRO-MEGA +).
- The instruments should be removed frequently from the canal and cleaned using a compress in order to eliminate the dentine debris.

Irrigation[10]

The canal should be thoroughly irrigated using• sodium hypochlorite between the use of each instrument. The use of a chelator is advised for instrument lubrication and dentine debris removal.

Apical Finishing[11]

- The AS instruments should be used without apical pressure, after using the SU.
- If necessary and according to the root canal• anatomy, use the AS30, AS35 and AS40 to enlarge the apical region. Their penetration depth corresponds to the working length. This length is shortened in thin root canals or with a marked curvature. They are then used in a step back motion (AS30 at WL, AS35 at WL -0.5 mm, AS40 at WL -1 mm if necessary).
- For a perfect apical finishing, use the sequence:
- AS30 only for an apical finishing at 30/100
- AS30 then AS35 for an apical finishing at 35/100.
- AS30 then AS35 and finally AS40 for an apical• finishing at 40/100.
- If an AS instrument fails to reach the working length, continue the preparation using the former instrument in order to work without any apical pressure.

Self Adjusting File (SAF)[12-18]

The SAF (ReDent-Nova Israel) is a hollow file designed as a compressible, thin-walled pointed cylinder either 1.5 or 2.0 mm in diameter composed of 120- mm-thick nickel-titanium lattice.

Mode of operation

- The 1.5-mm file may easily be compressed to the extent of being inserted into any canal previously prepared or negotiated with a # 20 Kfile. The 2.0-mm file will easily compress into a canal that was prepared with a #30 K-file.
- The file will then attempt to regain its original dimensions, thus applying a constant delicate pressure on the canal walls.
- When inserted into a root canal, it adapts itself to the canal's shape, both longitudinally and along the cross-section. In a round canal, it will attain a round cross-section, whereas in an oval or flat canal it will attain a flat or oval, providing a three dimensional adaptation.
- The surface of the lattice threads is lightly abrasive, which allows it to remove dentin with a back-and-forth grinding motion.
- The SAF is operated with transline (in and out) vibrating handpieces with 3,000 to 5,000 vibrations per minute and an amplitude of 0.4 mm. Such a handpiece may be the KaVo GENTLE power or equivalent combined with either a 3LDSY head (360_ free rotation; Kavo, Biberach Riss Germany) or MK-Dent head (360 degree free rotation; MK-Dent, Bargteheide, Germany) or RDT3 head (80

rpm when free and stops rotating when engaging the canal walls, recently developed by Re- Dent-Nova, Ra'anana,)
- The irrigation tube is connected to a continuous-flow source and has an on-off switch (white).
- The vibrating movement combined with intimate contact along the entire circumference and length of the canal removes a layer of dentin with a grinding motion.

Advantages and Characteristics Features of SAF[19-24]
- An Self-adjusting File that Adapts Itself to the Three Dimensional Anatomy of Root Canals
- Uniform Removal of Dentin and Remaining Wall Thickness
- Prevention of Canal Transportation
- High Durability
- Continuous Irrigation with Sodium Hypochlorite
- Removal of the Smear Layer in the Apical Part of the Canal

Twisted Files (TF)[25]

TF (Sybronendo) is a recently introduced Nickel Titanium engine-file manufactured with a twisting method. It was reported to have a higher fracture resistance than ground files. The manufacturer claimed that TF has a different surface texture (natural grain structure) that runs in the longitudinal direction and that the instrument is made of the Rphase of Nickel Titanium alloy (although no transition temperature data are presented). It was further claimed that these features serve to raise the flexibility and the fracture resistance of the instrument. There is also an absence of transverse-running machining marks (as a result of electropolishing) that would result in slower crack initiation and propagation. To date, only very few reports of the fatigue behavior of this new twisted Nickel Titanium file are available.

CONCLUSION

Rotary instrumentation is an exciting and valuable advancement in canal preparation. The concept of shaping the root canal walls and maintaining the original canal curvature and shape has now become the prime motive of designing the new generation of Nickel Titanium rotary files. Understanding the fundamentals of file designs, along with the ease of operating them and combining them with preclinical trials, aids in choosing the ideal rotary Nickel Titanium file. Better apical cleaning, the essence of successful therapy, is now possible with the latest generation of rotary nickel–titanium instruments. In contrast to stainless steel files Nickel Titanium instruments have sufficient cleaning ability and can preserve the root canal anatomy. Thus appropriate handling of engine driven Nickel Titanium systems in combination with sufficient irrigation facilitates endodontic treatment. To minimize the risk of instrument fracture the use of Nickel Titanium rotary instruments with torque controlled motors not exceeding the recommended speed for the specific system should be used. However, each rotary system has its own advantages; so a hybrid concept should be utilized to gain optimum advantage of the newer generation rotary systems.

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