Original Article

An In Vitro Comparison of Root Canal Transportation by Reciproc File With and Without Glide Path

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Abstract

Objective: The aim of ideal canal preparation is to prevent iatrogenic aberrations such as transportation. The aim of this study was to evaluate the root canal transportation by Reciproc file with and without glide path.

Materials and Methods: Thirty acrylic-resin blocks with a curvature of 60° and size#10 (2% taper) were assigned into two groups (n= 15). In group 1, the glide path was performed using stainless steel k-files size#10 and 15 at working length In group 2, canals were prepared with Reciproc file system at working length. By using digital imaging software (AutoCAD 2008), the pre-instrumentation and post-instrumentation digital images were superimposed over, taking the landmarks as reference points. Then the radius of the internal and external curve of the specimens was calculated at three α, β and γ points (1mm to apex as α, 3mm to apex as β, and 5mm to apex as γ). The data were statically analyzed using the independent T-test and Mann-Whitney U test by SPSS version 16.

Results: Glide path was found significant for only external curve in the apical third of the canal; that is, 5mm to apex (P=0.005). But in the other third, canal modification was not significant (P> 0.008).

Conclusion: Canal transportation in the apical third of the canal seems to be significantly reduced when glide path is performed using reciprocating files.

Key Words: Root Canal Preparation; Instrumentation; Transportation

Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran (2014; Vol. 11, No. 5)

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Received: 15 April 2014
Accepted: 2 August 2014

INTRODUCTION

In some teeth, gaining the endodontic preparation objective seems to be difficult because of the root canal anatomy complexity, degree and radius of the curvature of the canal [1,2]. Due to the tendency of restoring files to their original liner shape, transportation that is so called as removal of the canal wall structure on the outside curve in the apical half of the canal will occur. In addition, it may lead to negatively affect the disinfection and the long-term prognosis of root canal therapy [1, 3].

A previous study showed that pre-flaring would minimize procedural errors such as transportation and ledge formation [4, 5]. Implementing Ni-Ti instruments in a reciprocating movement was first recommended by Yared [6]. Consequently, the introduction of this new technique for root canal preparation

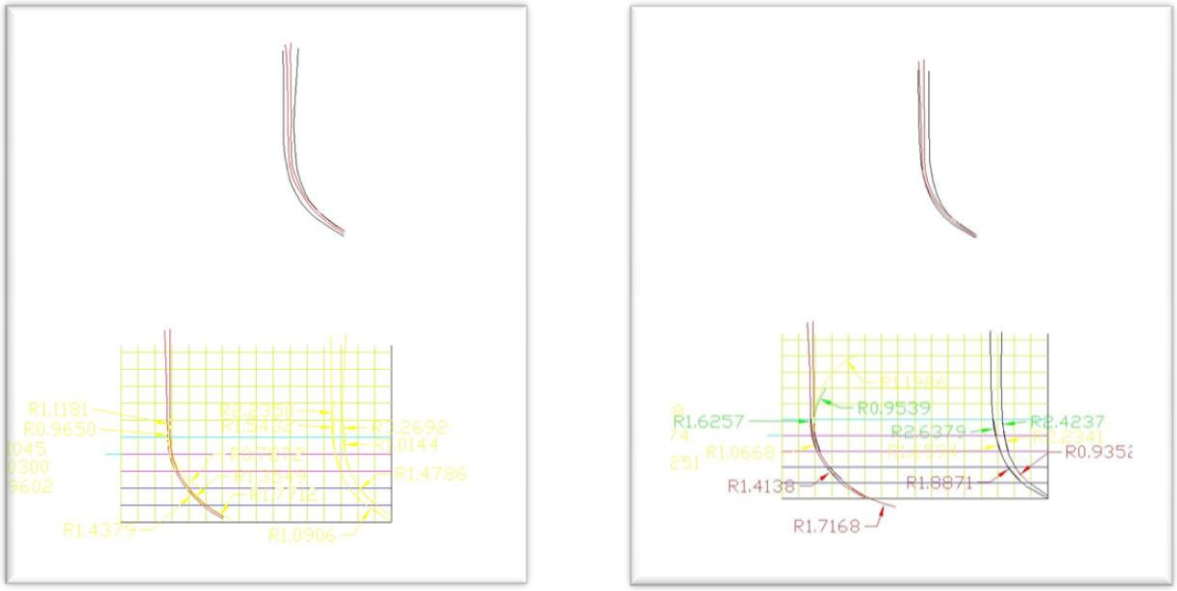

Fig 1. a and b. Change in external and internal curve using glide path

with Reciproc that reduces the number of instruments to achieve root canal therapy objectives was pioneered. The reciprocating movement prepared the canal in a more uniform manner centered on the original canal, and simultaneously enlarged almost equally in both the inner and outer directions with less iatrogenic aberrations [7]. With a continuous rotary Ni-Ti file, creating a glide path to minimize the file fracture is necessary [6]. The manufacturer of Reciproc claims that creating a glide path when using the reciprocating instrumentation is not prerequisite [8].

Recently, Berutti revealed that canal modifications should be significantly reduced when a previous glide path is performed using the new wave one nickel titanium single-file system [9]. The aim of this study was to compare transportation of the canal curvature with single file reciprocating system in Endo training blocks, with and without glide path.

MATERIALS AND METHODS

Thirty acrylic-resin simulated root canal blocks (VDW co; Munich Germany) were used in this experimental study.

The degree of curvature was 60°; the diameter and the taper of all simulated canals was equivalent to an ISO standard size#10 (2% taper) root canal instrument.

The simulated canal was colored with ink injected by a syringe. Four landmarks were placed in each block. Each specimen was then mounted on a stable support consisting of a rectangular slot the size of the specimen (30×10mm) and a support for a digital camera (Nikon D 70, Tokyo, Japan) positioned centrally and 90° to the specimen. Digital images of all specimens before instrumentation were taken and saved as Jpeg format images. Specimens were then randomly assigned to two different groups (n=15).

In group 1, the mechanical glide path was performed using RC-prep as a lubricating agent with k-file size#10 (Mani-k. file-Dentsply) and then proceeded with size#15 k-file until reaching full W.L. Each simulated canal was then prepared with reciprocating files, the Reciproc file size 25 taper 0.08 (VDW Co, Munich, Germany) coupled to a 1:16 reduction gear rotary hand piece, driven by a VDW Silver Reciproc motor (VDW Co, Munich, Ger-

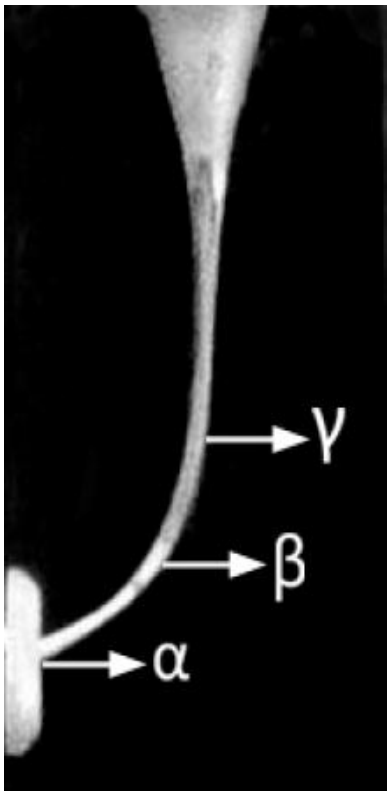

Fig 2. Both sides were evaluated at three points

many), at a programmed movement format as 'Reciproc' mode until reaching full W.L. Reciproc file was only used to prepare four canals; the preparations were carried out by a single operator.

In group 2, the mechanical glide path was not made, but prepared by Reciproc file size 25 taper 0.08 similar to group one.

After preparation, all specimens in each group were repositioned in the same position and photographed as described above. Using digital imaging software (AutoCAD 2008), the pre-instrumentation and post-instrumentation digital images were superimposed over, taking the landmarks as reference points (Figure 1).

Then the radius of the internal and external curves of the specimens was calculated by AutoCAD software.

The artificial canals were evaluated at three points on the canal curvature as α, β and γ (1mm to apex as α, 3mm to apex as β and 5mm to apex as γ) (Fig 2). These points were described; γ as coronal of the curve, β as middle of the curve, and α as apical of the curvature.

The data were analyzed by the independent T-test and Mann-Whitney U test using SPSS for Windows version 16 (SPPS Inc., Illinois, Chicago, USA). The significance level was set as 0.008 after Bonferroni correction.

RESULTS

As Table 1 demonstrates, group 1 and 2 showed no statistically significant difference at γ and β, although the difference for the two groups was significant at α.

This means that more resin was removed from the external curvature wall in group 2 (without glide path). Nevertheless, the internal and external wall modification at γ and β point in group 1 were less than group 2, and it revealed no significant difference (P>0.008).

Table 1. Mean of Change in External and Internal Curve With and Without Flaring

	Change in external curve			Change in internal curve		
	Coronal third mean (SD)	**Middle third mean (SD)**	**Apical third mean (SD)**	**Coronal third mean (SD)**	**Middle third mean (SD)**	**Apical third mean (SD)**
Group1: With glide path	1.5508(0.8442)	0.6452(0.2908)	0.7823(0.7310)	2.2689(1.2352)	0.6858(0.3902)	0.6360(0.2228)
Group 2: Without glide path	1.6463(0.4509)	0.6452(0.5762)	1.3207(0.3014)	1.9068(0.8350)	0.5043(0.2635)	0.5332(0.2251)
P value	0.110 (MannWhitney U)	0.45 (Independent T-Test)	0.005 (Mann-Whitney U)	0.355 (Independent T-Test)	0.147 (Independent T-Test)	0.219 (Independent T-Test)

DISCUSSION

One of the most challenging endodontic objectives is pulpal tissue elimination [10]. Different techniques and file systems have been used for root canal therapy. Moreover, with the advent of Ni-Ti rotary file system, root canal therapy becomes easier and faster than before by creating less aberrations. The endodontic glide path is a smooth tunnel shape from the canal orifice to physiologic terminus. It has been broadly accepted that without the endodontic glide path, the rationale of endodontics cannot be achieved, especially for NI-TI rotary file system [11].

Many studies showed that coronal pre-flaring and making a glide path either manually or mechanically are essential for safer use of Ni-Ti rotary instrumentation [4, 12], because it keeps rotary instruments from excessive torsion stresses [12] that lead to file fracture. If the engagement between the dentine walls and the cutting edges of the instruments increases, torsion stresses might increase significantly [13]. In literature, different methods for creating glidepath have been described; the use of a small size hand file might be a safer method to provide a glide path that maintains the original canal anatomy [14]. No transportation in the majority of samples were seen when size 08 stainless steel k flex and then size 10 stainless steel reamers were used as patency files [15]. In consistency to our study, modifications in the external and internal walls were less in group 1 when glidepath was created by K hand file #10 and then file #15, respectively.

More recently, Reciproc with an S-shaped cross-section, a non-cutting tip and sharp cutting edges with reciprocating motion (150 degree counterclockwise and then 30 degree clockwise rotation) with a speed of 300 rpm that has the capability to prepare canal with one file without making glidepath, has been presented in the market. Previous studies revealed that reciprocating motion increases canal centering ability, reduces the risk of root canal deformity and iatrogenic aberrations [13, 16]. Some investigators showed that continuous rotation movement similar to most rotary file systems tends to shift the center of the preparation in a clockwise direction in contrast to the reciprocating movement that prepares the canal more symmetrical in both directions; therefore, the tendency would be reduced [17]. In our study, curvature tendency before and after preparation were calculated. In group 1, the external curvature wall modification was less than group 2, that is, the glide path creation can reduce transportation mainly at the apical third. For evaluating root canal transportation, different model studies such as plastic resin blocks, extracted teeth and tooth clearing have been implemented [18]. To match the samples, we used acrylic- resin block with 60˚curvature and size#10 (2% taper). Each method has its own advantages and disadvantages. Resin blocks hit standardization of the radius and the degree of simulated canal curvature, but they are not an accurate replacement for natural tooth structure. Moreover, heat generating during root canal preparation can soften resin, which interferes with file penetration. In some studies, extracted teeth with normal teeth hardness, but different canal anatomies were used; therefore, it was likely to affect their assessment negatively [19-21]. As a previous study revealed, root canal preparation with glide path decreased root canal tendency toward the external wall at the apical third, especially a severe (60 degrees) curved canal. It is assumed that its keeps rotary instruments from excess torsional stress; therefore, taper lock or overloading at the engagement point will be prevented [22,23]. Previous studies revealed that canal transportation leads to remove dentin inappropriately with a high risk of modification of the canal curvature and the ledge formation [24,25].

In this study, similar to others, pre and post-operative photographs of the root canal were evaluated with AutoCAD 2008 and we enabled to assess transportation and centering

ability of the internal and external canal curves.

CONCLUSION

Creating glidepath before using Reciproc file system in curved canal may prevent external wall change at the apical third.

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551

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