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College of Dentistry**



**In Vitro Assessing The Canal Transportation and  
Centering Ability of Four Nickel-Titanium Single File  
Rotary Systems by Cone Beam Computed Tomography**

A Thesis

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## Abstract

The clinical challenge in shaping the curved root canals is preserving the original shape of the canals producing a flare shape from the apical portion to the coronal end, thus preserving the apical foramen with no deviation away from its original axis and reducing the risk of iatrogenic events such as instruments separation, perforation, transportation and ledge formation.

The new improvements that recently happened in the science of metallurgy and new heat treatment process during manufacturing of Ni-Ti files led to the invention of new files which were claimed to be able to accomplish the canal preparation using only one file.

These newly developed files were evaluated regarding their shaping ability and their performance by many methods. Cone beam computed tomography (CBCT) was suggested for evaluation as it is a non-destructive and very precise method.

The aim of this study was to assess the shaping ability of four rotary nickel-titanium single file systems using cone beam computed tomography (CBCT). Forty permanent maxillary first molars with mesiobuccal canals curvature ranging from 20-30 degree were selected and assigned into four groups (n=10), according to the biomechanical preparation system used: WaveOne GOLD (WOG), Reciproc blue (RB), Hyflex EDM (HF) and OneShape (OS) . The teeth were accessed and then sectioned at the cemento-enamel junction (CEJ) in order to standardize root length at 15 mm; working length estimation was done after that. The samples were mounted on acrylic bases with the aid of a dental surveyor and two L shaped metal plates and were pre-scanned with CBCT at 3, 6 and 9 mm from the root apex corresponding to the apical,

middle and coronal thirds respectively. The roots were instrumented after that according to manufacturer instructions. Then the teeth were post-scanned after instrumentation of root canals. Images from both pre and post instrumentation were captured and processed by AutoCAD software program. Data were not normally distributed so Kruskal-Wallis and Mann-Whitney U tests were statistical tests used for analysis at the 5% confidence level. The results showed that there were no significant differences at the apical and coronal third while a significant difference at the middle third regarding canal transportation was present. However, a non-significant difference in the centering ability was found among the groups at all the levels except at the apical third.

It was concluded that the four tested systems produce transportation of the canal at the middle region, and different centering ability at the apical third. The innovated manufacturing method of the HF system leads to superior shaping ability that produced less transportation and better centering ability than that of the other systems. WOG group showed less transportation and better centering ratio than Reciproc blue at all levels. On the hand, OneShape group showed the greater amount of canal transportation and less centering ability than the other groups at all levels.