The Effect of Recently Introduced Rotary Nickel Titanium Root Canal System on the Canal Centering Ability and Apical Transportation (Invitro Study)

Thesis

Submitted to the faculty of dentistry
Ain Shams University

For

Partial Fulfillment of the requirements of the master degree
In

(Endodontics)

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2009

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Cleaning and shaping of the root canal system is an important objective of root canal therapy to receive three dimensional obturation. Maintaining the original path of the canal is also important and is more of a challenge in small curved canals, which present bends and curves that may not be apparent on a conventional radiograph.

The shaping of curved canals presents a considerable problem for practitioners when stainless steel instruments are used. There is a tendency for all preparation techniques to transport the prepared canals from its original axis. Deviation from its original curvature can lead to procedural errors, such as ledge formation, zipping, stripping and perforation. As a consequence, new endodontic instruments and techniques have been introduced with help to minimize these risks.

Nickel titanium instruments were first introduced in endodontics to overcome the limitations of stainless steel instruments and make the preparation of curved canals much easier. Ni- Ti alloy is non magnetic, self resisting and water proof when this alloy is subjected to stress and upon release of this stress, the structure reverts back to its original case.

During the last ten years, scientific evidence has clearly shown that rotary Ni- Ti instrument used in a crown down fashion produced constant canal shape, less debris extrusion and stay well centered inside the root canal, despite these advantages however, c1inical experience has underlined some deficiencies of the current systems and a real need to increase flexibility in larger size and tapers, increase cutting efficiency, better safety in use and enhanced user with fewer instruments and simpler sequences. For these reasons there are new rotary Ni-Ti instruments that are discovered to overcome these needs.

Although nickel titanium endodontic rotary instruments do overcome the shortcomings associated with stainless steel instruments such as canal transportation and excessive dentin removal, we must know the fact that although these instruments are flexible, they will eventually fatigue when become overstressed. And so a need to introduce recent rotary nickel titanium systems to overcome the shortage of the old systems was a must.

Any new root canal instrument should be evaluated regarding its physical and mechanical properties, and most importantly its effect upon root canal shape and path.

Nickel titanium rotary instruments have become very popular for endodontic treatment because their much lower elastic modulus, compared with stainless steel, enables these instruments to negotiate curved root canals with considerably lower likelihood for failure. Nickel titanium rotary files keep tile original path of root canals with minimal deviation and have more ability to clean the canals with less risk from canal transportation, perforation and zipping.

Glosson et al [(1)] compared Ni Ti hand instrument, Ni Ti engine driven and K flexo files used in root canal preparation using modified Bramante technique and new digital subtraction software, they used 60 mesial canals of extracted lower six and divided them into five random groups, A, B, C, D and E. they were instrumented by k-flex files, Ni-Ti hand files, NT sensor engine driven files, Ni-Ti canal master "U" hand instrument and Ni-Ti light speed engine driven respectively. Results showed that canals that were instrumented by Canal Master "U" hand instrument and Ni-Ti engine driven (light speed and NT sensor files) showed less canal transportation ($p<0.05$), remained more centered in the canal removed less dentin and produced rounder canal preparation than K flex and Mity files. Engine instrumentation using lightspeed and NT sensor file was significantly faster than hand instrument.

Zakariasen et al. [2] compared quality preparation and time using three different filing protocols. Sixty teeth were used in this study: Twenty, 30 degrees canals in acrylic blocks were prepared by hand instrumentation using stainless steel K-files and Gate-Glidden burs, 20 by using the M-4 handpiece (Kerr) and radical taper Ni-Ti files and 20 using the Profile (PF) System. Two different clinicians each prepared 10 blocks using each protocol and the quality was assessed blindly by 2 other clinicians. Results showed that: Hand instrumentation required the most time and generated the greatest number of procedural errors (transportation, elbowing, ledging). The protocol employing RTF took less time, generated an excellent preflare, but caused some procedural errors though much less than hand filing. The PF System required the least amount of time and generated the fewest procedural errors. The results of this study indicate that the quality and efficiency of canal preparation can be greatly enhanced through the use of engine driven Ni-Ti files.

Short et al [3] compared the canal centering ability of four instrumentation techniques. Mesial roots of mature lower first molars with separate canals were paired on basis of curvature and morphology. Canal lengths were standardized to 11 mm. Profile, Lightspeed, McXIM and Flex-R hand filing techniques respectively were randomly assigned to one of the four canals of each tooth pair. The roots were mounted and sectioned at 1 mm, 3 mm, and 5 mm from working length using the modified Baramante technique. All sections were video-imaged preoperatively, after instrumentation to size 30 file and after final instrumentation to size 40 file. The images were computer analyzed for changes in canal area and centering. The Ni-Ti systems remained well centered in the canal than stainless steel hand files. The use of Profiles resulted in significantly greater canal area at the middle and coronal levels at size 30.

Coleman and Svec [(4)] compared step back preparations in curved canals of resin blocks using nickel titanium k-files and stainless steel k- files. Forty canals in resin blocks were cross sectioned at three levels: one to two mm from the apical foramen, middle of the curve, and coronal. Direct digital computer images were recorded before and after instrumentation. Superimposition of the images combined with digital subtraction software allowed direct measurement of area instrumented, distance of transportation and shape analysis. Results showed NiTi files to cause significantly less transportation and remain more centered at the apical level of the canal.