

Original Research

Assessment of dentinal cracks in root canal surface with ProTaper Next and 2 Shape rotary system

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ABSTRACT:

Background: Defect is referred as the presence of craze line or microcracks or even complete crack that extends from the inner root canal space all the way to the outer surface of the root. The present study evaluated dentinal cracks in root canal surface with ProTaper Next and 2 Shape rotary system. **Materials & Methods:** 30 extracted human single canal mandibular premolars which were decoronated and were randomly divided into 3 groups ($n = 10$) according to the nickel-titanium (Ni-Ti) rotary file system used in preparation as follows: Group I: control group roots were left unprepared. Group II: canals were prepared using Ni-Ti 2 Shape system up to TS2 file (#25/0.06). Group III: canals were prepared using Ni-Ti ProTaper Next system up to X2 file (#25/0.06). **Results:** The mean rank value in group I was 58.1, in group II was 59.7 and in group III was 65.2. The difference was non-significant ($P > 0.05$). **Conclusion:** ProTaper Next group showed a high percentage of dentinal crack incidence followed by 2 Shape and control groups regardless of the root canal cross-section.

Key words: ProTaper, dentinal crack, rotary system

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INTRODUCTION

Successful endodontic therapy depends upon triad of proper diagnosis, thorough biomechanical preparation and three-dimensional obturation of root canal system.¹ Biomechanical is one of the most important factors for successful root canal treatment and determines the efficacy of all subsequent procedures. It is done to completely remove organic tissue, microorganisms and debris by enlarging the canal diameter and creating a shape that allows a proper seal.² Stainless steel root canal instruments clean the canal superficially and can create canal aberrations such as ledges, zips, and elbows. To eliminate these shortcomings of stainless steel instruments, nickel-titanium (Ni-Ti) instruments have been developed.³

Defect is referred as the presence of craze line or microcracks or even complete crack that extends from

the inner root canal space all the way to the outer surface of the root.⁴ So, in order to minimize the dentinal cracks and other mishaps during root canal instrumentation, different Ni-Ti rotary systems are always introduced and developed to improve the efficiency and clinical outcomes of the root canal treatment.⁵ Rotary Ni-Ti instrumentation could potentially cause dentinal defects in the walls of the canal which may act as areas of stress concentration and crack initiation.⁶ These Ni-Ti instruments increase the risk of dentinal damage to root in the form of complete cracks, incomplete cracks, craze lines or fractures. The present study evaluated dentinal cracks in root canal surface with ProTaper Next and 2 Shape rotary system.

MATERIALS & METHODS

The present study was conducted among 30 extracted human single canal mandibular premolars which were decoronated perpendicular to the long axis of the tooth leaving roots and then positioned centrally in a mold using acrylic resin.

Roots were randomly divided into 3 groups ($n = 10$) according to the nickel-titanium (Ni-Ti) rotary file system used in preparation as follows: Group I: control group roots were left unprepared. Group II: canals

were prepared using Ni-Ti 2 Shape system up to TS2 file (#25/0.06). Group III: canals were prepared using Ni-Ti ProTaper Next system up to X2 file (#25/0.06). Each root was sectioned horizontally using IsoMet saw into three sections as coronal, middle, and apical with a total of 120 sections and observed by stereomicroscope and scanning electron microscope to detect dentinal cracks. Results were assessed statistically. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of teeth

Groups	Group I	Group II	Group III
Method	Control	Ni-Ti 2 Shape	Ni-Ti ProTaper Next
Number	10	10	10

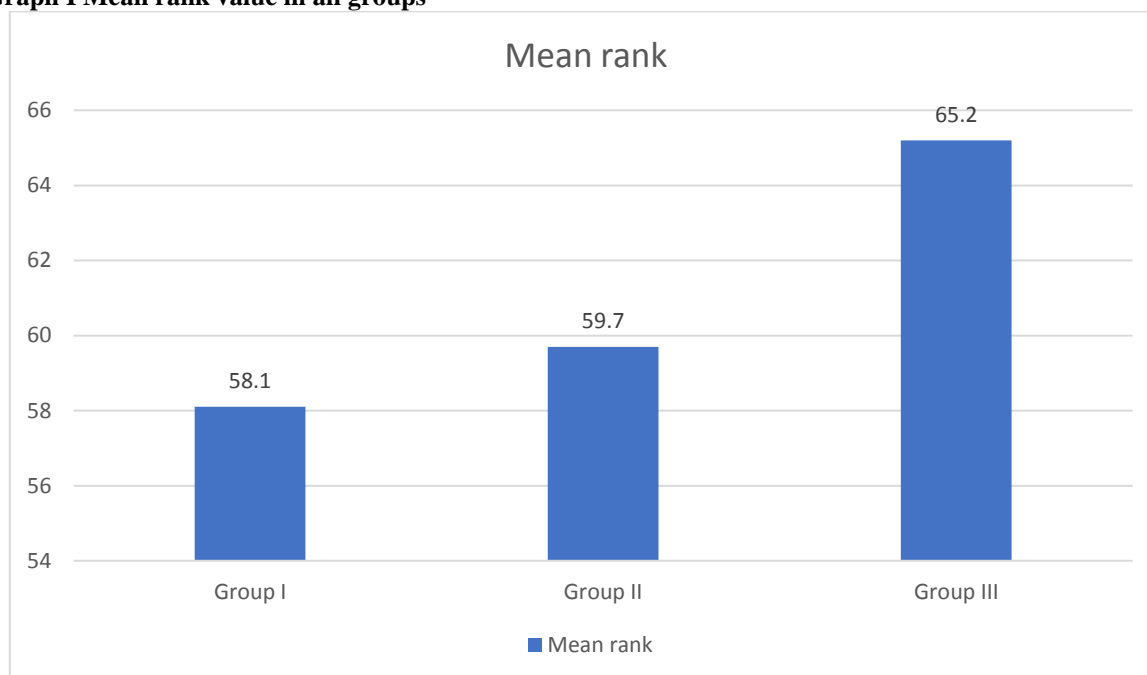
Table I shows distribution of teeth based on methods used. Each group had 10 teeth samples.

Table II Mean rank value in all groups

Groups	Mean rank	P value
Group I	58.1	0.15
Group II	59.7	
Group III	65.2	

Table II, graph I shows that mean rank value in group I was 58.1, in group II was 59.7 and in group III was 65.2. The difference was non-significant ($P > 0.05$).

Graph I Mean rank value in all groups



DISCUSSION

The aim of endodontic treatment is to completely remove microorganisms, pulp tissue, and debris and achieve a three-dimensional seal for the root canal system by enlarging the diameter of the original canal anatomy to a more desirable canal shape to obtain a proper coronal and apical seal.^{7,8} Proper and adequate biomechanical preparation is the most important step in endodontics as it greatly helps to achieve uniform hermetic three-dimensional obturation of the root

canal system and prevent reinvasion of the bacteria as it may proliferate in crack lines and dentinal cracks that might be created during cleaning and shaping, furthermore establishing biofilms on the root surface and consequently failure of the whole procedure of endodontic treatment.⁹ The present study evaluated dentinal cracks in root canal surface with ProTaper Next and 2 Shape rotary system.

In present study, mean rank value in group I was 58.1, in group II was 59.7 and in group III was 65.2. Bier et

al¹⁰ compared the incidence of dentinal defects after canal preparation with different nickel-titanium rotary files. Two hundred sixty mandibular premolars were selected. Forty teeth were left unprepared (n = 40). The other teeth were prepared either with manual Flexofiles (n = 20) or with different rotary file systems: ProTaper (Dentsply-Maillefer, Ballaigues, Switzerland), ProFile (Dentsply-Maillefer), SystemGT (Dentsply-Maillefer), or S-ApeX (FKG Dentaire, La Chaux-de-Fonds, Switzerland) (n = 50 each). Roots were then sectioned 3, 6, and 9 mm from the apex and observed under a microscope. The presence of dentinal defects was noted. There was a significant difference in the appearance of defects between the groups ($p < 0.05$). No defects were found in the unprepared roots and those prepared with hand files and S-ApeX. ProTaper, ProFile, and GT preparations resulted in dentinal defects in 16%, 8%, and 4% of teeth, respectively. Some endodontic preparation methods might damage the root and induce dentinal defects.

Elnazzer et al¹¹ assessed dentinal cracks in root canal surface after biomechanical preparation using rotary file systems such as ProTaper Next, 2 Shape, and RaCe. Forty extracted human single canal mandibular premolars were decoronated perpendicular to the long axis of the tooth leaving roots (12 ± 1 mm) and then positioned centrally in a mold using acrylic resin. Roots were randomly divided into four main groups (n = 10) according to the nickel-titanium (Ni-Ti) rotary file system used in preparation as follows: Group I: Control group roots were left unprepared. Group II: Canals were prepared using Ni-Ti 2 Shape system up to TS2 file (#25/0.06). Group III: Canals were prepared using Ni-Ti ProTaper Next system up to X2 file (#25/0.06). Group IV: Canals were prepared using Ni-Ti RaCe system up to file (#25/0.06).

There are more dentinal cracks in the ProTaper Next group than in the 2 Shape, RaCe, and control groups as there was a statistically significant difference present ($p < 0.05$). There was no statistically significant difference between the apical, middle, and coronal sections ($p = 0.536$).

Garg et al¹² compared dentinal damage caused by hand and rotary nickel-titanium instruments using ProTaper, K3 Endo, and Easy RaCe systems after root canal preparation.

One hundred and fifty freshly extracted mandibular premolars were randomly divided into five experimental groups of 30 teeth each and biomechanical preparation was done: Group 1 with unprepared teeth; Group 2 were prepared with hand files; Group 3 with ProTaper rotary instruments; Group 4 with K3 rotary; Group 5 with Easy RaCe rotary instruments. Then, roots were cut horizontally at 3, 6, and 9 mm from apex and were viewed under stereomicroscope. The presence of dentinal defects was noted. Significant difference was seen between groups. No defects were found in unprepared roots and those prepared with hand files. ProTaper, K3

rotary, and Easy RaCe preparations resulted in dentinal defects in 23.3%, 10%, and 16.7% of teeth, respectively. More defects were shown in coronal and middle sections, and no defect was seen in apical third.

CONCLUSION

Authors found that ProTaper Next group showed a high percentage of dentinal crack incidence followed by 2 Shape and control groups regardless of the root canal cross-section.

REFERENCES

1. Jain A, Bhadoria K, Choudhary B, et al. Comparison of dentinal defects induced by hand files multiple and single rotary files: a stereomicroscopic study. *World Dent J* 2017;8(1):45–48.
2. Ferrara G, Taschieri S, Corbella S, et al. Comparative evaluation of the shaping ability of two different nickel-titanium rotary files in curved root canals of extracted human molar teeth. *J Investig Clin Dent* 2017;8(1):15-8.
3. Das S, Pradhan PK, Lata S, et al. Comparative evaluation of dentinal crack formation after root canal preparation using ProTaper Next, OneShape, and Hyflex EDM. *J Conserv Dent* 2018;21(2):153-6.
4. Singh TK, Mathur R, Passi D, et al. To study the crack initiation on the apical root surface following different root canal preparation techniques and instruments: an in vitro study. *Ann Med Health Sci Res* 2018;8(3):55–59.
5. Liu R, Hou BX, Wesselink PR, et al. The incidence of root microcracks caused by 3 different single-file systems versus the ProTaper system. *J Endod* 2013;39(8):1054–1056.
6. Wilcox LR, Roskelley C, Sutton T. The relationship of root canal enlargement to finger-spreader induced vertical root fracture. *J Endod* 1997;23(8):533–534.
7. Nazir SM, Abdallah AM, Mokhless NA. Detection of crack formation following coronal flaring with three different instruments using two evaluation methods-in-vitro study. *Alexandria Dent J* 2017;42(2):135–140.
8. Yoldas O, Yilmaz S, Atakan G, et al. Dentinal microcrack formation during root canal preparations by different NiTi rotary instruments and the self-adjusting file. *J Endod* 2012;38(2):232–235.
9. Cordeiro MM, Rocha MJ. The effects of periradicular inflammation and infection on a primary tooth and permanent successor. *J Clin Pediatr* 2005;29(3):193–200.
10. Bier CAS, Shemesh H, Tanomaru-Filho M, et al. The ability of different nickel-titanium rotary instruments to induce dentinal damage during canal preparation. *J Endod* 2009;35(2):236–238.
11. Elnazzer HM, Sherif DA, Labib AH. Incidence of Dentinal Cracks in Root Surface by Different Ni-Ti Rotary File Systems. *J Oper Dent Endod* 2020;5(2): 63–68.
12. Garg S, Mahajan P, Thaman D, Monga P. Comparison of dentinal damage induced by different nickel-titanium rotary instruments during canal preparation: An in vitro study. *J Conserv Dent* 2015;18:302-5.