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RESEARCH ARTICLE

EVALUATION OF REMAINING DENTINE THICKNESS USING REVO-S AND NEO- ENDO FILE SYSTEM THROUGH CBCT- AN IN VITRO STUDY

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ABSTRACT

Shaping and Cleaning is considered as one of the most important phase of the endodontic treatment. In our study we compare and evaluate the remaining dentin thickness of root canals using Neo-Endo and Revo-S file systems with the help of cone beam computed tomography for analysis. Thirty extracted human mandibular molars were taken and Pre-instrumentation cone beam computed tomography scan was done. After the instrumentation with each file post instrumentation cone beam computed tomography scans were taken. Neo-Endo and Revo-S file systems showed statistically significant difference in remaining dentin thickness. Hence we concluded that Revo- S file system removed less dentine than Neo-Endo file system.

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INTRODUCTION

Shaping and Cleaning is considered as one of the most important phase of the endodontic treatment. Because of the wide availability of various nickel-titanium (Ni-Ti) instruments developing for both rotary as well as manual use, it is becoming necessity for the clinician to explore the designs and features that will help in achieving success in the field of endodontics (Deka *et al.,* 2015). Remaining dentin thickness is the most important parameter to be considered while instrumentation. Operator should keep in mind that not to weaken the dentinal wall during instrumentation by avoiding procedural errors like ledges, strip perforations, vertical root fractures (Tomer *et al.,* 2016). Ni-Ti rotary instruments have an advantage of preparing the canal in more tapered way avoiding canal transportation. Operator should have a thorough idea on the anatomy and its variations of the root canal systems. During cleaning and shaping the clinician must keep in mind to observe about the preservation of sound dentin. At least 1mm of root dentin should be there to prevent the root from fracture, as the strength of root depends on the remaining dentin thickness. Removal of excessive dentin from the radicular portion is termed as danger zones because it leads to Strip perforations and vertical root fractures (Tomer *et al.,* 2016). Stripping is defined as a lateral perforation in the root with a thin wall which is usually caused by over instrumentation. There is less tooth structure present in the danger zones, so in order to avoid procedural errors anticurvature filing should be done (Montgomery, 1985). Kessler *et al* found that below the orifice of pulp chamber, about 4 to 6 mm lies the danger zone. Very less information have been discussed about the remaining dentine thickness (Alshehri *et al.,* 2010). Cone-beam computed tomography (CBCT) is a technique that rotates around the object. This is based on a cone-shaped X-ray beam. It produces a series of 2 dimensional images centred. The interesting part is this new system comes in smaller sizes than those of conventional CT. The images which are obtained also have a very higher resolution (Stern *et al.,* 2012). Hence the aim of this study was to evaluate the remaining dentine thickness in mandibular molars using Revo-S and Neo- Endo files system by cone beam computed tomography.

MATERIALS AND METHODS

This comparative study was carried out on extracted tooth of human mandibular molars. A total 30 samples were taken in this study.

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Sample size calculation: The sample size was estimated on the basis of a remaining dentin thickness. The sample size actually obtained for this study was 15 teeth for both the group. So total of 30 teeth (Group I- Revo-S File, Group II- Neo-Endo File) we included in the study

Subjects and selection method: The study was based on the evaluation of remaining dentin thickness of each file system after instrumentation. Samples were divided into two groups (each group had 15 teeth).

- Group I (N=15 teeth) – Neo-Endo File system
- Group B (N=15 teeth) –Revo-S File system

Procedure methodology

A Sample of thirty extracted human mandibular molars were takenfor the study (Figure 1). Two groups were divided of having 15 teeth in each group. Samples were then engraved in a wax rim in order to stabilize the sample (Figure 2). Pre-instrumentation CBCT scan was taken after the stabilization of the sample (Figure 3). Working length was taken with a 15 K-file till the apical foramen of the mesiobuccal canal of all the samples. The canals were then prepared till 20K-file till the working length with minimum apical pressure (Figure 4). Irrigation was done between every file. Rotary instruments were used with endomotor (dentsply) according to manufacturer's recommendation respectively.

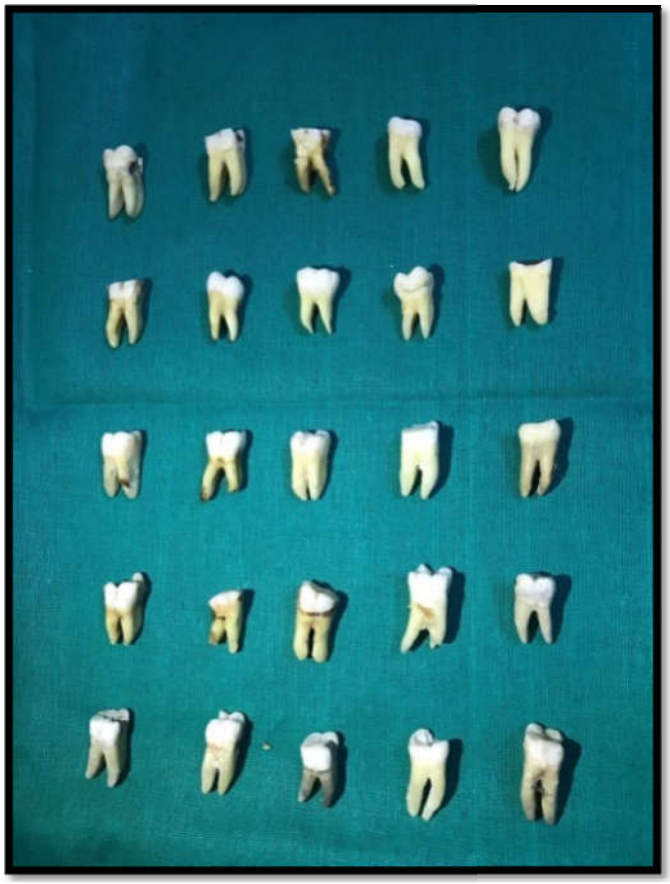


Figure 1. Thirty extracted human mandibular molars

For Group I - Neo-Endo group, the instruments were used in a crown-down manner at a speed of 350 rpm and a torque of 1.5Ncm. File sequences used were: Size 15/0.06 was used up to working length, followed by sizes 20/0.04, 25/0.06, and 30/0.06 all up to the working length (Figure 5).

Figure 2. Stabilization of the sample

Figure 3. Pre instrumentation CBCT Scan

Figure 4. Canal prepared upto 20K-File

Figure 5. Group I - Neo-EndoFile system

Recapitulation was done between each file to provide the apical patency. For Group II- Revo-S (Micro-Mega) group, instruments were used with a rotation speed of 400 rpm and a torque of 2 Ncm. File sequence used were: Size 25/0.06 up to two-third the working length, sizes 25/0.04 and 25/0.06 until the apex was reached (Figure 6).

The canals were irrigated after each file to remove the smear layer with 2ml of 3% sodium hypochlorite solution followed by 2 ml of 17% EDTA solution. Finally, canals were instrumented up to size 30/0.06 for apical finishing. Final irrigation was done with 5 ml of saline (Figure 7).

Sample analysis: Post instrumentation CBCT of all samples were taken (Figure 7). The images were saved and were edited with CS3 Photoshop software The remaining dentin thickness of each canal was measured at the apical (3 mm from the tip of the radiologic apex), middle (5 mm from the tip of the radiologic apex) and cervical (7 mm from the tip of the radiologic apex) thirds before and after instrumentation for comparison among the two rotary systems as well as to evaluate the remaining dentine thickness in the three-third of the canal. Data was analyzed using one-way ANOVA test for multiple comparisons. Comparisons of area measurements before and after instrumentation were carried out by Student's t-test.

RESULTS

Tables 1,2 shows the means and standard deviations in remaining dentin thickness for each system pre- and postoperative values at different thirds. At apical third, the mean percentage of remaining dentine thickness was highest with Neo-Endo (25.22) and least with Revo-S (20.83). Similarly, at the middle third and coronal third, the mean percentage was highest NeoEndo(25.64) and (28.26) and least with Revo-S (17.68) and (15.85), respectively.

Figure 6. Group II - Revo-S File system

Figure 7. Post instrumentation CBCT

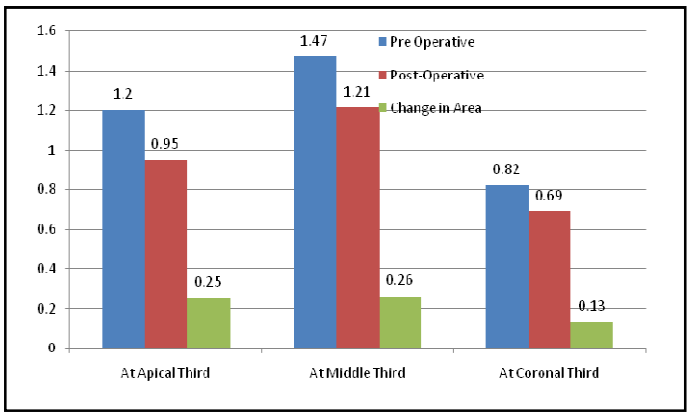
After the instumentaion and Post CBCT Scan:

Table 1. The mean and standard deviation of pre-operative and post-operative values of dentin thickness by Revo-S file system

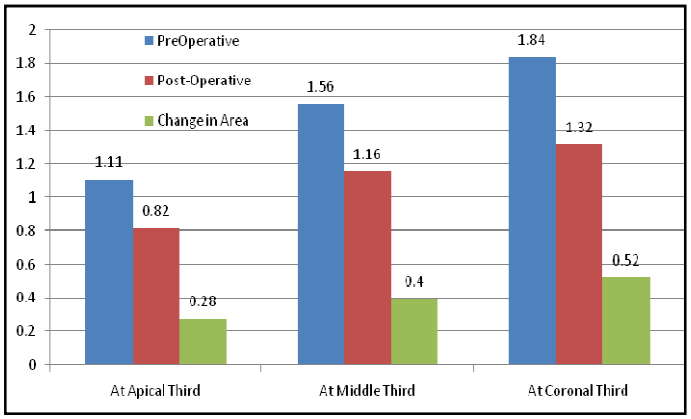
	Pre Operative	Post-Operative	Change in Area	% Change in Area
At Apical Third	1.20±0.19	0.95±0.18	0.25±0.01	20.83±2.34
At Middle Third	1.47±0.19	1.21±0.14	0.26±0.05	17.68±1.92
At Coronal Third	0.82±0.18	0.69±0.17	0.13±0.01	15.85±1.87

Table 2. The mean and standard deviation of preoperative and Post-operative values of dentin thickness by Neo-Endo file system

	PreOperative	Post-Operative	Change in Area	% Change in Area
At Apical Third	1.11±0.51	0.82±0.29	0.28±0.22	25.22±4.98
At Middle Third	1.56 ±0.49	1.16.±0.31	0.40±0.18	25.64±5.21
At Coronal Third	1.84±0.64	1.32±0.29	0.52±0.35	28.26±5.43



Graph 1. The mean and standard deviation of preoperative and post operative values of dentin thickness by Revo-S file system



Graph 2. The mean and standard deviation of preoperative and post operative values of dentin thickness by Neo-Endo file system

DISCUSSION

The purpose of this study was to evaluate of remaining dentine thickness using Revo-S and Neo- Endo file system through CBCT. The most important thing a clinician must do is to completely disinfect the root canal space, to eliminate the cause of periradicular infection. A successful endodontic treatment can be achieved only by a proper shaping and cleaning. The traditional hand instruments could not achieve proper shaping and cleaning. Since the hand instruments are not flexible, they straighten up the canals which have a curved anatomical configuration. Thus they can cause over-prepared canals. There is more chances of procedural errors and instrument separation.

In the present study, two Ni-Ti rotary systems namely Neo Endo, and Revo-S were used to investigate the remaining dentin thickness before and after instrumentation. According to Peters, radicular dentin is of much importance, during cleaning and shaping a clinician must leave as much radicular dentin as possible. If the remaining radicular dentin after biomechanical preparation is less, it will weaken the root structure, which may lead to root fracture (Cohen's, 2011). In the present study, cleaning and shaping is done with a crown down technique according to manufacturer's instruction. A crown down technique is preffered because it reduces intracanal friction and thus avoids instrument separation (Yoshimine *et al.,* 2005). The NeoEndo instruments have alternating cutting edges, and this design is alleged to have two functions: (i) To eliminate screwing in and blocking in continuous rotation and (ii) to reduce the working torque.

In the present study, Revo-S seemed to remove the less dentin from both middle and coronal portions compared to NeoEndo, which is statistically significant. Revo-S (Micro-Mega, France), another Ni-Ti rotary system was developed with a distinctive asymmetric cross-section intended to decrease the stress on the instrument. Revo-S showed less dentin removal than NeoEndo at all the different thirds (www.aplipratica.pt/PDF/revoseng). Nowadays a relatively new diagnostic imaging modality has been used in endodontic imaging that is the Volumetric or CBCT, Nair and Nair published a review of digital and 3D applications for endodontic uses. They summarized the CBCT portion by stating that CBCT technology is an useful tool for locating root canals, treatment planning of periapical surgery and detection of root fractures in extracted teeth. Cone-beam computed tomography image analysis software was used which allowed pre- and post-instrumentation measuring of remaining dentine thickness. In the present study, we have used CBCT, which provided a practical and nondestructive technique for assessment of canal morphology before and after shaping (Scarfe and Farman, 2009).

Conclusion

Within the limitations of this study, it was concluded that REVO-S showed more amount of remaining dentine thickness than NEO ENDO. Since lower thickness of root dentin exists near the furcation area in the mandibular first molars, the rotary file leaving more remaining dentine thickness after shaping and cleaning is preferable.

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