COMPARATIVE EVALUATION BETWEEN TWO NITI ROTARY FILES USING CBCT

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ABSTRACT

Aim: The aim of the study was to evaluate and compare the effects of WaveOne and Protaper Next on volume of dentin removed, centering ability and dentin thickness using CBCT on human mandibular molars.

Methodology:50 recently extracted human mandibular molars were taken and divided into two groups i.e. Group 1- Pro taper next and Group -2 Wave One.The distal root was discarded and the mesiobuccal root canals were selected. Further the selected root canals were scanned to standardize the mesial root canal ranging from 15o to 45ofollowed by root canal preparation.Here CBCT a non invasive technique was used for assessment. The data extracted were tabulated and subjected to statistical analysis for pair wise comparison.

Result: It was seen that Protaper Next showed statistically significant centric ability where as dentin thickness at cervical, middle and apical level and showed no significant differences. Even mean of volume of removed dentin also showed no significant difference ($p>0.05$) between the groups.

Conclusion: The inventive method of NiTi rotary system is having better-quality shaping ability in curved canals that results more centered instruments and less canal errors.

Keywords: Root Canal,CBCT, centering ability; NiTi , dentin thickness.

INTRODUCTION

Since the prehistoric timeextraction of decayed teeth was the mainlyfamiliar practice but now it has been replaced with restoration of teeth within the limits by common dental clinical procedure which is root canal treatment (RCT). [1] In the RCT there are three main steps which are thecomplete diagnosis followed by proper preparation and to finishwith restoration. Although successful treatment depends upon the clinical experience of dentist but root canal preparation plays a pivotal role in root canal treatment.[2,3]Cleaning and shaping of the root canal system is acrucial step scrupulous debridement of the root canal system and precise shaping of root canal preparation, while preserving the tangible anatomy of the canal isimperative.[2,4]

Even though canal shaping is reasonablytrouble-free in straight roots but for curved roots it's been always challenging which requires high skill consecutively to avoid procedural errors.[5,6]Because many complications like ledging, apical perforation, and mid-root strip perforation may distress the triumph of management as it fails to abolish infection of the root canal system which further makes the obturation trickier.[1,7]So, canal shaping should be done in wise manner as it principally decides the further stages of treatment such as irrigation and obturation but conformist stainless steel hand instruments were not able to meet these goals. [8]For that reason, there was introduction of nickel–titanium (NiTi) alloys that have reduced the procedural errors allied with root canal instrumentation and manage the essential time for finishing the preparation.[10]These alloys are having super elastic property which helps the files to stay well centered and shapes the canals with less haulage. Furthermore a variety of instrumentation techniques and instruments like varying tapers, non cutting safety tips, and varying length of cutting blades, etc have been introduced for reduction of shape preparation related troubles.[9,11] According to the manufacturers, the NiTi rotary instrument such as ProTaper(Dentsply Maillefer, Ballaigues, Switzerland) which was first introduced in 2011has an enhanced cross-sectional design that proficientlyremovedentin and dropping the torsion stress. Howeverwhen we use it aggressive manner; it leads to more amount of canal transportation. [4,12]Other type of files weremanufactured through anintricate heating–cooling proprietary treatment and are now available as two gold and two blue heat-treated systems. Among them two are used in reciprocating motion (Reciproc Blue, VDW; WaveOne Gold).[13]

Various methods have been used to appraise the canal shape before and after instrumentation of these new NiTi systems with different design, features and kinematics. [14]One such advance technique is CBCT imaging for the investigation of canal geometry and the efficiency of shaping abilities of different instruments. Even we can compare the anatomical structure of the root canal before and after preparation with the help of CBCT.[15,16]Till date fewer studies have been

reported \ on the use of cone-beam computed tomography (CBCT) to assess and compare the canal transportation, centering ability of twoNiTi files system. Thus, this study was conducted with the aim to compare thecentring ability and remaining dentinethickness of two different Nickel Titanium rotary instruments (Protaper Next and Wave One) using CBCT.

METHODOLOGY

- **Selection of Sample and preparation** :For the present study 50 recently extracted human mandibular molars were taken taken from the department of oral and maxillofacial surgery and divided into two groups i.e. Group 1- Protaper next and Group -2 Wave One. Sample size calculation was done with the help of G-Power software as per the previous studies with 85% confidence. Study design was approved by the Institutional Ethical Committee Board.
- For the sample preparation the distal root was discarded and the mesiobuccal root canals were selected. Further the selected root canals were scanned to standardize the mesial root canal ranging from 15o to 45o.

  Root canal prepration: All samples of Group 1 were instrumented with crown-down methodology using Protaper Next to the working length and samples of Group 2 were also instrumented with crown-down methodology using Wave One to the working length. A freshly prepared 2.5% sodium hypochlorite solution was usedfor irrigating the root canals and teeth were scanned before and after mechanical preparation with i-CAT CBCT.

Measurement of centring ability: The measurements of the non-instrumented areas and the measurements after root canal preparation were done as follows:

- **A1:** Measurement of the quantity of voxels from the external surface of the mesial portion of the root to the mesial wall of the non-instrumented canal
- **A2:** Measurement of the quantity of voxels from the external root surface of the mesial portion of the root to the wall of the canal after instrumentation
- **B1:**Measurement of the quantity of voxels of the external surface of the distal portion of the root to the distal wall of the non instrumented canal
- **B2:**Measurement of the quantity of voxels from the external surface of the distal portion of the root to the distal surface of the canal after instrumentation

Centralization ability ratio was calculated using the values: (A1-A2/B1-B2)

Measurement of Dentin Thickness: Dentin thickness was measured on the axial cuts from the periphery of the pulp space to the outer surface of the tooth in the four directions at the three levels (cervical, middle, and apical).

Measurement of volume of dentin removed: The volume of dentin removed was determined for each canal by subtracting the pre instrumented canal volume from the instrumented canal volume.

Statistical Analysis: The data extracted were tabulated and subjected to statistical analysis using the statistical package for the social sciences IBM SPSS Statistics version 22.0 software and Krushkal Wallis and Mann-Whitney U tests were for Intergroup and Intragroup comparison.

RESULTS

In the present study comparison of the shaping ability of two different file systems having different design features were done by assessing three parameters -centering ability, dentin thickness andvolume of removed dentin.While assessing the first parameter i.e. Measurement of centering ability; it was seen that Protaper Next showed statistically significant centric ability in comparison to other groups. (Table 1and 2) and p value was less than 0.05 in the assessment of centering ratio at cervical, middle and apical level among the two groups and there is significant difference between them. (Table 3) During the second parameter assessment i.e. Measurement of Dentine thickness it was found thatdentin thickness at cervical, middle and apical level and showed no significant differences ($P>0.05$) between the twogroups.(Table 4) Third parameter analysed in our study was Volume of removed dentin and found that there was no significant difference ($p>0.05$) between all the groups.(Table 5)

i) Measurement of centering ability:

Table 1: Mean and standard deviation values for pre instrumentation of both the groups

Pre Instrumentation	Group 1	Group 2	p value
Cervical	0.019 + 0.01	0.024 + 0.02	0.07**
Middle	0.021 + 0.01	0.021 + 0.02	0.6**
Apical	0.023 + 0.01	0.016 + 0.01	0.01*

*statistically significant ** statistically non significant

Table 2: Mean and standard deviation values for post instrumentation of both the groups

Post instrumentation	Group 1	Group 2	p value
Cervical	0.025 ± 0.01	0.038 ± 0.02	0.01*
Middle	0.032 ± 0.02	0.036 ± 0.02	0.8**
Apical	0.035 ± 0.01	0.032 ± 0.01	0.5**

*statistically significant ** statistically non significant

Table 3: Ratio of canal area to root area (Post/Pre)

Levels	Group 1	Group	p value
Cervical	1.44 ± 0.49	1.78 ±	0.04*
Middle	1.78 ± 0.74	1.93 ±	0.05 **
Apical	1.62 ± 0.52	2.61 ±	0.004*

*statistically significant ** statistically non significant

ii) Measurement of Dentine thickness:

Table: 4 Mean and Standard deviation values of both the groups at three different levels

Instrument	Apical	Middle	Coronal
Protaper Next	0.41 + 0.48	0.39 + 0.45	0.32 + 0.35
Wave one	0.5 + 0.46	0.42 + 0.36	0.37 + 0.39
p value	0 .73 **	0.780**	0.208**

*statistically significant ** statistically non significant

iii) Measurement of volume of dentin removed

Table 5: Mean and standard deviation of volume of removed dentin of the two diff systems

Groups	Mean	SD
Protaper Next	0.001960	0.0015133
Wave one	0.001720	0.0012423

*statistically significant ** statistically non significant

DISCUSSION

Various irretrievable injurious effects occur due to hauling that causes loss of integrity of the root and accommodating the NiTi instruments with towering flexibility can provide improved adaptation of files in curved canals.[1,13] TheProtaper Next and Wave One are recently introduced file systems that are distinctly different in their geometric design. [17,18]

In the present study noninvasive CBCT scanning was used because it provides an accurate, reproducible, 3- dimensional evaluation of changes in both dentin thickness and canal centering ability before and after preparation.[12,16,19] The mesiobuccal canal was standardize as it's usually present with most torturous and accentuated curvature. The first parameter evaluated in this study was centring ability and it was seen that there was no statistically significant difference between found between Protaper next and Wave One during pre-instrumentation whereas ProtaperNext showed the statistically significant lowest mean ratio while post-instrumentation. Even the pair-wise comparisons among the systems revealed no statistically significant difference. This might be due to the reason that instruments have non cutting tips that work with minimal apical pressure and function only as a guide to allow easy penetration. The study done by Saber et al. where comparison of Wave One, reciproc& One shape was done and it was concluded that One shape Files failed to remained centred in curved canals whereas there was no significant difference between others. [17, 20]In the current study it was also observed that at the cervical and apical levels, there was statistically significant difference between the systems (p = 0.047 and 0.004 respectively) and pair-wise comparisons between the systems revealed that Wave One showed statistically significant highest mean ratio whereas no statistical significant difference was observed between ratios after the two systems were used at the middle level.

In the study measurement of remaining dentine thickness was also done at three different levels between both the groups and no statistically significant difference between Protaper Next and Wave One systems was seen as they both showed the statistically significant lowest mean ratios. Even the amount of remaining dentine between Protaper next and Wave One was similar which may be because of the asymmetric design. Moreover changes in original canal shape and curvature was also not reported in the study. The results are familiar to study done by Celikten et al. where they compared the Protaper next and One shape for evaluation of remaining dentin thickness and reported that there was no significant difference between them.[20,21] EvenArora et al. [17] who found out that greater speed of rotation leads to faster preparation of the canals.Various types of rotary systems are reachable commercially, but still one needs to select cautiously keeping morphology of each canal in mind so that iatrogenic mistakes can be avoided. [19, 22]Additional research is enviable to elaborate on its canal transportation, uninstrumented surface area, and conservation of dentin thickness which influences the prognostic solidity of the teeth.

CONCLUSION

Within the limitations of the study ;ProtaperNext and Wave One systemsproduced canalpreparations withadequate geometry with no significant differences between the two files. The reciprocating file system is having a better file design and tapering motion which adapts to the canal walls in efficient way. The volume of the touched surface of the canal depends on the tooth anatomy and also the instrument cross-section, taper, metal properties, and file size

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FIGURES

Fig 1: Samples preparation

Fig 2: Samples for scanning

Fig 3: Measurement of centring ability

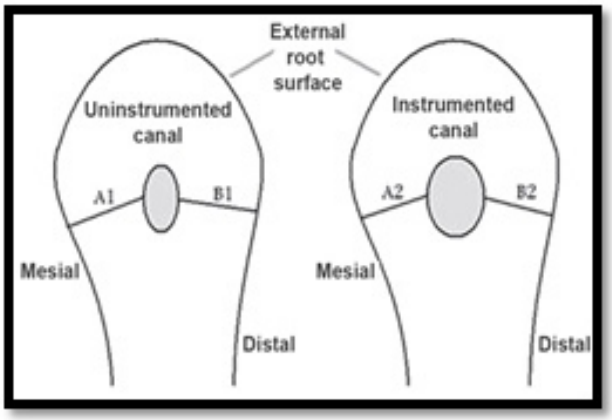

Fig 4: Scan for centring ability

Fig 5: Measurement of dentin thickness

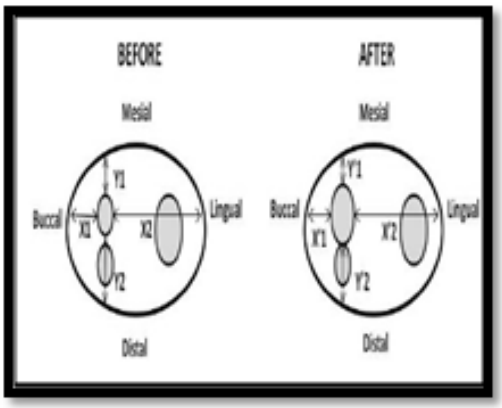

Fig 6: Scan for remaining dentin thickness