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Evaluation of Root Canal Enlargement with Mtwo and Revo-S Rotary Endodontic Files

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ABSTRACT

Introduction: The introduction of novel technologies such as nickel-titanium (NiTi) instruments and new canal filling systems have helped the dentist, and reduces the operating time.

Objective: To evaluate root canal enlargement following mechanical shaping using 2 nickel-titanium rotary systems.

Methods: 60 single-rooted teeth were immersed in resin and sectioned perpendicular to the long axis at 4, 8, and 12 mm from the apex. Digital capture of sections was achieved before and after canal instrumentation using Mtwo and Revo-S instruments. The area upsurge of endodontic space was calculated by subtraction.

Results: The use of both instruments has permissible for removal of excessive amounts of dentin from the canal walls, even when the endodontic morphology is characterized by gracelessness to reach recesses.

Conclusions: Both procedures appear to be effective and no differences were observed amongst Mtwo and Revo-S allowing for the amount of dentin removed at different distances from the apex.

Key Words: Endodontic, Mtwo rotary, Revo-S, Root Canal Enlargement

INTRODUCTION

The introduction of novel technologies such as nickel-titanium (NiTi) instruments and new canal filling systems have helped the dentist, along with the use of microscopes, to set even more efficient therapeutic protocols.[1,2] The overview of these instruments has permitted root canal instrumentation to be earlier while remaining respectful of the original root canal anatomy.[3] This can be additionally potential thanks for the various design of file [4,5] and the crown-down method.[2,6] Numerous NiTi instruments are available on the market. However, the metal type, instrument geometry is the main aspect that impacts the performance of instruments concerning torque stresses, fracture strength, rotation speed, and operator sensitivity.[7]

The first generation NiTi instruments had reduced shaping capacity (neutral cutting angle) and currently, a lot of instruments with great shaping ability (positive cutting angle) are existing on the marketplace. This characteristic has unescapably improved their use;, while the first generation instruments, required longer appointments for the patients the latest instruments, with[8-11] greater shaping ability, allow the dentist to accomplish quicker procedures with lesser appointments.

This study was done to evaluate dentin removal during shaping with 2 different nickel-titanium systems by calculating the cross-sectional area of the root canals before and after instrumentation.

MATERIALS AND METHODS

This in-vitro study was done in the department of Conservative dentistry after obtaining Ethical approval from the intuitional

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ethic committee. Sixty single-rooted human teeth, with intact crowns with fully formed apices, extracted for orthodontic and/or periodontal reasons, were included for the study. All teeth were cleared in 5% NaOCl solution for 24 h, remnants of calculus and periodontal tissue, washed under running water, dried, and stored in 10% formalin solution. All specimens had a root canal with a curvature angle lower than 20° that was estimated using the Schneider technique using 2 radiographs (mesial-distal and buccal-lingual). Exclusion criteria were roots with fractures, resorptions, and open apices.[12] The working length of the canals was assessed by detecting a file number 10 expanded through the apical foramen and deducting 0.5 mm from the verified length. [13]

All specimens were submerged in self-curing transparent resin (Viapal P 0004/64; Vianova Resin, Hamburg, Germany), to create resin blocks which were cut to obtain sections containing resin and a root portion. From the apical foramen, for every specimen, 3 sections perpendicular to the longer axis were formed at 4, 8, and 12 mm. Digital apprehensions of all sections (coronal view) were verified before reassembling them using a relocation device to file the canals.[14] Each resin blocks were arbitrarily distributed into 2 groups, A and B, of 20 samples each.

Group A was treated with Mtwo (Sweden & Martina, Padova, Italy) file and group B with Revo-S (Micro-Mega) file system. In both the groups, NiTi instrumentation was done for 7 seconds (which is less than the suggested working time from the manufactures) and for 5 canals so each instrument was used only for 40 sec to retain the sharpening; irrigation was done out with EDTA-based Glyde chelating solution (Maillefer, Ballaigues, Switzerland), along with NaClO Niclor 5 (Ogna, Muggio, Italy) alternatively to enable the development of the instrument inside the canal, to reduce the torsional stress and minimize the usury on the blades.[3]

For any digital capture, a stand was created to maintain a digital camera (Coolpix 5400, Nikon, Japan) and the sections in a repeatable position, to permit pre- and post preparation image comparison through superimposition. Each image was digitalized before reaming to hold the original morphology of the endodontic section (coronal view). Root canal shaping was usually done by the same trained investigator. The clinical procedures were conducted using the following order.

Group A with Mtwo: 10/.04, 15/.05, 20/.06, and 25/.06. The instantaneous technique without any early coronal enlargement (total 32 seconds). Group B. with Revo-S :25/.08, 15/.05, 25/.04, 25/.06 (total 32 seconds) (crown-down technique).[15-17]

It is outstanding that, in our study, any instrument (except BR0) was taken at the working length, with light apical pressure, and used just for 8 seconds; all the tested instruments were used with lateral pressure (brushing mode) to obtain a circumferential cut. After shaping, all specimens were undone and the sections were relocated on the stand for another capture. Digital image analysis was carried out with AutoCAD graphic software (Autodesk Inc, USA).[4]

Obtained data were statistically evaluated using SPSS software version 20 with Wilcoxon test; at the significance of 0.05.

RESULT

Throughout replicated clinical use none of the instrument had an intracanal fracture, whereas certain files in both groups displayed small noticeable signs of plastic deformation, particularly close to the tip; no transportation of the root canal or strip perforation occurred. The upsurge in the post preparation endodontic space area in group A (Mtwo) was statistically substantial in all three segments (coronal, middle and apical sections) (Table-1).

In group B (Revo-S) pre-and post-preparation changes were statistically substantial in all three segments (coronal, middle and apical). The evaluation between the two groups of samples at the coronal, middle, and apical segments, done with the Mann-Whitney test, did not display statistically substantial alterations between the two different kinds of rotary instruments (coronal sections, middle sections, and apical sections).

DISCUSSION

Within the limitations of an “in vitro” study, the Bramante method[13] (improved by Kuttler et al.,[14]) agreements a method that is comparatively simple and economical and delivers useful evidence about the action of instruments in the canal space. A substitute method of assessing root canal instrumentation techniques is the microcomputer tomography that is costlier and needs well-trained operators to obtain valid results.

This study assessed two different procedures based on NiTi rotary instruments that were used for just 32 seconds inside the canal and without preparing with Gates-Glidden or Largo burs. In ideal situations, both files seem to generate rapidly a round shape regardless of the initial root canal’s morphology. The investigation of the results showed the shaping ability for both types of instruments that permitted proper dentin removal from the canal walls, and pre-and-post preparation differences were statistically substantial in all 3 sections.

The Mtwo removed lesser amounts of dentine related to Revo-S at the coronal sections. NiTi Mtwo instruments (simultaneous technique) do not eliminate extensively coronal root dentine with an initial coronal enlargement, but fairly

and gradually remove dentine at the orifice through a careful coronal enlargement.[17] Given the cutting ability of the rotary instruments tested, few seconds were adequate to ensure a proper shaping reducing, at the same time, stresses in the NiTi alloy. Even if the canal preparation shape became uttered more by anatomy than by alterations in instrumentation method [18] both types of instruments tested presented a comparable propensity to change the wall of the canal. Although the use of Mtwo files related with canal preparation with RaCe or K3 files presented a less creation of debris, as designated by Schäfer et al. [19]within the parameters of this study, the statistical analysis did not reveal a significant difference between the Mtwo group and the Revo-S group seeing the quantity of dentin removed at all different levels. The absence of implication between the two groups may be a consequence of the high degree of similarity between them; a variety of root canal anatomy within the groups may have created a relatively high dispersion of the data.

Yammine et al evaluated *in vitro* study to subordinate canal straightening following shaping of curved canals with three types of new generation nickel-titanium (NiTi) rotary instruments-ProTaper Next (PTN)®, BT RaCe (BTR)®, and WaveOne Gold (WOG)®- and three dissimilar levels of protrusion beyond the main apical foramen. They determined that Overinstrumentation in curved canals resulted in straightening of the canal curvature.[20]

Aminsobhani et al. assessed Mtwo and RaCe Rotary File Systems in Root Canal Deviation, There were no significant variances amongst RaCe and Mtwo or between the two root canal preparation methods in root canal deviation and they determined that two rotary systems and the two root canal preparation methods had equal efficacy in straightening the canals. [21] Maia Filho et al. assessed shaping and preservation of the original curvature of replicated curved root canals using WaveOne (Wo), Reciproc (Rcp), and the ProTaper Next system (Ptn). There were no substantial differences amongst the instruments in terms of the entire amount of resin removed of the inner or outer walls of the apical curvature. Instruments that use rotary movement achieved an effect similar to that of the reciprocating instruments concerning change in angle.[22]

Both rotary instruments tested were also used with a brushing motion which may have predisposed the final shape of all canals more than the differences (shaping ability) between Mtwo and Revo-S.

CONCLUSION

Mtwo and Revo-S tested in this study, are effective in canal enlargement and may allow the dentist, in a few minutes, to obtain an efficient enlargement of the root canals.

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Author contribution

1. Dr. Shivu ME-Editing
2. Dr. Saswat Satyabrata Nanda- Investigation
3. Dr. Suman Yadav - Review
4. Dr. Akhil Shetty- Analysis
5. Dr. Riya Patel- Editing
6. Dr.Nandita Bansal – Manuscript writing

REFERENCES

1. Glickman GN, Koch KA. 21st-century endodontics. J American Dent Assoc 2000;131:39-46.
2. Peters OA. Current challenges and concepts in the preparation of root canal systems: a review. J Endod 2004;30(8):559–567.
3. Schilder H. Cleaning and shaping the root canal. Dent Clin North Am 1974;18(2):269–296.
4. Dobó-Nagy C, Serbán T, Szabó J, Nagy G, Madléna M. A comparison of the shaping characteristics of two nickel-titanium endodontic hand instrument. Inter End J 2002;35(3):283–288.
5. Schafer E, Erler M, Dammaschke T. Comparative study on the shaping ability and cleaning efficiency of rotary Mtwo instruments. Part 2. Cleaning effectiveness and shaping ability in severely curved root canals of extracted teeth. Inter End J 2006;39(3):203–212.
6. Riitano F. Anatomic endodontic technology (AET)—a crown-down root canal preparation technique: basic concepts, operative procedure and instruments. Inter End J 2005;38(8):575–587.
7. Ounsi HF, Al-Shalan T, Salameh Z, Grandini S, Ferrari M. Quantitative and qualitative elemental analysis of different nickel-titanium rotary instruments by using scanning electron microscopy and energy dispersive spectroscopy. J Endod 2008; 34(1):53–55.
8. Ruddle CJ. Nickel-titanium rotary instruments: current concepts for preparing the root canal system. Australian Endod J 2003;29(2):87–98.
9. Guelzow A, Stamm O, Martus P, Kielbassa AM. Comparative study of six rotary nickel-titanium systems and hand instrumentation for root canal preparation. Inter Endod J 2005;38(10):743–752.
10. Veltri M, Mollo A, Mantovani L, Pini P, Balleri P, Grandini S. A comparative study of Endoflare-Hero Shaper and Mtwo NiTi instruments in the preparation of curved root canals. Inter Endod J 2005;38(9):610–616.
11. Yun HH, Kim SK. A comparison of the shaping abilities of 4 nickel-titanium rotary instruments in simulated root canals. Oral Surg Oral Med Oral Path Oral Rad End. 2003;95(2):228–233.
12. Schäfer E, Erler M, Dammaschke T. Comparative study on the shaping ability and cleaning efficiency of rotary Mtwo instruments. Part 1. Shaping ability in simulated curved canals. Int Endod J 2006;39(3):196–202.
13. Bramante CM, Berbert A, Borges RP. A methodology for evaluation of root canal instrumentation. J Endod 1987;13(5):243–245.
14. Kuttler S, Garala M, Perez R, Dorn SO. The endodontic cube: a system designed for evaluation of root canal anatomy and canal preparation J Endod 2001;27(8):533–536.

15. Plotino G, Grande NM, Falanga A, Di Giuseppe IL, Lamorgese V, et al. Dentine removal in the coronal portion of root canals following two preparation techniques. Inter Endod J 2007;40(11):852–858.
16. Foschi F, Nucci C, Montebugnoli L, Marchionni S, Breschi L, Malagnino VA, et al. SEM evaluation of canal wall dentine following the use of Mtwo and ProTaper NiTi rotary instruments. Int Endod J 2004;37(12):832–839.
17. Plotino G, Grande NM, Sorci E, Malagnino VA, Somma F. A comparison of cyclic fatigue between used and new Mtwo Ni-Ti rotary instruments. Int Endod J 2006;39(9):716–723.
18. Peters OA, Schönenberger K, Laib A. Effects of four Ni-Ti preparation techniques on root canal geometry assessed by micro-computed tomography Int Endod J 2001;34(3):221–230.
19. Schäfer E, Erler M, Dammaschke T. Comparative study on the shaping ability and cleaning efficiency of rotary Mtwo instruments. Part 2. Cleaning effectiveness and shaping ability in severely curved root canals of extracted teeth. Int Endod J 2006;39(3):203–212.
20. Yammine S, Jabbour E, Diemer F, Majzoub Z. Canal Straightening Following Overinstrumentation with Three Nickel-Titanium Rotary Instruments. J Int Soc Prev Community Dent 2018; 8(3): 245–251.
21. Aminsobhani M, Razmi H, Nozari S. Ex Vivo Comparison of Mtwo and RaCe Rotary File Systems in Root Canal Deviation: One File Only versus the Conventional Method. J Dent (Tehran) 2015;12(7):469–477.
22. Maia Filho EM, Dos Reis Santos RM, Lima DM, da Silva Pereira SM, Soares JA, de Jesus Tavarez RR. Shaping Ability of ProTaper Next, WaveOne, and Reciproc in Simulated Root Canals. J Contem Dent Pract 2016;17(11):902-906.

Table 1: Comparison of endodontic file for dentin removal during shaping

Sections	Group A- Mtwo file		Group B -Revo-S file	
	Area increase mm²	Mean mm²	Area increase mm²	Mean mm²
Coronal	0.14 to 0.8376	0.4953 ± 0.2065	0.1902 to 1.1234	0.6568 ± 0.2318
Middle	0.0853 to 0.6212	0.3221 ± 0.1528	0.0526 to 0.6008	0.3267 ± 0.1427
Apical	0.0068 to 0.5478	0.1928 ± 0.1557	0.0049 to 0.4825	0.1428 ± 0.1228