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Original Research

To Compare Shaping Ability of Different Rotary Nickel Titanium Single File Systems in Root Canals Of Mandibular Molars: An In-Vitro Study

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ABSTRACT:
Background: In the root canal treatment, the important and chief procedure is the cleaning and shaping of the canal system. The main objective of cleaning and shaping is proper irrigation of the root canal system while preserving the original root canal anatomy. The aim of the present study was to compare the shaping ability of different rotary nickel titanium Single File Systems in Root Canals of mandibular molars. **Material and methods:** The present study was conducted from August 2019 to October 2019 among sixty freshly extracted mandibular first molars. The molars were extracted due to poor periodontal status, during orthodontic and prosthodontic treatment. After sealing the apices with wax, the canals were mounted in the muffleblock using self-cure acrylic resin. After complete polymerization of the resin, the block was removed from the model. The blocks were sectioned horizontally at three sites (coronal, middle and apical). The disk was mounted on an electric saw for cutting the blocks. Photographs were taken of all three cross-sections of each tooth. The sections were reassembled in the muffle. The specimens were randomly divided into the following two groups: Group 1: Prepared using Reciproc rotary files. Group 2: Prepared using OneShape rotary files. Statistical analysis was done using software SPSS (version 20.0) Analysis of variance (ANOVA) and the post hoc Tukey-HSD test were used for analysis of data. P-value of less than 0.05 was considered statistically significant. **Results:** A total of 60 samples, 30 from each groups were taken. Group 1 contain Reciproc rotary files and Group 2 contains OneShape rotary files. At coronal level, middle level, apical level Reciproc showed better canal centering ability than OneShape. At coronal level, middle level, apical level Reciproc showed less canal transportation than OneShape. **Conclusion:** Our study concluded that Reciproc instruments were better than Oneshape instruments by maintaining the original canal curvature and by less canal transportation.
Key words: single rotary, oneshape, reciproc.

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INTRODUCTION:
Endodontic therapy involves a sequence of procedures for treating vital and nonvital dental pulp. It helps the patients to retain and prolong the life of their natural teeth in form, function and esthetics.[1,2] Among the different factors for successful root canal therapy, shaping and cleaning of the canals have a major role in reducing the microbiota and preparing the canals in such a manner that the original canal anatomy is preserved.[2,3] However, the total elimination of microorganisms in the root canal remains a difficult task. Pathogens such as *Enterococcus faecalis, Pseudomonas aeruginosa, Staphylococcus aureus* and *Candida albicans* are frequently observed when endodontic treatment has failed.[4] Success of the root canal treatment depends on many factors such as method and the quality of instrumentation, irrigation, disinfection, and three-dimensional obturation of the root canal.[5] In the recent years, several nickel titanium (NiTi) instruments capable of faster and more efficient root canal preparation were introduced in the market. These systems have differences in some features such as cleaning efficacy, stress applied to dentinal walls, and ability to prepare oval-shaped root canals.[6] One Shape file (MicroMega, France) operates with continuous rotational movement compared with

the other single-file systems. One Shape instruments have higher cutting efficacy in the root, which is probably attributed to electropolishing, flexibility, and variable cross section along its blade.[7] Reciproc file (VDW, Munich, Germany) is made of M-Wire, which increases its strength and flexibility.[8] The aim of the present study was to compare the shaping ability of different rotary nickel titanium Single File Systems in Root Canals of mandibular molars.

MATERIAL AND METHODS:

The duration of the present study was 2 months and conducted from August 2019 to October 2019 in the department of conservative dentistry and endodontics, UCMS college of dental surgery, Bhairahawa, Nepal. The present study was done on sixty freshly extracted mandibular first molars. The molars which were included in the study were extracted due to compromised periodontal status, extraction indicated due to orthodontic treatment and during prosthodontic treatment in order to maintain normal occlusion. The extracted molars were collected from the Department of Oral and Maxillofacial Surgery, UCMS college of dental surgery, Bhairahawa, Nepal.

Before the commencement of the study ethical approval was taken from the Ethical Committee of the institute. Teeth with completely formed apices and mesiobuccal canal curvature between 20º and 35º were included in the study. Teeth with canal curvature greater than 35°, Teeth with open apices, Teeth with calcified canals, Teeth with anatomical variations, Teeth with caries and restorations invading the pulp were excluded from the study. Equipments and materials used in the study were X-Smart plus endomotor, DSLR Camera, Diamond discs (0.3mm diameter), Radiographic jig., Modified Bermante muffle system, Digital Vernier calliper, RECIPROC rotary files, ONESHAPE rotary files, 17% EDTA solution, 5% NaOCl, 0.9 Physiologic saline. The teeth were disinfected in 5% sodium hypochlorite solution for 30 min. The teeth were kept in normal saline until used. Radiographs were taken to evaluate the mesial roots. In each tooth specimen, any one canal of the mesial root was standardized to 9mm length by removing the crown using diamond discs. The canals were controlled for apical patency with ISO no #10 k –files. Only teeth whose canal width near the apex was approximately size 15 were included; this was evaluated with size 15 K-file. Working length was established at 9 mm, and was determined by subtracting 0.5 mm from the length at which the tip of a size #15 K-file could be visualized. A radiographic platform, as described by previous researchers was used to take standardized radiographs prior to instrumentation with the k-file size #10 has been inserted into the buccal or lingual canal in order to determine the degree and radius of the curvature using periapical Kodak Insight films (Eastman Kodak Company, Rochester, NY).[9] After sealing the apices with wax, the canals were mounted in the muffle-block using self-cure acrylic resin. The blocks were sectioned horizontally at three sites (coronal, middle and apical) by a thin cutting disk (0.3-mm thick) at two levels: one 3 mm from the apex and the other 6 mm from the apex. The disk was mounted on an electric saw (CIR-SAW, Confident Dental Equipments Ltd, India) for cutting the blocks. Photographs were taken of all three cross-sections of each tooth using a DSLR Camera (Nikon Digital, Tokyo, Japan) at a fixed position. The sections were reassembled in the muffle. The specimens were randomly divided into the following two groups: Root canal instrumentation Group 1: In this group, one canal of mesial root of thirty mandibular first molars was prepared using Reciproc rotary files. The R25 Reciproc file (tip size = 25, apical taper = 0.08) was used in a programmed reciprocating motion generated by the X-Smart plus motor in the ‘‘RECIPROC ALL’’ mode. The files were used in a pecking motion (amplitude less than 3 mm, 3 pecks) according to the manufacturer’s instructions. Group 2: In this group, one canal of mesial root of thirty mandibular first molars was prepared using OneShape rotary files. The OneShape file (tip size=25, taper=0.06) was used in full clockwise rotation with a rotational speed of 400 rpm generated by the X-Smart plus motor, and the torque was adjusted to 4 N cm. The files were used in a slight pecking motion according to the manufacturer’s instructions. All canals were prepared by a single experienced operator. Copious irrigation with 5.0 ml of 5% NaOCl solution using side-vented close ended needles. Finally, the canal were irrigated with 5.0 ml of a 17% EDTA for 3 minutes, followed by 5 ml of 5% NaOCL. All the canals were rinsed with 10 ml of 0.9% sterile saline. After instrumentation, all sectioned canals were separated, and then photographed in the same manner as preinstrumentation photographs. The shaping ability of the rotary instruments was evaluated using the computer program Corel draw X6 software. Centering ability of the instruments towards the original canal was evaluated by the ratio of (a1-a2) ÷ (b1-b2) or (b1-b2) ÷ (a1-a2) according to the method developed by Gambil et al, in this formula, a1 and b1 represent the thickness of the internal and external sides of the canal wall, respectively, mesiodistally, before instrumentation and a2 and b2 after instrumentation.[10] If these numbers were not equal, the lower number was considered as numerator of the ratio. A result with ratio 1 indicates that the canal has remained centered and a result less than 1 indicates deviation of the canal outward, and result of more than one show that the canal deviates inward.The amount of canal transportation was determined by measuring the shortest distance from the edge of uninstrumented canal to the periphery of the root (mesial and distal) and then comparing this with the same measurements obtained from the instrumented images. The following formula was used for the calculation of transportation at each level for both groups: (a1-a2)-(b1-b2).

Statistical analysis was done using software SPSS (version 20.0) Analysis of variance (ANOVA) and the post hoc Tukey-HSD test were used for analysis of data. P-value of less than 0.05 was considered statistically significant.

RESULTS:

A total of 60 samples, 30 from each groups were taken. Group 1 contain Reciproc rotary files and Group 2 contains OneShape rotary files. At coronal level, middle level, apical level Reciproc showed better canal centering ability than OneShape. At coronal level, middle level, apical level Reciproc showed less canal transportation than OneShape.

Table 1: Canal centering ability among groups

		Mean± SD	p-value
Coronal	**Group 1**	**0.678±0.092**	**<0.001**
	Group 2	**0.458±0.082**	
Middle	**Group 1**	**0.653±0.063**	**<0.001**
	Group 2	**0.478±0.059**	
Apical	**Group 1**	**0.629±0.087**	**<0.001**
	Group 2	**0.494±0.083**	

Table 2: Canal transportation among groups

		Mean± SD	p-value
Coronal	**Group 1**	**0.121±0.032**	**<0.001**
	Group 2	**0.162±0.053**	
Middle	**Group 1**	**0.103±0.028**	**<0.001**
	Group 2	**0.134±0.045**	
Apical	**Group 1**	**0.054±0.018**	**<0.001**
	Group 2	**0.082±0.026**	

DISCUSSION:

The factors contributing for the success of root canal treatment depends on: providing a precise diagnosis; obtaining a proper treatment plan; complete information of the anatomy; morphology (shape) of the tooth; executing proper irrigation, disinfection, and obturation of the root canal system.[11] The preservation of apical root canal anatomy and prevention of apical transportation provide a well-sealed root filling with mere extrusion of debris and diminished postoperative discomfort. Various factors contribute to mechanical instrumentation outcomes are the design of instrument, sequence of instrumentation, rotational speed, experience of operator, and the use of irrigants.[12]

Mandibular molars are among the most common teeth requiring endodontic treatment.[13,14] Mesial canals of these teeth often have mesiodistal and/or buccolingual curvatures. Due to more severe curves in the mesiobuccal canal, this canal is highly susceptible to transportation during mechanical preparation by endodontic instruments. Canal transportation refers to complete removal of dentin from the external wall of the curvature in the apical half of the canal, which is due to the tendency of file to straighten up and return to its original straight shape during preparation of curved root canals; this may lead to ledge formation and possible perforation of canal. In addition, canal transportation in the coronal third may lead to strip perforation and reduction in residual dentin thickness.[15]

A total of 60 samples, 30 from each groups were taken. Group 1 contain Reciproc rotary files and Group 2 contains OneShape rotary files. At coronal level, middle level, apical level Reciproc showed better canal centering ability than OneShape. At coronal level, middle level, apical level Reciproc showed less canal transportation than OneShape.

Berutti *et al.* have reported that reciprocating movement allows a more centralized chemomechanical preparation when compared to continuous rotary motion, especially in the apical third.[16]

Burklein et al reported that WaveOne, Reciproc and OneShape maintained the original curvature of severely curved canals in extracted teeth well.[17,18]

Capar et al using cone-beam computed tomographic (CBCT) imaging found that WaveOne, Reciproc and OneShape maintained root canal curvature equally well and produced similar canal transportation during the preparation of mesial canals of mandibular molars.[19]

Saleh *et al* where OneShape and F360 showed better centering ability as compared to reciproc and Wave One because instruments with minimum taper i.e., OneShape with 6% taper and F360 with 4% taper causes reduced transportation when compared with larger tapered single-file instruments.[20]

CONCLUSION:

Our study concluded that Reciproc instruments were better than Oneshape instruments by maintaining the original canal curvature and by less canal transportation.

REFERENCES:

1. Ingle JI, Bakland LK, Baumgartner JC. Ingle's Endodontics. 6th ed. Hamilton, ON: B.C. Decker; 2008. p. 573-87, 800-10, 813-66, 909-15, 919-53, 942-3,992-1011.
2. Haapasalo M, Endhal U, Zandi H, Coil JM. Eradication of endodontic infection by instrumentation and irrigation solutions. Endod Topics 2005;10:77-102.
3. Peters OA. Current challenges and concepts in the preparation of root canal systems: A review. J Endod 2004;30:559-67.
4. Siqueira JF, Jr, Rôças IN. Clinical implications and microbiology of bacterial persistence after treatment procedures. J Endod. 2008. Nov;34(11):1291–1301.e3. 10.1016/j.joen.2008.07.028
5. Katge F, Patil D, Poojari M, Pimpale J, Shitoot A, Rusawat B, et al. Comparison of instrumentation time

and cleaning efficacy of manual instrumentation, rotary systems and reciprocating systems in primary teeth: An *in vitro* study. J Indian Soc Pedod Prev Dent. 2014;32:311–6.
6. A. Dagna, C. Poggio, R. Beltrami, M. Colombo, M. Chiesa, and S. Bianchi, "Cyclic fatigue resistance of OneShape, Reciproc, and WaveOne: an in vitro comparative study," Journal of Conservative Dentistry, vol. 17, no. 3, p. 250, 2014.
7. A. Dhingra, N. Ruhal, and A. Miglani, "Evaluation of single file systems Reciproc, Oneshape, and WaveOne using cone beam computed tomography–an in vitro study," Journal of Clinical and Diagnostic Research, vol. 9, no. 4, p. ZC30, 2015.
8. Y. Shen, G. S.-p Cheung, Z. Bian, and B. Peng, "Comparison of defects in ProFile and ProTaper systems after clinical use," Journal of Endodontics, vol. 32, no. 1, pp. 61–65, 2006.
9. Schneider SW. A comparison of canal preparations in straight and curved root canals. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1971;2(32):271-5.
10. Gambill JM, Alder M, Rio CE. Comparison of NickelTitanium and Stainless Steel Hand-File Instrumentation Using Computed Tomography. J Endod. 1996;22(7):369-75.
11. Ingle JI, editor. Endodontics. 5th ed. Hamilton, London: BC Decker, Inc.; 2002.
12. Dhingra A, Kochar R, Banerjee S, Srivastava P. Comparative evaluation of the canal curvature modifications after instrumentation with One Shape rotary and Wave One reciprocating files. J Conserv Dent 2014;17:138-41.
13. L. L. Kirkevang, P. Hörsted-Bindslev, D. Ørstavik, and A. Wenzel, "A comparison of the quality of root canal treatment in two Danish subpopulations examined 1974–75 and 1997–98," International Endodontic Journal, vol. 34, no. 8, pp. 607–612, 2001.
14. L. Bjørndal, M. Laustsen, and C. Reit, "Root canal treatment in Denmark is most often carried out in carious vital molar teeth and retreatments are rare," International Endodontic Journal, vol. 39, no. 10, pp. 785–790, 2006.
15. S. P. Mantri, R. Kapur, N. A. Gupta, and C. A. Kapur, "Type III apical transportation of root canal," Contemporary Clinical Dentistry, vol. 3, no. 1, p. 134, 2012.
16. Berutti E, Paolino DS, Chiandussi G, Alovisi M, Cantatore G, Castellucci A, *et al.* Root canal anatomy preservation of waveOne reciprocating files with or without glide path. J Endod 2012;38:101-4.
17. KazeStenman E, Spangberg LS. Machining efficiency and wear resistance of nickel titanium endodontic files. Oral Surg Oral Med OralPathol Oral Radiol Endod. 1996;81:596- 602.
18. Thompson SA, Dummer PM. Shaping ability of ProFile.04 Taper Series 29 rotary nickel titanium instruments in simulated root canals. Part 1. Int Endod J. 1997;30:1-7.
19. Marzouk AM, Ghoneim AG. Computed tomographic evaluation of canal shape instrumented by different kinematics rotary nickel-titanium systems. J Endod. 2013;39:906–9.
20. Saleh AM, Vakili Gilani P, Tavanafar S, Schäfer E. Shaping ability of 4 different single-file systems in simulated S-shaped canals. J Endod 2015;41:548-52.