Geometric Analysis of Root Canal Preparation by Three New Rotary Ni-Ti Systems in Rotation and Reciprocation

(An In Vitro Study)

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بسم الله الرحمن الرحيم

﴿رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ
الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ
وَأَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ
وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ
الصَّالِحِينَ﴾

آية: ١٩ سورة النمل

Dedication

I would like to dedicate this work to my parents, wife and my lovely daughter

Acknowledgment

I express my profound sense of reverence to my supervisor ***Prof. Salma El Ashry*** *Professor of Endodontics, Faculty of Dentistry, Ain Shams University, for the time and guidance she devoted to me.*

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One of the most important factors in the success of root canal treatment is complete biomechanical cleaning of the canal system. This includes the removal of the pulp and organic tissue, infected dentin, bacteria and their by-products, while providing adequate canal shape for proper obturation. This is fulfilled by both the effect of the chemical irrigation as well as the mechanical action of the used files.

Traditionally, shaping of root canals was achieved by the use of stainless steel hand files. However upon the introduction of nickel titanium (Ni-Ti) instruments, many of the disadvantages of stainless steel files were overcome owing to their flexibility. Ni-Ti also tend to maintain the original canal shape during preparation and have reduced tendency to transport apical foramen.

Inspite of their advantages, the Ni-Ti cutting efficiency was found to be less than the stainless steel, and the use of electric motors to rotate the files at higher speeds as opposed to manual rotation-was then introduced to improve Ni-Ti cutting rate.

Although rotational motion is commonly used for driving the files in the canals, recently there has been an increased interest and renewed focus on reciprocation, which may be defined as any repetitive back and froth motion.

However, all current market versions of reciprocating motors produce a file movement where there is the clockwise and counter

clockwise degree of rotation. On combining the reciprocation motion along with the newly introduced Ni-Ti rotary systems, better preservation of the canal anatomy could be attained.

Techniques that allow teeth canals to be evaluated without destroying the specimens have been suggested to compare root canal shape prior to and after instrumentation. With the use of cone beam computed tomography (CBCT) root canal instrumentation and preparation methods can be compared.

Therefore conducting a study to evaluate the rotary Ni-Ti files in a rotation and reciprocation motion that could affect the canal transportation and centering ability was thought to be of value.

Review of literature

Root canal instrumentation is accomplished by the use of endodontic instruments and irrigating solutions under aseptic working conditions. Root canal instrumentation may be carried out using hand-held or engine-driven (rotary) instruments. The ideal preparation should possess a progressive taper with the original anatomy of the canal maintained; the canal should get narrower as it goes from coronal to apical with the end of the preparation in the original position of the apical foramen and not over enlarged (**Schilder 1974**) [(1)]**.** Using stainless steel files in canals displaying even the slightest complexity showed tendency to cause various procedural errors such as ledge formation, mid-root strip perforations and transportations. These complications would compromise the ability to adequately seal the canal to guarantee long-term success of the treatment.

Bertrand et al [(2)] evaluated curved root canal preparations using HERO 642 rotary nickel-titanium instruments by the Bramante method in twenty four canals with curvature greater than twenty. Roots were embedded in clear resin using a plaster mould and cross-sectional cuts were made in apical, middle and coronal thirds of each root. The control group was prepared using stainless