

Comparison of Canal Transportation and Centric Ability of HyFlex CM and Wave One File System

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ABSTRACT

Background: The success of root canal therapy requires effective cleaning and shaping of canals. The present study was conducted to compare canal transportation and centric ability of CM and WO file system. **Methods:** The present study was conducted on 40 recently extracted mandibular premolars of both genders. The teeth were randomly divided into 2 groups. In group I, teeth were prepared using HyFlex CM files up to 25/0.4 and in group II, teeth were prepared using WO files up to 25/0.8. The amount of canal transportation was evaluated by measuring the shortest distance from the edge of un-instrumented canal to the periphery of the root (mesial and distal) and then comparing this with the same measurements obtained from the instrumented images. The mean centering ratio indicates the ability of the instrument to stay centered in the canal. **Results:** Canal transportation was small in group I as compared to group II at 3mm, 9mm and 12 mm. The difference was significant ($P < 0.05$). The mean centric ratio in group I was 0.394 at 3 mm, 0.311 at 9 mm and 0.459 at 12 mm. In group II, it was 0.514 at 3 mm, 0.501 at 9 mm and 0.782 at 12 mm. The difference was significant ($P < 0.05$). **Conclusion:** Canal preparation with HyFlex CM file system showed lesser transportation and better centering ability than WO file system.

Keywords: Centering ability, HyFlex, Wave One.

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INTRODUCTION

The success of root canal therapy requires effective cleaning and shaping of canals. Cleaning and shaping of the root canal have been recognized as an important phase in endodontic therapy while maintaining the original canal configuration and canal form.^[1] In straight canals, it is achieved easily however, in curved canals, these goals are not easily attainable and root canal instrumentation becomes more difficult because there is a tendency for all preparation techniques and instruments to divert the prepared canal away from its original axis.^[2]

To overcome this drawback, the introduction of nickel-titanium (NiTi) instruments has represented a major breakthrough in root canal preparation by permitting faster instrumentation while maintaining the original canal shape.^[3] This approach is quick, safer and more accuracy-oriented, with a lower risk of procedural errors compared to hand instrumentation. In spite of ongoing research intended to accommodate a safe instrumentation technique,

the one that promotes efficient cleaning and shaping does not cause root canal transportation. The need to enlarge curved canals and at the same time preserve dental anatomy will always involve the challenge of selecting appropriate endodontic instruments.^[4]

In rotary endodontics, two types of motions are there, one is continuous rotation and other is reciprocating motion. HyFlex controlled memory (CM) rotary instruments are made of CM wire and display the property of CM making the files extremely flexible. Wave One (WO) single file system is manufactured by M-wire alloys, which works on the principle of reciprocating motion.⁵ The present study was conducted to compare canal transportation and centric ability of CM and WO file system.

MATERIALS & METHODS

The present study was conducted in the department of Endodontics. It comprised of 40 recently extracted mandibular premolars of both genders. Root canal treatment was performed following all standardized parameters. Roots were embedded into transparent acrylic. The teeth were randomly divided into 2 groups. In group I, teeth were prepared using HyFlex CM files up to 25/0.4 and in group II, teeth were prepared using WO files up to 25/0.8.

All teeth were scanned using CT to assess the root canal shape before instrumentation. Three sections

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were selected, first section was 3 mm from the apical end of the root (apical level), second section was 9 mm from the apical end of the root and third section 12 mm from the apex.

In Group I, the samples were prepared using HyFlex CM. In Group II, the samples were prepared using WO reciprocating files. All measurements were done at 3 mm, 9 mm and 12 mm from the apical foramen.

The amount of canal transportation was evaluated by measuring the shortest distance from the edge of un-instrumented canal to the periphery of the root (mesial and distal) and then comparing this with the same measurements obtained from the instrumented images. The mean centering ratio indicates the ability of the instrument to stay centered in the canal. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table 1: Distribution of teeth

Total- 40		
Groups	Group I	Group II
Type of system	HyFlex CM	Wave One

[Table 1] shows that in group I, teeth were prepared using HyFlex CM files and in group II, teeth were prepared using WO files.

Table 2: Comparison of canal transportation

Site	Group I	Group II	P value
3 mm	0.124	0.192	0.01
9 mm	0.102	0.190	0.02
12 mm	0.174	0.215	0.05

[Table 2] shows that canal transportation was small in group I as compared to group II at 3mm, 9mm and 12 mm. The difference was significant ($P < 0.05$).

Table 3: Comparison of mean centering ratio

Site	Group I	Group II	P value
3 mm	0.394	0.514	0.01
9 mm	0.311	0.501	0.02
12 mm	0.459	0.782	0.05

[Table 3], graph I shows that mean centric ratio in group I was 0.394 at 3 mm, 0.311 at 9 mm and 0.459 at 12 mm. In group II, it was 0.514 at 3 mm, 0.501 at 9 mm and 0.782 at 12 mm. The difference was significant ($P < 0.05$).

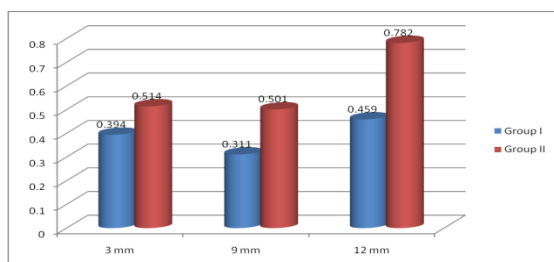


Figure 1: Comparison of mean centering ratio

DISCUSSION

Ni-Ti rotary instruments such as ProTaper have a modified cross-sectional design that resembles a K-File configuration as compared to other rotary instruments. With this cross-sectional design, it cuts dentine more electively, and may therefore reduce torsional loads. However more aggressive cutting could produce increased canal transportation.^[6] Other than clinical guidelines, little information exists about these instruments. The objectives of this new technique were to reduce the working time and cost and to improve safety of the shaping procedure. Recently, Wave One, a reciprocating file system with a dedicated motor mechanism has been introduced. Wave One files are made of a special Ni-Ti alloy called M-wire that is created by an innovative thermal treatment process. The benefits of M-wire are increased flexibility of the instruments and resistance to cyclic fatigue.^[7] The present study was conducted to compare canal transportation and centric ability of CM and WO file system.

In present study, it was found that group I, teeth were prepared using HyFlex CM files and in group II, teeth were prepared using WO files. We observed that canal transportation was small in group I as compared to group II at 3mm, 9mm and 12 mm.

Lim et al⁸ in their study included a total of 30 freshly extracted premolars having curved root canals with at least 10 degrees of curvature were divided into three groups of 10 teeth each. In Group 1, the canals were prepared with Rotary Pro Taper files, in Group 2 the canals were prepared with One Shape files and in Group 3 canals were prepared with Wave One files. After preparation, post-instrumentation scan was performed. Pre-instrumentation and post-instrumentation images were obtained at three levels, 3 mm apical, 3 mm coronal and 8 mm apical above the apical foramen were compared using CBCT software. Data suggested that Wave One files presented the best outcomes for both the variables evaluated. Wave One files caused lesser transportation and remained better centered in the canal than One Shape and Rotary ProTaper files.

In present study, mean centric ratio in group I was 0.394 at 3 mm, 0.311 at 9 mm and 0.459 at 12 mm. In group II, it was 0.514 at 3 mm, 0.501 at 9 mm and 0.782 at 12 mm.

Hartmann et al,^[9] in their study sixty freshly extracted single-rooted teeth having curved root canals with at least 25–35 degrees of curvature were selected. The teeth were randomly divided into three experimental groups of twenty each. After preparation with TF, HyFlex CM, and WO, all teeth were scanned using CT to determine the root canal shape. Pre- and post-instrumentation images were obtained at three levels, 3 mm apical, 9 mm middle, and 15 mm coronal above the apical foramen were

compared using CT software. Least apical transportation and higher centering ability were seen in HyFlex CM file system in all the three sections followed by TF. WO file system showed maximum transportation.

Schäfer et al.^[10] maintained that the size of a taper is one of the main factors involved in apical root transportation because an increase in the taper reduces instrument flexibility; therefore, recommended that NiTi files with tapers greater than 4% should not be used to shape the apical area of curved canals.

In the study conducted by Dhingra et al,^[11] the canal curvature modification after instrumentation with One Shape rotary file and Wave One primary reciprocating file was compared, and it was concluded that canal prepared with Wave One file preserved canal shape, respected the anatomical J-shape and produced a continuously tapered funnel. The limitation of the study is small sample size and only two rotary instruments were compared.

CONCLUSION

Authors found that the canal preparation with HyFlex CM file system showed lesser transportation and better centering ability than WO file system.

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