

EVALUATION OF CANAL TRANSPORTATION AND CENTERING ABILITY OF HYFLEX EDM, SMARTTRACK X3 AND PROTAPER NEXT ROTARY FILE SYSTEMS USING CBCT (IN-VITRO STUDY)

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INTRODUCTION

The main objective of successful endodontic treatment is proper biomechanical instrumentation through shaping, disinfection, and obturation (1).

New rotary files are produced in a trial for maintenance of canal anatomy without affecting the main goal; by improving their efficiency of cutting, fracture resistance and flexibility (2). This study aims to assess the canal transportation and centering ability of the following 3 different rotary file systems: HyFlex EDM, SmartTrack X3 and ProTaper Next, in the mesiobuccal canals of mandibular molars using Cone Beam Computed Tomography (CBCT). The Null hypothesis of the present study was that the three rotary file systems would not significantly differ from one another regarding both canal transportation or centering ability.

METHODOLOGY

For this study, 27 newly extracted mandibular molars with mesial roots showing moderate to severe root curvature according to Schneider's technique randomly divided into three groups of nine teeth (n = 9).

Three Rotary Ni-Ti systems were used to instrument the root canals to their full working length. Group I: HyFlex EDM with a variable taper and ISO 25 tip size. Group II: SmartTrack X3 with a variable taper and an ISO 25 tip size; Group III: ProTaper Next with an ISO 25 tip size and a 0.06 taper. All specimens were obtained to the same length 18mm to obtain a reproducible reference point with flat occlusal surface reduction was done using double-faced diamond disc (Komet, USA, LLC) mounted on low-speed handpiece. Distal root was resected to get a clear CBCT images.

Using preoperative and postoperative CBCT, axial cuts images were analyzed Using OnDemand 3D software (Cyber Med Inc, USA) at three, six- and nine-mm level from the apex, respectively, to assess the incidence of canal transportation and centering ability of these rotary file systems by Gambill method (3). (Figure 1) Preoperative and postoperative CBCT images were analysed by one evaluator who was blinded to the file system used.

The Kruskal-Wallis, Freidman, and pairwise comparison with the Bonferroni correction tests were used for data analysis.

RESULTS AND DISCUSSION

Regarding canal transportation and centering ability, the overall results showed that there was no statistically significant difference at 3mm, 6mm and 9mm among all groups. (P> 0.05). Table (1,2)

These results were agreed with a study by Marceliano-Alves et al., (2022) (4) showing no significance difference between Hyflex EDM and ProTaper Next at all root canal level and both systems respecting the original anatomies during instrumentation.

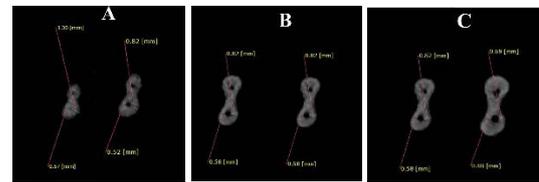


Figure (1): Showing CBCT images measurement analysis of tooth group at three, six and nine mm levels of pre and post instrumentation. (A) Axial sections measurement at 3mm level, respectively. (B) Axial sections measurement at 6mm level, respectively. (C) Axial sections measurement at 9mm level, respectively

Table (1): Comparison of centering ability among HyFlex EDM, SmartTrack X3, and ProTaper Next 3mm, 6mm and 9mm

		HyFlex EDM (n=9)	SmartTrack X3 (n=9)	ProTaper Next (n=9)	P value
3 mm	Median (IQR)	0.56 (0.56)	0.68 (0.45)	0.67 (0.26)	0.579
	Min - Max	0.15 - 1.00	0.24 - 1.00	0.39 - 0.85	
6 mm	Median (IQR)	0.69 (0.31)	0.58 (0.56)	0.52 (0.37)	0.311
	Min - Max	0.44 - 0.93	0.27 - 0.95	0.15 - 0.86	
9 mm	Median (IQR)	0.63 (0.52)	0.53 (0.57)	0.63 (0.54)	0.927
	Min - Max	0.19 - 0.97	0.23 - 1.00	0.18 - 1.00	
Overall	P value	0.717	0.690	0.641	0.901
	Median (IQR)	0.60 (0.21)	0.65 (0.24)	0.68 (0.30)	
	Min - Max	0.39 - 0.87	0.32 - 0.80	0.39 - 0.80	

Table (2): Comparison of canal transportation among HyFlex EDM, SmartTrack X3, and ProTaper Next 3mm, 6mm and 9mm

		HyFlex EDM (n=9)	SmartTrack X3 (n=9)	ProTaper Next (n=9)	P value
3 mm	Median (IQR)	-0.01 (0.26)	0.05 (0.21)	-0.02 (0.16)	0.616
	Min - Max	-0.23 - 0.33	-0.16 - 0.31	-0.14 - 0.17	
6 mm	Median (IQR)	-0.04 (0.12)	0.01 (0.24)	-0.10 (0.27)	0.667
	Min - Max	-0.14 - 0.20	-0.27 - 0.22	-0.28 - 0.12	
9 mm	Median (IQR)	0.06 (0.26)	0.05 (0.33)	0.11 (0.16)	0.813
	Min - Max	-0.50 - 0.21	-0.10 - 0.36	-0.13 - 0.48	
Overall	P value	0.717	0.074	0.016*	0.582
	Median (IQR)	0.02 (0.22)	0.06 (0.15)	-0.02 (0.10)	
	Min - Max	-0.22 - 0.12	-0.13 - 0.19	-0.08 - 0.20	

CONCLUSION

In light of the study's limitations, it was found that Hyflex EDM, SmartTrack X3, and ProTaper Next functioned very similarly, in the mesiobuccal direction, at the apical, middle, and coronal levels of the canal regarding the centering ability and canal transportation.

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