Print ISSN: 2321-6379
Online ISSN: 2321-595X
DOI: 10.17354/ijss/2017/485

Original Article

Comparative Study of Dentinal Defects after Root Canal Preparation with Hand Protaper, Continuous Rotation and Reciprocating Instruments

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Abstract

Aim: The aim of the study was to compare the root dentinal defects with Hand Protaper, continuous rotation and reciprocating instruments used to prepare root canals.

Materials and Method: 120 freshly extracted teeth were used for the study. They were divided into 3 groups with 40 teeth in each group. The root canals of teeth under group I were prepared with Dentsply Hand Protaper files while teeth under group II were prepared using Dentlsply rotary protaper files, Group 3 were prepared using Reciproc system Germany. Sectioning of these teeth was done at 3, 6 and 9 mm from the apex and was evaluated for the presence of any defects.

Results: The incidence of dentinal defects was 30 % in group I, 52.5% in-group II and 40 % in-group III. In coronal third 82.5% of the teeth in group I, 70% of teeth in group II and 77.5% in group III were having Score 0. However the difference was statistically insignificant (p=0.8918). In middle third 87.5% of the teeth in group I, 77.5% of teeth in group II and 82.5% in group III were having Score 0. However the difference was statistically insignificant (p=0.9323). None of the teeth showed dentinal defects in apical third in all the three groups, however only one tooth was having score 1 in group II. A significant difference in the incidence of dentinal defects between hand and rotary pro-taper (p=0.0410) was observed. The reciprocating instruments showed less dentinal defects as compared to rotary pro-taper but the results were statistically insignificant (p=0.2622). Similarly there was no significant difference between hand versus reciprocating system (p=0.3484).

Conclusion: It was concluded that hand protaper files produce less number of dentinal cracks in comparison to rotary instruments, however reciprocating reotary instruments produce lesser number of dentinal defects as compared with the instruments with continuous rotation. However, for more conclusive result, a more elaborated study needs to be carried out.

Key words: Dentinal cracks, Incidence, Rotary, Reciprocating files

INTRODUCTION

The removal of the bacteria and debris along with nerve tissue from the canal, preparation of the canal, and three-dimensional obturation of root canal system are the principal for successful endodontic treatment.[1]

Access this article online

www.ijss-sn.com

Month of Submission : 07-2017
Month of Peer Review : 08-2017
Month of Acceptance : 08-2017
Month of Publishing : 09-2017

Biomechanical preparation is one of the major steps toward achieving this goal. It is preferred to use rotary NiTi files over stainless steel because of its rapid canal shaping which is more centered with less chances of canal transportation.[2,3]

The NiTi instruments are used with two types of movement: first is continuous rotating full sequence and second is reciprocating. Torsion and flexion occur with continuous rotating NiTi instruments while preparing root canals, which can lead to instrument fracture. To avoid this, reciprocating movement was proposed.[4] This movement minimizes the stresses on instrument by counterclockwise (cutting action) and clockwise (release of instrument)

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movements. [5] Reciprocating movement claims to mimic manual movement and reduces various risks associated with continuous rotating file systems. But reciprocating systems with small and equal Clockwise (CW)/Counterclockwise (CCM) angles have decreased cutting efficiency, thus making progression into canal more laborious. [6]

Endodontically treated teeth have a long-term functional survival rate, but they are more prone to fracture when compared to vital teeth. [7] Studies done in the past have shown that root fracture is not an instant event but rather gradual propagation of tiny, less pronounced craze lines in tooth structure.[8,9,10]

The present study was conducted with an aim to compare the root dentinal defects with Hand Protaper, continuous rotation and reciprocating instruments used to prepare root canals.

MATERIAL AND METHOD

120 freshly extracted teeth were used for the study. They were divided into 3 groups with 40 teeth in each group. The root canals of teeth under group I were prepared with Dentsply Hand Protaper files while teeth under group II were prepared using Dentlsply rotary protaper files and Group 3 were prepared using Reciproc system Germany. Sectioning of these teeth was done at 3,6and 9mm from the apex and was evaluated for the presence of any defects. The scoring system was used according to the type of defects present, which is as follows:

No Defect (Score 0): Root dentin devoid of any lines or cracks where both external surface of root and internal root canal wall does not present any evident defects.

Craze line (Score 1): Line extending from outer surface into dentin but does not reach the canal lumen

Partial crack (Score 2): Line extending from canal walls into dentin without reaching outer surface

Fracture (Score 3): Line extending from root canal space all the way to outer surface of root [11]

Using a Chi square test the incidences of root dentinal defects among various groups was computed.

RESULTS

Table 1 showed that incidence of dentinal defects was 30% in group I, 52.5% in-group II and 40 % in-group III. Table 2 showed that in coronal third 82.5% of the teeth in group I, 70% of teeth in group II and 77.5% in group III were having Score 0. However the difference was statistically insignificant (p=0.8918).

In middle third 87.5% of the teeth in group I, 77.5% of teeth in group II and 82.5% in group III were having Score 0. However the difference was statistically insignificant (p=0.9323).

None of the teeth showed dentinal defects in apical third in all the three groups, however only one tooth was having score 1 in group II.

Table 3 showed that there was a significant difference in the incidence of dentinal defects between hand and rotary pro-taper (p=0.0410). The reciprocating instruments showed less dentinal defects as compared to rotary pro-taper but the results were statistically insignificant (p=0.2622). Similarly there was no significant difference between hand versus reciprocating system (p=0.3484).

DISCUSSION

The present study was conducted with an aim to compare the root dentinal defects with Hand Protaper, continuous rotation and reciprocating instruments used to prepare root canals. The findings of our study showed that majority of the teeth in all the 3 groups were having a score 0 in both coronal and middle third with none of them showing any score in apical third except 1 teeth with a score 1 in group II. Similar results were concluded by Monga P. *et al.*[12] Also, Versluis *et al.* also concluded that the stresses generated at 1 mm short of the apical foramen were one third of stresses at more coronal levels which might be due to an increase in taper of various files towards the coronal third.[13]

The present study showed that 52.5% of the teeth prepared with rotary protaper system showed dentinal defects which was more than dentinal defects created by hand protaper (30%) and reciproc reciprocating system (40%) which is in accordance with the study done by Monga P. *et al.* and GambariniG.[12,14] They found that the difference in the incidence of dentinal cracks was due to the reciprocating motion, different file design, with a shorter preparation of the root canal duration.

Reduction in dentin wall thickness is an important factor for increased fracture susceptibility. Mostly, fractures were located in apical and mid-root area, due to higher load located under cementoenamel junction.[15] Similar findings were shown in the present study. However, Milani *et al.*[9] found contrary results and concluded that hand K les produced more number of defects than rotary les. In their study, they used large tapered rotary les in mandibular incisors; however, by including periodontal ligament simulation, the relative number of defects in

Table 1: Comparison of number and percentage of teeth showing defects between three study groups

Defects	Group I (*n*=40) Hand protaper system (%)	Group II (*n*=40) Rotary pro-taper system (%)	Group III (*n*=40) Reciproc reciprocating system (%)
Present	12 (30)	21 (52.5)	16 (40)
Absent	28 (70)	19 (47.5)	24 (60)
Total	40 (100)	40 (100)	40 (100)

Table 2: Comparison of percentage of teeth in various study groups showing dentinal defects at various third of the roots

Dentinal damage	Group I (*n*=40) Hand protaper system (%)	Group II (*n*=40) Rotary pro-taper system (%)	Group III (*n*=40) Reciproc reciprocating system (%)	*P* value
At coronal third				
Score 0	33 (82.5)	28 (70)	31 (77.5)	*P*=0.8918
Score 1	4 (10)	6 (15)	4 (10)	
Score 2	2 (5)	4 (10)	4 (10)	
Score 3	2 (2.5)	2 (5)	1 (2.5)	
At middle third				
Score 0	35 (87.5)	31 (77.5)	33 (82.5)	*P*=0.9323
Score 1	3 (7.5)	5 (12.5)	5 (12.5)	
Score 2	1 (2.5)	2 (5)	1 (2.5)	
Score 3	1 (2.5)	2 (5)	1 (2.5)	
At apical third				
Score 0	0 (0)	0 (0)	0 (0)	-
Score 1	0 (0)	1 (2.5)	0 (0)	
Score 2	0 (0)	0 (0)	0 (0)	
Score 3	0 (0)	0 (0)	0 (0)	

Table 3: Level of significance between different groups

Group comparison	Chi square (χ^2)	Degree of freedom (df)	*P* value	Level of significance
Hand vs rotary protaper	4.178	1	0.0410	Significant
Hand vs reciprocating	0.879	1	0.3484	Insignificant
Rotary protaper vs Reciprocating	1.257	1	0.2622	Insignificant

the rotary group was low and the difference was not signicant.

The limitation of the present study was that different teeth among both the jaws with different root dentin thickness were not compared which could show significant differences in results due to change in strength and response to stresses during preparation of the canals. The duration of preparation was also not considered. Further studies with standardized protocols will provide better results.

CONCLUSION

It was concluded that hand protaper files produce less number of dentinal cracks in comparison to rotary instruments, however reciprocating reotary instruments produce lesser number of dentinal defects as compared with the instruments with continuous rotation. However, for more conclusive result, a more elaborated study needs to be carried out.

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How to cite this article: Sharma S, Mahajan N, Gupta R, Kotwal B, Kharyal S, Tomar V. Comparative Study of Dentinal Defects after Root Canal Preparation with Hand Protaper, Continuous Rotation and Reciprocating Instruments. Int J Sci Stud 2017;5(6):210-213.

Source of Support: Nil, **Conflict of Interest:** None declared.