



## Shaping Ability of Different new Nickel-Titanium Rotary Systems A comparative study using cone-Beam computed tomography



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### Abstract:

the aim of the present study was to evaluate and compare the shaping ability of four newly introduced nickel titanium file using cone beam tomography (CBCT) four types of Ni Ti rotary file were used in this study (protaper next, protaper gold, wave one, wave one gold).

Sixty extracted human mandibular molars were used in this study. The crowns were sectioned to the level of cemento enamel Junction. and the roots were sectioned to obtain mesial roots. all roots were positioned in a custom made holden for standardization of pre and post instrumentation images by (CBCT). Instrumentation of mesial canals by the four systems were performed according to the manufacture's recommendation. all samples were imaged used (CBCT). Canal transportation and centering ability were analyzed. the results showed that.

**Result :** Canal transportation Within both 3&5 mm planes, no significant difference in canal transportation was shown between the three file protaper gold, wave one gold and wave in files ( $P>0.05$ ), while protaper next transport the canals significantly ( $P<0.05$ ) more than the three files. Within 7 mm planes has no significant difference in transportation of the canal ( $P>0.05$ ) was found between all the tested files.

Centering ability: Regarding the centering ability of all tested files (protaper next, protaper gold, wave one gold and wave one files, no significant difference was found between all groups ( $P>0.05$ ) at the three levels of the root canal (3.5 and 7mm)

**Conclusion:** Within the limitation of the present study, it was determined that all of the tested Ni Ti files covered various level of canal transportation. However protaper gold, wave one gold and wave one Ni Ti files were found to be carve a lower degree of transportation than protaper next file.

### Introduction

The capability in order to clean inspiration canal system in a powerful way will depend on every instrumentation additionally to irrigation, whereas the appearance of the devices can be part that effects the powerfulness of scrap removal additionally to smear layer production. Trimming ability is printed consequently of the strength of the tools to cut through a given material, whereas the cutting efficiency is that the speed of the tool to slice through given substance. 1

The cutting furthermore to cleanup efficiency can be a multi-factorial property waging on utterly completely different parameters like field of study properties, cross sectional configuration of the the whole length, sharpness of flute, flute vogue ( vary of flutes, volute angle furthermore to rake angle ) tip vogue, lubrication through cutting, wear resistance, chip removal capability additionally to mode of use. 2

Root canal cutting tools is beneath continuous evolution, on a routine new geometrical vogue evolve with new field of study modifications incorporated, all this on the brink of enhance the quality of the chemo-mechanical preparation a part of passage medical aid, for each medical man additionally to patient. Modification of instruments to

increase cutting capability is very necessary in trendy medical specialty apply, because of this of it'll increase its efficiency. 3 in addition to reduces enough time needed for medical aid that in turn decreases the patients suffering of the procedure.

The cross section of the instrument among the precise has been of prime interest to researchers, 4, 5, 6, 7 over the time. OLIENT additionally to SORIN eight in 1973 evaluated the cutting efficiency of the sq. cross-sectional reamers versus triangular cross segment, passing through the invention of the formed cross area additionally to obtaining employed in many systems just like the ProFile 20 9 series. additionally to conjointly the Quantec system. 9 with the relived U- kind vogue. These in which the first-generation file that were seen as having unaggressive radial land. Second era file were innovated to have active cutting ends with fewer instrument to arrange the canal. 10 This capsulated the protaper with a planoconvex triangular in shape cross section, additionally to its modification the protaper universal with a mitigated triangular cross section. city dental recently introduced the protaper NEXT additionally to conjointly the protaper GOLD. 11

Protaper GOLD has been discharged with statements of obtaining active cross section additionally to improved

flexibility, strength additionally to with ground breaking science. it has been claimed to have 5 hundredth increased cyclic fatigue resistance. 12 protaper NEXT includes a particular rectangular cross section with academic degree unequal movement additionally to M-wire NiTi alloy for improved cyclic fatigue. Recently the Wave One GOLD was

introduced with academic degree impressive cross section in addition to field of examine modification.

Recently the computerized passage enlargement has shifted towards the use of just one instrument among the preparation of the inspiration cacera. mutual enlarging tools had been used before among the passage shaping furthermore to cleanup. 4, 5 additionally to presently it can obtaining used yet again to attenuate vary of overall tools additionally to time of the inspiration cacera treatment.

Many researchers researched shaping ability victimization NiTi files, however there is a scarceness of data relating to canal shaping utilizing a unique style of NiTi instrument boughten by new GOLD technology (protaper GOLD & Wave A single GOLD).

Recently, WaveOne has been upgraded to WaveOne Gold. The mechanics of this technique is unchanged, but the section, size, in addition to mathematics of the files square measure revised to make the document plenty of versatile. the heat take care of files has been changed from M-wire to gold alloy treatment that allows following versatility compared with NiTi additionally to conjointly the M-wire alloy. 13.

### Materials in addition to methods

#### Materials

Sixty extracted human oral cavity everlasting molar teeth were selected among the surprise idea study. Wave one, Protaper Next, Wave one rare metal additionally to Protaper gold files were utilized in preparation of the idea canals.

#### Specimen selection:

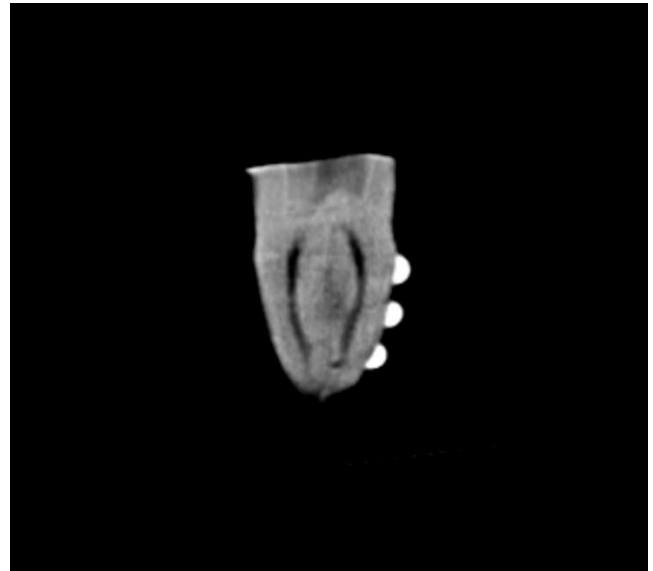
Removed chin first molars was washed by real estate agent 5. 01% for 5 min, then detain absolutely no. 9% ancient solution until the time of the research. sixty four every tooth was sectional in degree of cemental teeth teeth (CEJ) pattern gems disc, were used then a origins was sectional paralell to teeth at angularity house of induce inside root.

possible image taking, flowable composite things were mounted to interior root surface at 3, vi additionally to 9 metric linear measure levels from apex figure one, in addition to thus the origins were positioned in Associate in Breastfeeding passing made-to-order specimen owner additionally to attached to position with the assistance of serious body silicone-based material. Almost all teeth were scanned before and after used by CBCT in ascertain, root dentin size at the reference factors (by markers), additionally to thus the level of channel arch in keeping with Schneidier technique. sixty-five

#### Inclusion requirements

1 ) totally MB channel were used

2. every channel show just one arch in every BL (CBCT) additionally to MD channel (CBCT garland view)
3. completely canals whose position of curvature ranged between 25? 45? degrees were selected.
4. File #15 was snugly work functional, effectual length.
5. All canals showed patency from the passageway to the apex whereas not internal calcification



**Figure (1):** Every canal of the Cross-sectional views of aided with flowable composite markers were obtained at 3, 6 in addition to 9 millimeter, and they exists at the external surface of the root.

#### Specimen grouping

The specimens typically has been indiscriminately broken into 4 equal teams (n- 15) constant with the sort of the rotary NiTi filing system used; Fig. four

cluster (I) (WaveOne) major file &#40; # twenty five zero. 08&#41; throughout a reciprocal, slow in-and-out pecking motion. (Dentsply Maillefer, Ballaigues, Schweiz).

cluster (II) (WaveOne gold) primary file &#40; # twenty 5 fully no. 07&#41; throughout a reciprocal, sluggish in-and-out pecking motion. (Dentsply Maillefer, Ballaigues, Switzerland)

cluster (III) (Protaper gold) F2 are available in rotation action, slow in-and-out pecking action (Dentsply Maillefer, Ballaigues, Switzerland).

cluster (IV) (protaper next) X2 are available in rotator motion, slow in-and-out pecking motion (Dentsply Maillefer, Ballaigues, Switzerland).

#### Root canal instrumentation

Inside every of those four check teams, fifteen waterways were enlarged. Thus, a full of sixty canals were ready tools was accustomed prepare 5 pathways solely. All passageway plans was finished by one user. The operative length of every canal began by using of K 10 file till it show from the top, then a file length was weakened by one metric measure. it15

K-File was accustomed guarantee operative length in addition to to urge mechanical air street. Instrumentation of canals in every cluster was administrated per the manufacturer's recommendation for each single system.

The instruments from every cluster were driven by associate electrical motor X-Smart I.Q. (Dentsply Maillefer) with a conductor eight: one reducing handpiece, that allowed each the reciprocation in addition to in addition the rotation movements figure (2). every cluster was ready with the

appointed arrangement system, victimization EDTA answer (Glide) to act as a stuff, the documents were used per manufacturer's suggested speed.



Fig. (2); motor X-Smart I.Q. (Dentsply Maillefer) with a conductor 8: one reducing handpiece

The documents were used at intervals the consequent sequence:

- PTN X1 (17S/0.4) moreover to X2 (25S/0.6)
- WaveOne very little (#21/0.06) in addition to first document (# twenty five zero.08)
- WaveOne gold very little (# twenty zero.07) in addition to terribly initial file &#40; # twenty around five zero.07&#41;
- Protaper gold (Sx, S1, S2, F1 and F2) files

As before long as exploitation each file throughout the canal preparation, fully the teams, irrigation was performed once every modification of instrument with a pair of . not zero mil of a five. twenty fifth NaOCl resolution then a pair of. zero million of a Revolutionary Organization FTO EDTA resolution.

Cone Beam computed axial image resolution Imaging (CBCT)

All examples were imaged exploitation Cone Beam computed axial image resolution (CBCT Weraviewepocs 3D; L. Morita, Kyoto, Japan) operative at a hundred twenty emu in addition to 3--7 mA. the theater of browse eight cm in diameter in addition to eight cm is tall. items were 800--800 post exchange, with a locality size of zero. 125 mm, for consecutive samples analysis.

The Analysis the ability of shaping ability of shaping of t four used tools tested, were assessed via analysis of:

1. The the Canal transportation, at 3 fully and completely different levels
2. Instrument centering capacity.

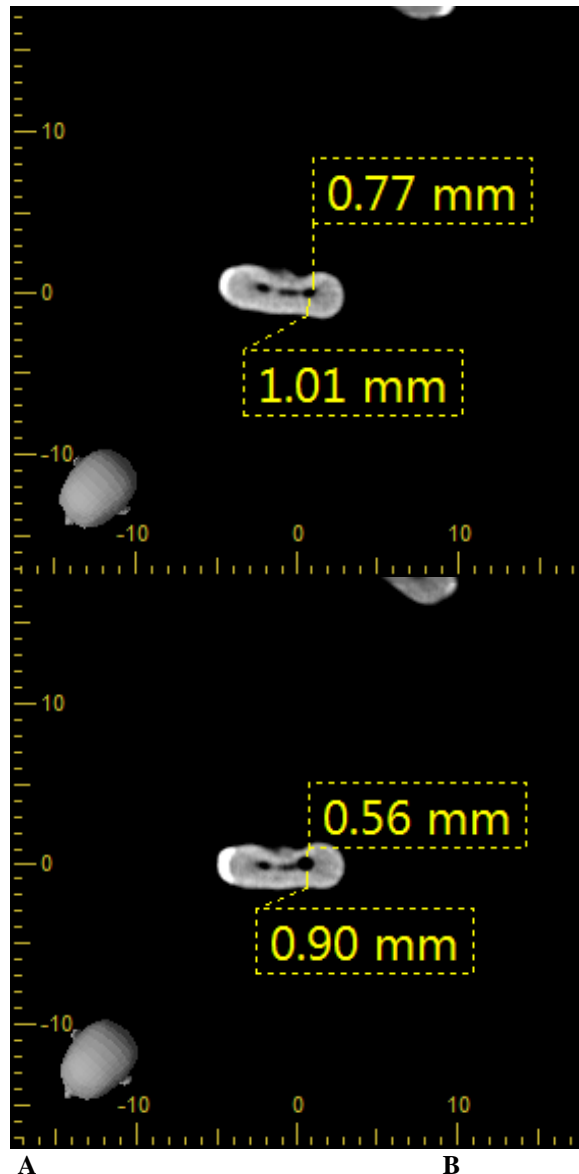


Figure (3): (A) The pre-instrumentation (B) the post-instrumentation.

### 1) Analysis of the transportation of the canal

The quantity of the transportation of the canal was determine; at 3 absolutely completely different levels (3, 6, and 9 m. linear measure from the apex); every technique introduced by Gambill et al. 1996. sixty six The minimum

distances from the sting of un-instrumented canal to the border of the muse (mesial in addition to distal, were measured then were compared to identical estimations got from the tools photos following recipe was utilized for the count of transportation at every stage of all the groups: (x1-x2-y1-y2) in Figure. 3:

D1 may be that minimum space from median fringe of the muse to the median fringe of the uninstrumented canal.  
 D2 may be is that the minimum space from the median fringe of the muse to the median fringe of the instrumented canal.

S1 is that shortest space from the distal fringe of the muse to the distal fringe of the uninstrumented canal.  
 S2 is that minimum space from the D fringe of the muse to the distal fringe of the instrumented canal.

Every this formula, a results of "0" showing no transportation of the canal. A result excluding "0" implies that transportation has occurred at intervals the channel. A negative result showing that there is transportation far from the angularity region, in addition to a positive result showing that there is transportation in front of the angularity region.

**2) Analysis of centering capacity**

In the point of view of Gambill et al 1996 " the magnitude relation of the mean centering " was firm for all the groupings to each level victimization following ratio: (D1-D2)-: -(S1-S2) or (V1-V2)-: -(D1-D2) If these don't seem to be equal, rock bottom figure is taken into thought the dividend of the affiliation. per this formula a results of "1" indicates marvelous centering.

In the beginning, illustrative insights for each and every cluster results. simplex research of variance variable research check of significance accompanied by pair-wise Newman-keulse that used for comparison mean values for canal transportation, centering regards. arithmetic analysis were victimization by Graph-Pad Prism-4 bundle for Windows (San Diego, Ca) principles

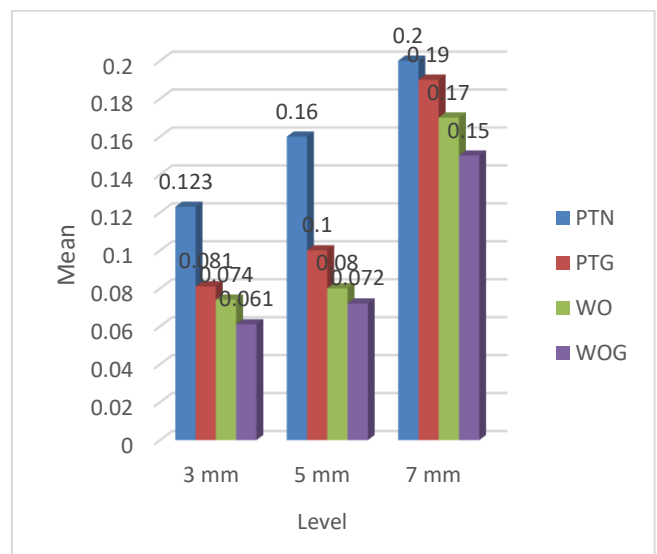
**Result :** Canal transportation Within both 3&5 mm planes, no significant difference in canal transportation was shown between the three file protaper gold, ware one gold and wave in files (P>0.05), while protaper next transport the canals significaty (P<0.05) more than the three files. Within 7 mm planes has no significant difference in transportation of the canal (P>0.05) was found between all the tested files.

**Table 1 :** mean ± standard Deviation of transportation (mm) values for tested groups , and statistical Analysis

Level	PTN	PTG	WO	WOG	P value
3 mm	0.123 <sup>a</sup> ± 0.07	0.081 <sup>a</sup> ± 0.04	0.074 <sup>a</sup> ± 0.06	0.061 <sup>a</sup> ± 0.025	0.008

5 mm	0.16 <sup>a</sup> ± 0.08	0.1 <sup>a</sup> ± 0.06	0.08 <sup>a</sup> ± 0.04	0.072 <sup>a</sup> ± 0.047	0.000
7 mm	0.20 ± 0.10	0.19 ± 0.1	0.17 ± 0.09	0.15 ± 0.1	0.262

Mean value represented with different superscript letter are significantly different according to LSD test (P<0.05)



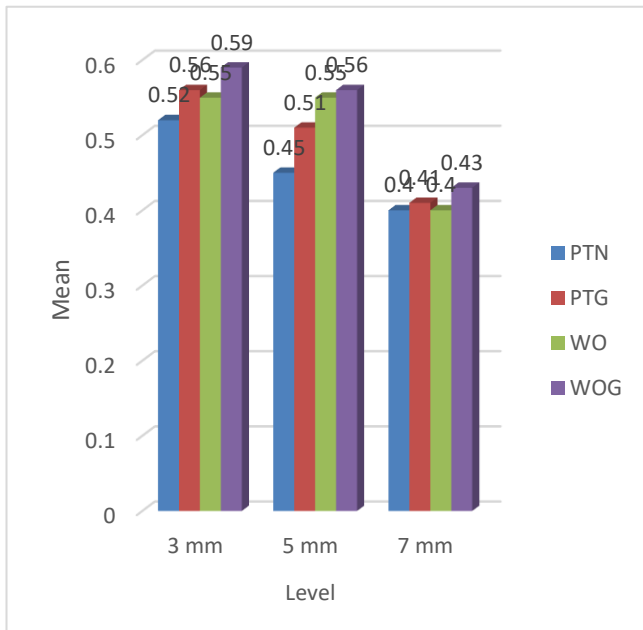
Centering ability: Regarding the centering ability of all tested files (protaper next, protaper gold, wave one gold and wave one files, no signifact difference was found between all groups (P>0.05) at the three levels of the root canal (3.5 and 7mm) .

**Table 2 :** mean ± standard Deviation of centering ratio values for tested groups , and statistical Analysis

Level	PTN	PTG	WO	WOG	P value
3 mm	0.52 ± 0.19	0.56 ± 0.13	0.55 ± 0.14	0.59 ± 0.15	0.584
5 mm	0.45 ± 0.13	0.51 ± 0.17	0.55 ± 0.14	0.56 ± 0.18	0.109
7 mm	0.4 ± 0.12	0.41 ± 0.1	0.4 ± 0.11	0.43 ± 0.1	0.76

Mean value represented with different superscript letter are significantly different according to LSD test (P<0.05)





### Discussion

An ideal passageway preparation technique ought to respect the initial anatomy of the foundation canal that means the removal of identical proportion of fabric from the inner in addition to outer aspects of the foundation canal, in addition to minimize top opening displacement. This principle is throughout preparation so as to stop induced complications like barring in addition to canal aberrations.

The purpose of this study is to check the shipping ability of 4 freshly introduced nickel Ti rotary instruments suggested for the preparation semicircular root canals, 2 of that work on principle of reciprocatory movement (wave one in addition to wave one gold) in addition to also the another 2 files (protaper next in addition to protaper gold) works by continuous rotary movement.

Crowns reminiscent of the medial roots were preserved to mimic the clinical conditions wherever the tenton is created throughout canal instrumentation by file, thanks to interference of cervical dentin projections.

The CBCT imaging technique was used for assessment of shaping ability of the 2 file because it provides an explicit, duplicable, 3 dimensional assessment of alterations in passageway volume before in addition to when preparation while not damaging the specimens (71).

The angle of curvature at 25-45 was most popular because it conseduel as moderate to sever curvature that cowl an oversized scale of case (72). Curvatures with high susceptiblensness to induced mishaps typically exist at 3 levels: three.5 in addition to 7 mm, that represent the top, middle, in addition to wreath thirds of the foundation canals, severally thus were chosen for analysis within the gift study.(73)

In the study , the results indicated that no important distinction was found in canal transportation between the 3 files (protaper gold ) in addition to were one) at any level an extended the canals . whereas protaper next transported the canal considerably (at three in addition to 5mm) quite the 3 files . the current findings, associated with the shortage of

distinction in transportation between wave one in addition to wave one gold corroborate those of a recent analysis of semicircular canals in extracted jaw in addition to jaw molars (74). within the letter study, they indicated that each wave ne associated wave one gold respect the initial canal anatomy well in addition to also the use of gold heat-treated instrument wasn't related to an improved shaping ability. On the contrary the higher performance of wave over protaper next found within the gift study isn't in agreement with previous study by Troierno et al.(75) United Nations agency found that shaping procedures with protaper next instruments incontestable a lower quantity of organic compound removed in addition to higher centering ability than wave one classic system . the distinction within the results could also be associated with use of various models for analysis canal transportation because the different study used a organic compound block for determination of canal anatomy changes.

Through the analysis centering ability it's doable to judge the symmetry of shaping . this can be important throughout clinical shaping procedures to avoid formation of induced defects. In general, all instruments maintained the initial canal curvature well, as no any important distinction in terms of centering ability were obtained during this study. so from a clinical purpose of vies , the distinction in canal transportation between restricted importance taking into consideration that severely semicircular canal were instrumented, the clinical connectedness of a most distinction in canal transportation of mere (0.04-0.1mm) remains not vital. furthermore in line with Wu et al (76) transportation larger than zero.3 metric linear unit might have a negative impact on the top seal. There for, it may well be argued that in terms of transportation one among the cluster preformed with any clinically important implications in terms of a reduced top seal.

In general, all the tested instruments within the current study have totally different improved styles in addition to increase flexibility either by producing by M wire on or heat treatment to boost their mechanical properties in addition to adaptability . thus it's not shocking that every one instruments may respect the canal curvature throughout preparation .

The increased dentin removal by protaper next could also be explained by the motion of the instrument, protaper next with the offset center of rotation may need larger envelope of motion compared with either the traditional focused mass of rotation with protaper gold or reciprocation of wave one in addition to wave one gold.

One of the extra rationalization of the shortage of obvious distinction in canal transportation between completely different teams is that the air lane that was performed before every system that is that the 1st in addition to one in every of the foremost vital steps in canal preparation safety in addition to bar of the canal aberrations.

One of the constraints of this study would be that the specimens employed in this study possessed only 1 curve of the canal. However, specimens with

S-shaped curvature in proximal in addition to clinical read radiographs one quite rare in addition to troublesome to gather , standardized in addition to divided equally between

four teams. any studies with the specimens having severely arched in addition to formed canal one needed to a lot of accurately appraise the performance of those file systems

### Conclusions

Within the limitation of the present study , it was determined that all of the tested Ni Ti files covered various level of canal transportation. However protaper gold, wave one gold and wave one Ni Ti files were found to be carve a lower degree of transportation than protaper next file.

### Recommendation

Further studies will be needed on other behaviors of instrumentation, including debris extrusion, [comparvery](#) there from Ni Ti system

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