Cleaning and shaping of curved root canals by Rotary RaCe Nickel-Titanium Instruments Using Two Different Techniques

Thesis

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Karim Mahmoud Kamel Eissa

بسم الله الرحمن الرحيم

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

صدق الله العظيم

النمل.....ايه رقم ١٩

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INTRODUCTION

Successful cleaning and shaping of the root canal system is a major requisite to upgrade treatment outcomes. Root canal system should be cleaned from pulp, bacteria, and endotoxins from the pulp chamber and root canals; shaped to create a funnel shaped preparation with the widest part at the canal orifice and the narrowest one at the apical constriction, and to leave as much radicular dentin as possible so as not to weaken the root structure.

However, achieving these objectives in narrow curved canals is difficult, time consuming, and can be complicated by procedural errors such as transportation of apical foramen, zipping, ledges, perforations and instrument separation attempts.

Many attempts have been developed to overcome these problems, either by changing and modifying the design of the instruments or by changing the alloy type from the rigid stainless steel to the more flexible Nickel-Titanium. Various Ni-Ti instruments have been developed in manual, or rotary versions in order to facilitate root canal cleaning and shaping by decreasing the working time, minimizing patient and operator fatigue and improving the quality of treatment.

Most of the recent rotary Ni-Ti systems are recommended for use in a crown-down fashion. However, the RaCe system doesn't recommend a precise technique when using its files. They give the operator the complete freedom of either using a crown-down or a step-back technique during canal preparation and this is a unique feature for this brand. Thus, comparison of root canal preparation with rotary RaCe, Nickel-Titanium instruments using crown-down and step-back techniques, was thought to be of value.

REVIEW OF LITERATURE

١.Canal centering ability:

Gambil et al (١٩٩٦) [١] compared Ni-Ti hand files with SS K-files using filing and reaming instrumentation techniques. They used CT image analysis system for evaluation. Thirty-six single-rooted teeth of similar shape and canal size were divided into three groups; group A canals were instrumented using quarter turn/pull technique with K-flex files, group B canals were prepared with Ni-Ti hand files using the same technique as group A and group C was prepared with Ni-Ti hand files using a reaming technique. All canals were scanned before and after instrumentation using CT, then they were compared. They found that Ni-Ti files used in reaming technique caused significantly less canal transportation.

Short et al (١٩٩٧) [٢] compared three Ni-Ti instrument systems with hand stainless steel files for their effect on canal transportation. Mesial roots of lower first molars with separate canals were paired on the basis of curvature and morphology. Canal lengths were standardized to ١١mm from orifice to apical foramen. Profile, Lightspeed, McXIM, and Flex-R hand filing techniques respectively were assigned to one of the four canals of each tooth pair. The roots were mounted and sectioned at ١mm,

٣mm, and ٥mm from working length using a modified Bramante technique. All sections were video imaged preoperatively after instrumentation to size #٣٠ and after final instrumentation to size #٤٠. The images were computer analyzed for changes in canal area and centering at each stage of instrumentation. Preparation time was also recorded. Results showed that all the Ni-Ti systems were more centered in the canal than stainless steel hand files, with no significant differences among the Ni-Ti systems at any level. Also, the difference between hand filing and the Ni-Ti techniques was more pronounced at size #٤٠ than at size #٣٠.

Kosa et al (١٩٩٩) [٣] compared canal transportation of ProFile Series ٢٩ rotary instruments, Quantec ٢٠٠٠ rotary instruments, Flex-R files in the Endo Gripper contra-angle handpiece, and Shaping Hedstrom files in the M٤ contra-angle handpiece; in moderately curved canals using a modified Bramante muffle system. The roots were cross-sectioned ٢mm from the working length and at the height of root curvature. Tracing of the root canals was made from slides of the cross sections before and after instrumentation. Results showed that except with Quantec at the apical level, there were no significant differences in transportation at either level. There were no differences in the direction of canal transportation between instrument systems, and the direction of canal transportation was not related to the direction of canal curvature.

Peters et al (٢٠٠١) [٤] compared the changes in root canal geometry after preparation by either K-files,Lightspeed, or Profile .٠٤ rotary instruments using CT. Canals were scanned before and after preparation. Differences in surface area and volume of each canal before and after preparation were calculated. Canal anatomy and the effects of preparation were further analyzed using image analysis software. They concluded that variations in canal geometry before preparation had more influence on the changes during preparation than the technique itself. They recommended that studies comparing the effects of root canal instruments on canal anatomy should also consider details of the preoperative canal geometry.

Peters et al (٢٠٠١) [٥] compared the effects of four preparation techniques on canal volume and surface area using ٣-dimensionally reconstructed root canals in extracted human maxillary molars. In addition, μCT data was used to describe morphometric parameters related to the four preparation techniques. Specimens were scanned before and after canal preparation using Ni-Ti, K-files, Lightspeed instruments, Profile .٠٤ and GT rotary instruments. Differences in dentin volume removed, canal straightening, the proportion of unchanged area and canal transportation were calculated using specially developed software. Results showed that instrumentation of canals increased volume and surface area. Prepared canals were significantly more

rounded, had greater diameters and were straighter than unprepared canals. Whilst there were significant differences between the three canal types investigated, very few differences were found with respect to instrument types. Within the limitations of the μCT system, there were few differences between the four canal instrumentation techniques used. By contrast, a strong impact of variations of canal anatomy was demonstrated.

Bergmans et al (٢٠٠١) [٦] evaluated root canal instrumentation using μCT. A desktop x-ray μCT scanner was used to provide data sets on an extracted mandibular molar before and after instrumentation (Profile .٠٤ Taper instruments) that were stored for later use by software. A volume visualization package was applied to obtain ٣D renderings of the molar to illustrate the qualitative visualization capacity. Next, medical image volume fusion software was used to allow alignment of pre and post image volumes. Finally, a software was developed to make quantitative measurements. Perpendicular re-slices were made at ٥ different levels within the mesiobuccal canal to evaluate transportation and centering ability. Numerical values were obtained for volume, volume changes and transportation. Centering ability was calculated by centering ratio.

Garip and Gunday (٢٠٠١) [٧] compared canal preparations completed with Hedstrom and K-files of ISO size ١٥-٤٠, made of

Ni-Ti and stainless steel. Eighty simulated canals with ٢٠° and ٣٠° curvatures were prepared using the step-back technique and quarter turn/pull instrument manipulation. Middle and apical level canal sections were taken using CT. They found that no significant difference was found between any of the file types at either level with respect to canal curvature (٢٠° or ٣٠°), at the middle level, the stainless steel files caused more enlargements toward the inner part. At the apical level, Ni-Ti files caused more enlargements toward the inner part, whereas more outward enlargement was caused by stainless steel instruments. No significant difference could be observed at the middle level related to the enlargement toward the outer side of the canal curvature. Transportation at both levels was significantly less for the Ni-Ti files than the stainless steel ones. They concluded that Ni-Ti instruments produced preparations with adequate enlargement, less transportation and a better centering ratio.

Gluskin et al (٢٠٠١) [٨] compared root canal preparation with conventional stainless steel Flexofiles and Gates Glidden burs versus GT rotary Ni-Ti files. A total of ٥٤ canals from ٢٧ mesial roots of mandibular molar teeth were prepared using one of the two tested methods. By a crown-down approach, pre and postoperative CT scans of each root were recorded and superimposed to assess changes in canal area, canal transportation and thickness of remaining root structure. The time taken for each