Research Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2017;6:1s:129-133.

To Compare and Evaluate Canal Shaping Using Hyflex CM, One Shape & Revo-S Using CBCT: An Invitro Study

Anil K Tomer[1] Anjali Miglani[2] P Nagarjuna[3*] Priyali Chauhan[4] Sandeep Rana[5] Leena Tomer[6]

[1]Professor and Head, Department of Conservative Dentistry & Endodontics, D.J College of Dental Sciences and Research, Modinagar, India.
[2]Reader, Department of Conservative Dentistry & Endodontics, D.J College of Dental Sciences and Research, Modinagar, India.
[3]Post Graduate Student, Department of Conservative Dentistry & Endodontics, D.J College of Dental Sciences and Research, Modinagar, India.
[4]Post Graduate Student, Department of Conservative Dentistry & Endodontics, D.J College of Dental Sciences and Research, Modinagar, India.
[5]Post Graduate Student, Department of Conservative Dentistry & Endodontics, D.J College of Dental Sciences and Research, Modinagar, India.
[6]Professor, Department of Prosthodontics & Implantology, Department of Conservative Dentistry & Endodontics, D.J College of Dental Sciences and Research, Modinagar, India.

ABSTRACT

Background: However, endodontic preparation in curved and narrow root canals is more challenging, with a tendency for the prepared canal to deviate away from its natural axis."Canal shaping is a critical aspect of endodontic treatment.

Materials & methodology: 45 human extracted mandibular first molars with curved mesial roots with two separated canals and apices were used for this study. 45 teeth were then divided into 3 groups[n = 15 each], Group I with using one shape, Group II with using Hyflex CM, Group III with using Revo S CBCT images for all prepared teeth were obtained before and after instrumentation, with CS9300 equipment (Carestream Healthcare India (P) Ltd) in the high resolution dental mode (i.e. 90 micron resolution). The data were compared statistically using ANOVA test & SPSS 20 Software.

Results: Hyflex CM file systems is showing the better results compared to the other file systems.

Conclusion: In this study Hyflex CM Multiple File System showed minimum or no canal transportation at all the levels – 0,1,2,3,4,5,6 and 7 mm as compared to One Shape Single File Systems and Revo S.

Keywords: Cone beam computed tomography, canal shaping, endodontics, treatment.

INTRODUCTION

The aim of endodontic treatment is to clean and shape root canals adequately so that canal disinfection and filling are optimized. According to Schilder, root canal preparation should present a flare shape from apical to coronal, preserving the apical foramen and not alter the original canal curvature[1]. However, endodontic preparation in curved and narrow root canals is more challenging, with a tendency for the prepared canal to deviate away from its natural axis."Canal shaping is a critical aspect of endodontic treatment because it influences the outcome of the subsequent phases of canal irrigation and filling and the success of the treatment itself "In the last few decades the development of rotary nickel-titanium (NiTi) systems has significantly improved the quality of canal shaping and allowed for root canal preparation with continued rotation on narrow and/or curved root canals. The success of NiTi systems is related to the design, flexibility, and elastic memory[4]. Moreover, NiTi instruments allow for greater conical canal preparation with less work

Received: Nov. 21, 2016: **Accepted**: Jan. 5, 2017
***Correspondence Dr. P. Nagarjuna.**
Department of Conservative Dentistry & Endodontics, D.J College of Dental Sciences and Research, Modinagar, India.
Email: drnagarjuna88@gmail.com

pISSN 2278-0076
eISSN 2321-9270

time and more centered shaping of the canal in its original axis, producing rounder preparations and reducing procedural errors[9].

MATERIALS AND METHODS

45 extracted mandibular first molars with curved mesial roots with two separated canals and apices were kept in distilled water. Teeth were embedded into wax blocks and the endodontic access was made and the radiographs were taken from two mesial canals with size 10 K files to determine the curvature angles and the working length. Then the teeth were sectioned vertically into two halves with the help of a diamond disc. After access cavity preparation 45 teeth were then divided into 3 groups [n = 15 each], Group I with using one shape, Group II with using Hyflex CM, Group III with using Revo S CBCT images for all prepared teeth were obtained before and after instrumentation, with CS9300 equipment (Carestream Healthcare India (P) Ltd) in the high resolution dental mode (i.e. 90 micron resolution). The technical outcomes were compared at 0, 1, 2, 3, 4, 5, 6, 7, 8 mm intervals. The parameters evaluated were: 1.Working Time, 2.Angle of Curvature, 3.Centric Ability, 4.Canal Transportation

Working Time: Time taken to prepare the mesial canals in the mandibular molars was calculated for both groups with the help of a stop watch.

Root Canal Curvature: Mandibular molars having severely curved mesial root with two separate canals i.e. mesiobuccal and mesiolingual and apices with a curvature angles ranging within 20-30 degrees were used.

Centering ability: The centering ability ratio i.e the ability of the instrument to remain in a central position within the canal, was calculated for each cross-section using the ratio of (X1 _ X2) to (Y1 _ Y2) where X1 is the distance between the mesial portions of the root and the un-instrumented canal, X2 is the distance between the mesial portions of the root and the instrumented canal, Y1 is the distance between the distal portions of the root and the un-instrumented canal, and Y2 is the distance between the distal portions of the root and the instrumented canal. Whenever these numbers were not equal, the lower figure was considered to be the numerator of the ratio. According to this formula, a result of 1 indicates optimal centering ability.

Canal transportation: Canal transportation was calculated in milli meters with the formula [(X1 _ X2) _ (Y1 _ Y2)], as described by Gambill et al. Pre- and postoperative measurements were compared to reveal the presence or absence of deviations in canal anatomy and to identify the most affected region.

Statistical Analysis

The mean difference and standard deviations in root canal curvature, working time, centric ability, cross-sectional area and canal transportation were measured for each file system. The data were compared statistically using ANOVA test & SPSS 20 Software.

RESULTS

Using ANOVA test there was a statistical difference between the root canal curvatures and working time between the two groups ($P < 0.05$). Hyflex CM Multiple File System showed minimum or no canal transportation at all the levels – 0,1,2,3,4,5,6 and 7 mm as compared to one shape and Revo S File Systems.

Table 1: showing working time between one shape, Hyflex CM & Revo S

S.NO.	TYPE OF ROOTS	Group1 [One Shape]	Group2 [Hyflex CM]	Group3 [Revo S]
1	Mesiobuccal	261.47±7.90min	420.66± 16.7 Min	240.27± 6.49 Min

Table: 1 show the working time of three different file systems. Hyflex cm is having the more working time compared to other file systems as it is having the multiple files, where as the other files are single file systems.

Table 2: showing Angle of curvature between one shape, Hyflex CM & Revo S

S. NO.	TYPE OF ROOTS	Group 1 [One Shape]	Group 2 Hyflex	Group 3 [Revo

				CM]	S]
1	Mesio buccal	Pre-instrumentation	30.00± 6.95°	30.33± 2.12°	24.67± 3.99°
		Post-instrume	32.40± 8.88°	28.66± 3.41°	26.66± 2.97°

		ntation			

Table 2: showing the angle of curvature of different file systems, Hyflex CM is showing the better result in maintaining the curvature of root canal compared to the Revo S and One shape.

Table 3: showing canal transportation between one shape, Hyflex CM & Revo S.

S.NO.	Length Of Canal At Different Levels [in mm]	**Group1** [One Shape]	**Group2** [Hyflex CM]	**Group3** [Revo S]
1	0	0.00±0.00	-0.004±0.01	0.00±0.00
2	1	0.00±0.00	-0.01±0.01	0.00±0.00
3	2	-0.02±0.03	0.00±0.00	0.00±0.00
4	3	-0.05±0.07	0.00±0.00	-0.03±0.04
5	4	-0.05±0.06	0.00±0.00	-0.10±0.01
6	5	-0.09±0.09	0.00±0.00	-0.06±0.09
7	6	-0.05±0.07	0.00±0.00	-0.03±0.04
8	7	-0.05±0.12	-0.01±0.01	-0.01±0.01

By observing the result hyflex is showing the less canal transportation compared with the other file systems.

Table 4: showing centric ability between one shape, Hyflex CM & Revo S.

S.NO.	LENGTH OF CANAL AT DIFFERENT LEVELS [in mm]	**Group1** [One Shape]	**Group2** Hyflex CM]	**Group3** [Revo S]
1	0	0.75±0.73	0.10±0.15	0.13±0.19
2	1	0.29±0.26	0.00±0.00	0.07±0.09
3	2	0.60±0.83	0.00±0.00	0.07±0.09
4	3	1.06±1.57	0.33±0.05	0.20±0.22
5	4	0.63±0.68	0.00±0.00	1.07±1.42
6	5	0.93±1.03	0.00±0.00	0.77±0.91
7	6	1.04±0.95	0.00±0.00	0.70±0.95
8	7	0.53±0.36	0.14±0.14	1.03±1.44

By observing the table 4 Hyflex CM is having better centric ability compared to the other file systems.

DISCUSSION

Considering the development of different devices and instrumentation techniques to perform root canal preparation, several methods have been proposed to evaluate the shaping ability of instrumented canals with the aim of preserving the apical foramen and original canal curvature[5, 8, 13]. Satisfactory results have been obtained with the root serial section technique[16], radiographic platform[18], and root resin canal simulation[17]. However, more accurate information can be

achieved with micro-computed tomography[6, 13] (micro-CT) and computed tomography[1, 7, 8, 20] (CT) which allows for the quantitative and qualitative evaluation of root canals in 3 dimensions[9]. Therefore, in the present study, the root canal transportation and centering ability of four different NiTi rotary systems were evaluated with CT. Root canal shaping is a key stage of endodontic treatment, when performed properly it is a predictive factor for success. Ideally, root canal shaping should create a continuous tapered preparation from crown to apex while maintaining the original path of canal and keeping the foramen size as small as practical **Schilder 1947**[10]. Working time taken for Hyflex CM files was more as it is having high number of files, while the working time differs from clinician to clinician. Coming to angle of curvature Hyflex CM has maintained the canal curvature compared with the one shape and Revo S and in between these two Revo S has maintained the better canal curvature. Canal transportation denotes the shortest distances from the central axis of the canal to the periphery of the canal before and after instrumentation, and it was measured in both mesial and distal directions, whereas the canal transportation is the difference between the diameter of the width of toot before and after the root canal preparation. Hyflex CM has very less compared to other files because of the design of the file and helps in canal transportation. Hyflex CM Multiple File System showed the better cleaning and shaping ability with respect to all the parameters evaluated in this study compared to Single File Systems.

CONCLUSION

Within the limitations of the study Hyflex CM Multiple File System showed minimum or no canal transportation at all the levels – 0,1,2,3,4,5,6 and 7 mm as compared to One Shape Single File Systems and Revo S.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Gambarini G, Gerosa R, De Luca M, Garala M, Testarelli L (2008a) Mechanical properties of a new and improved nickel-titanium alloy for endodontic use: an evaluation of file flexibility. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology 105, 798–800.

2. Gambarini G, Grande NM, Plotino G et al. (2008b) Fatigue resistance of engine-driven rotary nickel-titanium instruments produced by new manufacturing methods. Journal of Endodontics 34, 1003–5.

3. Gambarini G, Pongione G, Rizzo F, Testarelli L, Cavalleri G, Gerosa R (2008c) Bending properties of nickel-titanium instruments: a comparative study. Minerva Stomatologica 57, 393–8.

4. Gutmann JL, Gao Y (2012) Alteration in the inherent metallic and surface properties of nickel-titanium root canal instruments to enhance performance, durability and safety: a focussed review. International Endodontic Journal 45, 113–28.

5. Kuzekanani M, Walsh LJ, Yousefi MA (2009) Cleaning and shaping curved root canals: Mtwo® vs ProTaper® instruments, a lab comparison. Indian Journal of Dental Research 20, 268–70.

6. Machado ME, Sapia LA, Cai S, Martins GH, Nabeshima CK (2010) Comparison of two rotary systems in root canal preparation regarding disinfection. Journal of Endodontics 36, 1238–40.

7. Peters OA (2004) Current challenges and concepts in the preparation of root canal systems: a review. Journal of Endodontics 30, 559–67.

8. Sch€afer E, Vlassis M (2004) Comparative investigation of two rotary nickel-titanium instruments: ProTaper versus RaCe. Part 2. Cleaning effectiveness and instrumentation results in severely curved root canals of extracted teeth. International Endodontic Journal 37, 239–48.

9. Yang G, Yuan G, Yun X, Zhou X, Liu B, Wu H (2011) Effects of two nickel-titanium instrument systems, Mtwo versus ProTaper

Universal, on root canal geometry assessed by micro-computed tomography. Journal of Endodontics 37, 1412–6.

10. Yared G (2008) Canal preparation using only one Ni-Ti rotary instrument: preliminary observations. International Endodontic Journal 41, 339–44.

11. You SY, Kim HC, Bae KS, Baek SH, Kum KY, Lee W (2011) Shaping ability off reciprocating motion in curved root canals: a comparative study with micro-computed tomography. Journal of Endodontics 37, 1296–300.

12. Nagaraja S, Sreenivasa Murthy BV. CT evaluation of canal preparation using rotary and hand NiTi instruments: An *in vitro* study. J Conserv Dent 2010;13:16-22.

13. Dagna A, Poggio C, Beltrami R, Colombo M, Chiesa M, Bianchi S. Cyclic fatigue resistance of OneShape, Reciproc, and WaveOne: An *in vitro* comparative study. J Conserv Dent 2014;17:250-4.

14. Testarelli L, Plotino G, Al-Sudani D, Vincenzi V, Giansiracusa A, Grande NM, *et al.* Bending properties of a new nickel-titanium alloy with a lower percent by weight of nickel. J Endod 2011;37:1293-5.

15. Gambarini G, Gerosa R, De Luca M, Garala M, Testarelli L. Mechanical properties of a new and improved nickel-titanium alloy for endodontic use: An evaluation of file flexibility. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;105:798-800.

16. Pongione G, Pompa G, Milana V, Di Carlo S, Giansiracusa A, Nicolini E, *et al.* Flexibility and resistance to cyclic fatigue of endodontic instruments made with different nickel-titanium alloys: A comparative test. Ann Stomatol (Roma) 2012;3:119-22.

17. Zinelis S, Eliades T, Eliades G. A metallurgical characterization of ten endodontic Ni-Ti instruments: Assessing the clinical relevance of shape memory and superelastic properties of Ni-Ti endodontic instruments. Int Endod J 2010;43:125-34.

18. Shen Y, Coil JM, Zhou H, Zheng Y, Haapasalo M. HyFlex nickel-titanium rotary instruments after clinical use: Metallurgical properties. Int Endod J 2013;46:720-9.

19. Peters OA, Gluskin AK, Weiss RA, Han JT. An *in vitro* assessment of the physical properties of novel Hyflex nickel-titanium rotary instruments. Int Endod J 2012;45:1027-34.

20. Schäfer E, Vlassis M. Comparative investigation of two rotary nickel-titanium instruments: ProTaper versus RaCe. Part 1. Shaping ability in simulated curved canals. Int Endod J 2004;37:229-38.