

Original Research

Assessment of the shaping ability of rotary and reciprocating file systems- An *in vitro* study

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ABSTRACT:

Background: The present study was conducted to assess the shaping ability of four NiTi systems, two rotary, and two reciprocating. **Materials & Methods:** 40 resin blocks with simulated canals of 30° curvature were divided into 4 groups. In group I, the canals were prepared using One Shape rotary file system, in group II with F360 rotary file system, in group III with Wave One primary rotary file system and in group IV with Reciproc size 25 NiTi systems. The inner and outer walls of canal curvature were assessed. **Results:** There was significant difference in amount of dentin removed from inner and outer dentin wall in all groups ($P < 0.05$). The mean preparation time in group I was 60.2 seconds, in group II was 59.4 seconds, in group III was 90.8 seconds and in group IV was 104.6 seconds. The difference was significant ($P < 0.05$). **Conclusion:** Rotary single-file systems prepared canals with less preparation time as compared to other file system.

Key words: Rotary single-file, Reciproc size, Simulated canals

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INTRODUCTION

Root canal preparation is performed with files, reamers, burs, sonic instruments or mechanical apparatus and with nickel-titanium (NiTi) rotary files systems.¹ Since most hand preparation techniques are time-consuming and may lead to iatrogenic errors, much attention is directed toward root canal preparation techniques with NiTi rotary instruments.² Single-file rotary systems are classified to two groups: continuous rotating and reciprocating files, based on type of their motions. Wave One–Dentsply-Maillefer, Swiss, and Reciproc–VDW, Germany, have reciprocating motions while Neoniti–Neolix, Charles-La-Foret, France, One Shape–Micro-Mega, HyFlex/EDM–Coltene, Whaledent–Swiss, and XP-

endo shaper–FKG Swiss apply continuous motions.³ One Shape files and EDM files (HyFlex/EDM) are applicable by reciprocating and continuous engine-driven handpieces inside the root canal systems, both. The sparks generated in EDM process cause the surface of the material, melt, and evaporate and make the HyFlex EDM files stronger and more fracture resistant in comparison with CM HyFlex system.⁴ This perfect combination of flexibility and fracture resistance makes it possible to reduce the number of files required for cleaning and shaping during root canal treatment without having to dismiss preservation of the original curve and anatomy of the root canal.⁵

The reciprocating files move both in a counter clockwise and clockwise rotation. The counter clockwise rotation has a cutting action whereas the clockwise has a releasing operation. The metallurgy of reciprocating files is from M wire technology to the recently introduced gold wire technology with WaveOne gold files. This unequal reciprocating movement prevents taper lock and instrument separation.⁶ The present study was conducted to assess the prepared simulated curved canals by the use of four NiTi systems, two rotary, and two reciprocating.

MATERIALS & METHODS

The present study was conducted in the department of Endodontics. It comprised of 40 resin blocks with

simulated canals of 30° curvature. The approval for the study was obtained from ethical clearance committee. These resin blocks were divided into 4 groups with ten samples in each group. In group I, the canals were prepared using One Shape rotary file system, in group II with F360 rotary file system, in group III with Wave One primary rotary file system and in group IV with Reciproc size 25 NiTi systems using X Smart Plus (Dentsply). Pre- and post-preparation canals were photographed in a standardized manner and were superimposed.

The inner and outer walls of canal curvature were assessed to determine the most significant change using the image analysis software. Results were tabulated and assessed statistically. P value less than 0.05 was considered significant.

RESULTS

Table I Amount of resin removed from the outer walls of the canal

	Group I	Group II	Group III	Group IV
0-3 mm	0.42	0.41	0.75	0.86
3-6 mm	0.48	0.45	0.60	0.72
6-9 mm	0.90	0.88	0.94	1.15
F	40.21			
P value	0.001			

Table I shows that amount of resin removed from outer walls of the canal at 0-3 mm was 0.42, 0.41, 0.75 and 0.86 in group I, II, III and IV respectively. At 3-6 mm was 0.48, 0.45, 0.60 and 0.72 in group I, II, III and IV respectively. At 6-9 mm was 0.90, 0.88, 0.94 and 1.15 in group I, II, III and IV respectively. The difference was significant ($P < 0.05$).

Table II Amount of resin removed from the inner walls of the canal

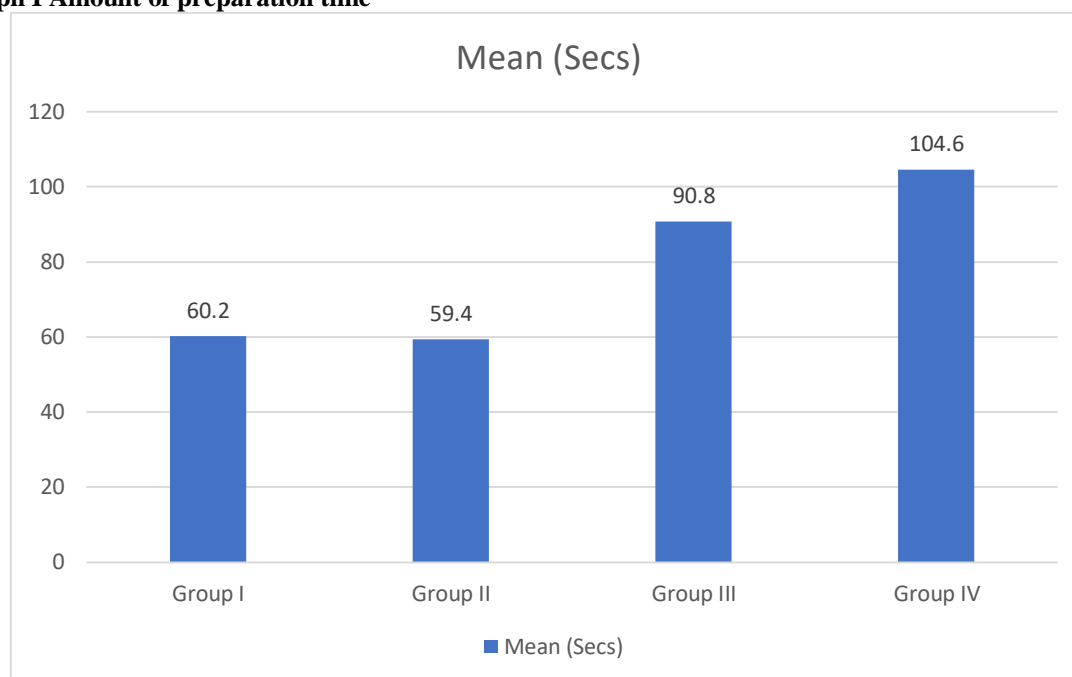
	Group I	Group II	Group III	Group IV
0-3 mm	0.42	0.42	0.76	0.88
3-6 mm	0.48	0.46	0.61	0.72
6-9 mm	0.92	0.90	0.93	1.14
F	39.1			
P value	0.021			

Table II shows that amount of resin removed from inner walls of the canal at 0-3 mm was 0.42, 0.42, 0.76 and 0.88 in group I, II, III and IV respectively. At 3-6 mm was 0.48, 0.46, 0.61 and 0.72 in group I, II, III and IV respectively. At 6-9 mm was 0.92, 0.90, 0.93 and 1.14 in group I, II, III and IV respectively. The difference was significant ($P < 0.05$).

Table III Amount of preparation time

Groups	Mean (Secs)	P value
Group I	60.2	0.01
Group II	59.4	
Group III	90.8	
Group IV	104.6	

Table III, graph I shows that mean preparation time in group I was 60.2 seconds, in group II was 59.4 seconds, in group III was 90.8 seconds and in group IV was 104.6 seconds. The difference was significant ($P < 0.05$).

Graph I Amount of preparation time

DISCUSSION

Endodontic mishaps in the form of canal transportation, ledges and perforations occur partly because of inattention to minute details; however, the most of which is related to metal technology.⁷ Root canal preparation is performed with files, reamers, burs, sonic instruments or mechanical apparatus and with nickel-titanium (NiTi) rotary files systems. Numerous studies have reported that they could efficiently create smooth, predetermined funnel-form shapes, with minimal risk of ledging and transportation.⁸ They also reduce operator fatigue and the time required to complete the preparation. Even though NiTi instruments are known for their super elasticity and shape memory, they have by tensile-compressive forces. The tensile-compressive forces are higher in the curved compared to the straight canals.⁹ The present study was conducted to assess the prepared simulated curved canals by the use of four NiTi systems, two rotary, and two reciprocating.

In present study, amount of resin removed from outer walls of the canal at 0-3 mm was 0.42, 0.41, 0.75 and 0.86 in group I, II, III and IV respectively. At 3-6 mm was 0.48, 0.45, 0.60 and 0.72 in group I, II, III and IV respectively. At 6-9 mm was 0.90, 0.88, 0.94 and 1.15 in group I, II, III and IV respectively. Yared¹⁰ a pioneer in the field of reciprocating file systems put forth the balanced force technique. The reciprocating files move both in a counter clockwise and clockwise rotation. The counter clockwise rotation has a cutting action whereas the clockwise has a releasing operation. The metallurgy of reciprocating files is from M wire technology to the recently introduced gold wire technology with Wave One gold files. This

unequal reciprocating movement prevents taper lock and instrument separation.

Kumar et al¹¹ evaluated the shaping ability of two rotary and two reciprocating nickel-titanium (NiTi) single-file instruments on simulated root canals. Forty resin blocks with simulated canals of 30° curvature were divided into four experimental groups containing ten samples in each group. The canals were prepared using Reciproc (VDW, Munich, Germany), WaveOne (Dentsply, Maillefer, Ballaigues, Switzerland), OneShape (Micro-Mega, Besancon, France), and F360 (Komet, Brasseler, Lemgo, Germany) size 25 NiTi systems using X Smart Plus (Dentsply). Pre- and post-preparation canals were photographed in a standardized manner and were superimposed. The amount of resin removed from the inner walls was less with rotary single-file NiTi systems when compared with reciprocating. Preparation time was less with rotary instruments. No instrument separation was noted. All instrument systems maintained the original canal curvature.

We found that amount of resin removed from inner walls of the canal at 0-3 mm was 0.42, 0.42, 0.76 and 0.88 in group I, II, III and IV respectively. At 3-6 mm was 0.48, 0.46, 0.61 and 0.72 in group I, II, III and IV respectively. At 6-9 mm was 0.92, 0.90, 0.93 and 1.14 in group I, II, III and IV respectively. Schafer et al¹² described a significant 60% decrease in shaping time. Even though there is a significant reduction in the overall preparation time, the preparation time for reciprocating files was considerably higher. This may be due to the increased time required for cleaning of the flutes which augured more debris coronally.

The shortcoming of the study is small sample size.

CONCLUSION

Authors found that rotary single-file systems prepared canals with less preparation time as compared to reciprocating single-file systems.

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