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## Shaping Ability of Different Rotary Nickel Titanium Systems (An In Vitro Study)

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### Abstract

#### Aim

The aim of the study was to evaluate the shaping ability of three rotary nickel titanium systems Revo-S, M-Pro and 2Shape regarding the change of canal curve.

#### Materials and methods

Thirty human mandibular molars were selected for the study, with moderate angle of curvature between (25°-35°). Samples were randomly distributed into three equal groups each of ten according to system used for mesiobuccal canal preparation. Cone beam computed tomography was used to evaluate angle of canal curvature pre and post instrumentation using Schneider method.

#### Results

There was a statistically significant difference between different groups in percentage of reduction of canal curve. The highest values of percentage of reduction was found in Revo-S group.

#### Conclusion

Revo -S root canal rotary system caused the highest percent of reduction in canal curve among all groups.

#### Keywords

Shaping ability, M-Pro, 2Shape, Revo-S

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## Introduction

The main objective of root canal treatment is bacterial eradication through mechanical preparation and canal disinfection, while Preserving original canal anatomy and configuration.

Although Nickel titanium (Ni-Ti) rotary file systems greatly improved root canal preparation efficiency (1), canal preparation and instrumentation is still challenging (2).

Recently introduced, 2Shape (2S) Nickel titanium rotary file is made of alloy called T-wire. 2Shape has a sequence with two instruments: TS1 (#25, 0.04) and TS2 (#25, 0.06) (3).

M-Pro nickel titanium rotary file made of a controlled memory alloy with sequence of three instruments. orifice opener (#18,0.09), two shapers (#20,0.04) and (#25,0.06) (4). Revo-S is made of a conventional nickel titanium alloy.

The aim of this was to evaluate the shaping ability of three rotary nickel titanium systems Revo-S, M-Pro and 2Shape regarding the change of canal curve.

## Materials and methods

Thirty human permanent mandibular molars with mature apices and having moderate curvature ( $25^{\circ}$ - $35^{\circ}$ ) were selected for this study (n=30).

Radiographs were taken to determine degree of curvature according to Scheinder's method (5). Access cavities were prepared and the root canals were negotiated using #10 K-file (Mani, Inc, Tochigi, Japan) The working length of the mesiobuccal canal was measured by inserting K file #10 until it is visible from the apex then subtracting one millimeter from tooth length (6)

The teeth were randomly divided into three equal groups (n=10)

Group (A) Revo-S (n=10)

Group (B) M-Pro (n=10)

Group (C) 2Shape (n=10)

Instrumentation was done according to manufacturer's instruction.

## Cone-beam computed tomography analysis

Pre and post mechanical preparation canal scanning was done using cone beam computed tomography (CBCT) (7) The pre and post -operative angles of curvature were measured according to Schneider technique on CBCT images.

Schneider's method is done by drawing a line parallel to the long axis of the canal in the coronal third (line A). A second line is then drawn from the apical foramen to intersect the point where the canal starts to deviate from the long axis (line B). The angle between them is the Schneider's angle(5) (figure 1).

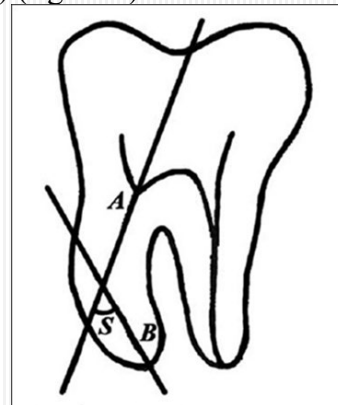


Figure (1) Schneider method

## Evaluation of canal curvature

Percent of reduction of canal curvature was calculated according to following equation

$$\frac{\text{Pre instrumentation measurement} - \text{post instrumentation measurement}}{\text{Pre instrumentation measurement}} \times 100$$

The greater the percentage the more change happened

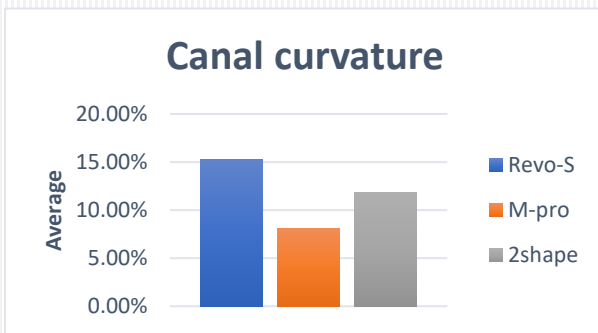
## Results

Mean and standard deviation (SD) values of percentage of reduction of canal curvature were presented in table (1) and figure (2)

Results showed that there was a statistically significant difference between different groups in percentage of reduction of canal curve. The highest values of percentage of reduction was found in Revo-S group followed by 2Shape, while the lowest value was for M-Pro group.

**Table (1):** Mean ± standard deviation (SD) of percentage of reduction of canal curvature

Percentage of reduction of canal curve (mean±SD)			p-value
Revo-s	M-pro	2shape	
15.22±2.49 <sup>A</sup>	8.10±1.27 <sup>C</sup>	11.82±3.17 <sup>B</sup>	<0.001*



**Figure (2):** Bar chart showing average percentage of reduction of canal curvature

**Discussion**

the main technical goal during root canal preparation is to develop a continuously tapered preparation from orifice to root canal apex, while maintaining original root canal anatomy and configuration(5) Root canal preparation can be done by using manual or rotary instrumentation. Both instrumentation techniques used in root canal preparation may lead to procedural errors(8). However, several studies showed that Ni-Ti rotary instruments maintained original canal shape better than stainless steel files(9).

With their advantage of simulating the clinical situation extracted human teeth was used rather than stimulated canal (10). Although simulated canals guarantee the

standardization, but it is different from natural teeth in dentin hardness and canal irregularities(11)(12)(13). Also, the heat produced by rotary instruments through friction may cause resin to melt(14)(15). Mesio-buccal canals of mandibular molars were selected because they show curvature at least in mesiodistal plane. They are narrow increasing instrumentation difficulty. (16)

Various methods are used to evaluate the quality of endodontic instrumentation including, scanning electron microscope, photography, a prefabricated model of the canal and computerized systems(17). Computed tomography (CT) and micro-CT were first suggested for this purpose since they are non-invasive and do not require tooth sectioning. CBCT has been confirmed to be an accurate tool to study the root canal anatomy(18)(19).

In the present study all groups showed significant reduction in canal curvature. The highest value of percentage of reduction was found with samples shaped with Revo-S followed by 2Shape while the lowest value were found in samples shaped with M-pro.Revo-S is made of conventional Ni-Ti alloy increasing file tendency to straightening canal curve .While M-pro and 2Shape are made of heat treated Ni-Ti alloy. Since heat-treatment increases file flexibility allowing better respect to original canal curve. (20)(21) (22) .

**Conclusion**

With the limitation of the present study it was concluded that Revo -S root canal rotary system caused the highest percent of reduction in canal curve among all groups.

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