

ORIGINAL ARTICLE

COMPARATIVE ANALYSIS OF PREPARATION OF ROOT CANAL SYSTEMS WITH EITHER HAND OR ROTARY INSTRUMENTS: AN IN VITRO STUDY

Hemaneerathore¹, Shivani Markanday², Gurpreet Singh³, Fatinder Jeet Singh⁴, Tarun Mohan Sharma⁵, Vasudha Kak⁶

^{1,2,3}Post graduate students, Deptt of Conservative Dentistry and Endodontics, MM College of Dental Sciences And Research, Mullana, Ambala, Haryana, ⁴PG student, Deptt of Conservative Dentistry and Endodontics, Surendera Dental College, Sri Ganga Nagar, Rajasthan, ⁵E.C.H.S Polyclinic, Chandigarh, Punjab, ⁶Deptt of Public Health Dentistry, Registrar, GDC, Jammu, J&K

ABSTRACT:

Background: NiTi rotary files in comparison to hand instruments (K-files) aid in endodontic procedure by making the procedure easier and more precise, conserving root structure in curved canals, and achieving even conical shape of the canal in lesser time. So, the present study was planned to analytically compare the root canal preparation systems with either hand or rotary instruments. **Material and methods:** For the study, 40 extracted teeth were selected. The total teeth were randomly grouped into two groups, Group 1 and Group 2. Root canals of teeth in Group 1 were prepared using conventional method (stainless steel hand K-files) whereas in Group 2 were prepared using rotary method (NiTi Profile 0.04 taper). Different elements were recorded i.e. Preparation time and root canal blockage. **Results:** The mean preparation time for K-files was 8.13 minutes and for Protaper files was 9.21 minutes. These results were statistically significant with p-value less than 0.05. In case of K-files we observed 15% blocked canals and 85% patent canals. In comparison to this, Profiles showed 5% blocked canals and 95% patent canals. **These** results were statistically insignificant with p value greater than 0.05. **Conclusion:** From the results of the present study, we evaluated that the mean preparation time for canals was less in case of K-files as compared to Protaper NiTi rotary files. But, the incidence of canal blockage was more in case of K-files as compared to Protaper NiTi rotary files.

Keywords: K files, Protaper, Rotary, Root canal.

Corresponding author: Dr. Hemaneerathore, Post graduate students, Department of Conservative Dentistry and Endodontics, College of Dental Sciences and Research, Mullana, Ambala, Haryana,

This article may be cited as: Rathore H, Markanday S, Singh G, Singh FJ, Sharma TM, Kak V. Comparative analysis of preparation of root canal systems with either hand or rotary instruments: An in vitro study. J Adv Med Dent Sci Res 2017;5(5):37-40.

Access this article online	
<p>Quick Response Code</p> 	Website: www.jamdsr.com
	DOI: 10.21276/jamdsr.2017.5.5.10

INTRODUCTION:

The fulfilling of endodontic medication is speedily aide to the microbial abbreviation in the root canal system by root canal debridement, shaping, and sealing.¹ K-files and H-files are the instruments mostly used for mechanical preparation of the root canals. But now-a-days, majority of endodontists prefer the use of nickel titanium (NiTi) rotary files with endomotor for preparation of rootcanals.^{2,3} NiTi rotary files in comparison to hand instruments (K-files) aid in endodontic procedure by making the procedure easier and more precise, conserving root structure in curved canals, and achieving even conical shape of the canal in lesser time.^{4,5} NiTi rotary files are available in various designs and tapers for use in endodontic procedures.⁶As of late there needed been an aggregate movement starting

with manual root canals preparation instruments to rotary defiant because of its exactness and shorter preparation period. Moreover, hand instruments are usually utilized for endodontic procedures in dental institutes and general dental practice.⁷ So, the present study was planned to analytically compare the root canal preparation systems with either hand or rotary instruments.

MATERIALS AND METHODS:

The present study was conducted in the Department of Conservative Dentistry and Endodontics of the dental institution after obtaining ethical approval from the ethical committee of the institute. For the study, 40 extracted teeth were selected. The inclusion criteria for selection of extracted teeth were as follows:

- Only premolars with single canal were included

- Non-carious
- Completely formed apex
- Absence of structural and morphological defects

The total teeth were randomly grouped into two groups, Group1 and Group 2. Root canals of teeth in Group 1 were prepared using conventional method (stainless steel hand K-files) whereas in Group 2 were prepared using rotary method (NiTi Profile 0.04 taper).

Preparation of access cavities was done and working length (WL) was determined using visible method with size 10 K file. In group 1, canal was prepared using step-back technique with size 15 file as starting file and size 45 file as master apical file. In group 2, preparation of canal was done using crown-down technique with profile 0.04 taper 29 series rotary instruments. In both the procedures, copious irrigation was done throughout the procedure with 2.5% NaOCl and recapitulation was done during the procedure using size 10 K file. Different elements were recorded i.e. Preparation time and root canal blockage. The statistical analysis of the data was done using Software of Statistical Package for Social Sciences (SPSS) for windows. Chi-square test and Student’s t-test were used to

ensure the significance of the data. The significance of the results was predetermined at P value less than 0.5.

RESULTS:

In the present study, 40 extracted teeth were selected and were randomly grouped into two groups Group1 (canals prepared with K-files) and Group 2 (canals prepared with rotary Protaper files). Table 1 shows the comparative analysis of canal preparation time between K-file (hand) and Protaper 0.04 taper (rotary) files. The mean preparation time for K-files was 8.13 minutes and for Protaper files was 9.21 minutes. These results were statistically significant with p-value less than 0.05 [Figure 1]. Table 2 shows the Comparative analysis of canal blockage due to debris after canal preparation with K-files (hand) and Protaper (rotary) files. In case of K-files we observed 15% blocked canals and 85% patent canals. In comparison to this, Profiles showed 5% blocked canals and 95% patent canals. These results were statistically insignificant with p value greater than 0.05 [Figure 2].

Table 1: Comparative analysis of canal preparation time between K-file (hand) and Protaper 0.04 taper (rotary).

Method of instrumentation	Mean preparation time (minutes)	P-value
K-file (hand)	8.13	0.014
Protaper 0.04 taper (rotary)	9.21	

Figure 1: Comparison of K-file (hand) and Protaper 0.04 taper (rotary) for canal preparation time

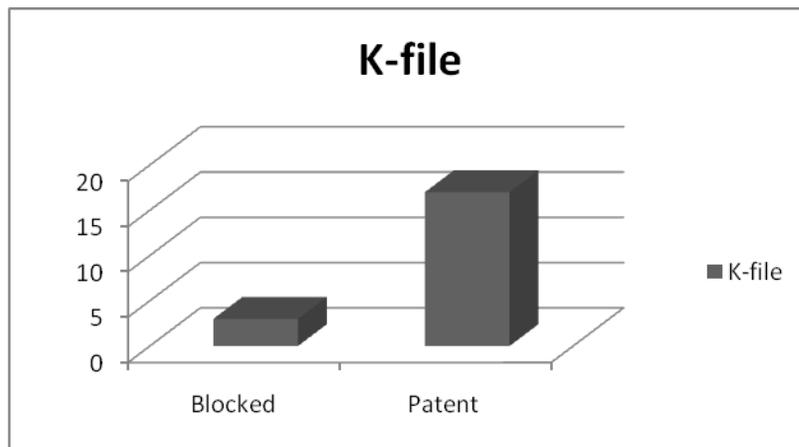


Table 2: Comparative analysis of canal blockage due to debris after canal preparation with K-files (hand) and Protaper (rotary) files.

Status of canal	K-file	Profiles	P-value
Blocked	3 (15%)	1 (5%)	0.26
Patent	17 (85%)	19 (95%)	
Total	20	20	

Figure 2: Comparative analysis of canal blockage due to debris after canal preparation with K-files (hand) and Protaper (rotary) files.



DISCUSSION:

Bio-mechanical preparation of the root canals is one of the most important stages of a root canal treatment. Original canal curvature, especially at the apex and inner side of the root curvature should be preserved during canal shaping. In this regard, any straightening which might interfere with canal integrity has to be prevented. In this present study, we comparatively analyzed the preparation of root canal system with hand and rotary instruments. The preparation time for K-files was less as compared to Protaper NiTi files and was statistically significant. Also, the canal blockage was more observed in case of K-files as compared to Protaper NiTi rotary files and was statistically insignificant. Katge F et al compared the cleaning efficacy and instrumentation time between manual Hedstrom files (H-files) and rotary Mtwo files in primary molar root canals. A total of 90 primary root canals were selected using standardized radiographs. The canals were injected with India ink with 30 gauge insulin syringe and divided into three groups. Group I—30 root canals instrumented with H-files, group II—30 root canals instrumented with Mtwo files, and group III—control group in which no canal instrumentation was done. The teeth were cleared in various solutions and then observed under a stereomicroscope. No significant difference was seen in cleaning efficacy between H-files and Mtwo files in coronal, middle, and apical thirds of the root canal. The instrumentation time recorded for H-files (3.41 ± 0.38 minutes) was significantly less than that of Mtwo files (4.81 ± 0.52). The authors concluded that although there was no significant difference in cleaning capacity, further studies should be carried out using the single file systems. Azar MR et al compared the cleaning ability and preparation time of rotary instruments (Mtwo) and conventional manual instruments (K-file) in preparing primary and permanent molar root canals. Access cavities were prepared in 70 primary and 70 permanent teeth and India ink was injected into 120 canals of selected molars. The teeth were randomly divided into two main subgroups

(n=20) and three control groups (n=10). In each of these main subgroups, either the manual instrument (K-file) or the rotary system (Mtwo) was used to prepare root canals. After cleaning the canals and clearing the teeth, dye removal was evaluated with the help of a stereomicroscope. In addition, the time needed for root canal preparation was recorded by a chronometer. With regard to the cleaning ability of root canals, there were no significant differences between the K-file and Mtwo rotary system in primary and permanent teeth in the apical, middle or coronal third of the canals. Moreover, there were no significant differences between primary and permanent teeth prepared with K-files and rotary instruments. In all the groups, shorter times were recorded with the rotary technique. The working time was shorter in primary than in permanent teeth. Authors concluded that Mtwo rotary system showed acceptable cleaning ability in both primary and permanent teeth, and achieved results similar to those of K-files in less time.^{8,9} Taşdemir T et al compared ex vivo root canal preparation with conventional stainless steel K-files and Hero 642 rotary Ni-Ti instruments. Mesio buccal canals of 20 maxillary first molars (with angles of curvature between 25 and 35) were used. After preparation with Hero 642 rotary instruments and stainless steel K-files, the amount of transportation that occurred was assessed using computed tomography. The teeth were scanned by computed tomography before instrumentation. One millimetre thick slices were prepared from the apical end point to the pulp chamber. The first two sections were 3 mm from the apical end of the root (apical level) and 3 mm below the orifice (coronal level). A further section (mid-root level) was recorded, dividing the distance between the sections of apical and coronal levels into two equal lengths. Ten teeth were instrumented using Hero 642 rotary instruments and another 10 teeth were instrumented using stainless steel K-files. Following the completion of the instrumentation, the teeth were again scanned and compared with the cross-sectional images taken prior to canal preparation. Amount of transportation and centring ability was assessed. Less

transportation occurred with Hero 642 rotary instruments than stainless steel K-files at the mid-root and coronal levels. Hero 642 rotary instruments had better centering ability than K-files at all three levels. It was concluded that Hero 642 rotary instruments transported canals less, especially at the middle and coronal thirds of the root canals than stainless steel K-files. Hero 642 instruments had better centering ability. Limongi O et al compared, using computed tomography (CT), the amount of dentin removed from root canal walls by manual and mechanical rotary instrumentation techniques. Forty mandibular incisors with dental crown and a single canal were selected. The teeth were randomly assigned to two groups, according to the technique used for root canal preparation: Group I - manual instrumentation with stainless steel files; Group II - mechanical instrumentation with RaCe rotary nickel-titanium instruments. In each tooth, root dentin thickness of the buccal, lingual, mesial and distal surfaces in the apical, middle and cervical thirds of the canal was measured (in mm) using a multislice CT scanner (Siemens Emotion, Duo). Data were stored in the SPSS v. 11.5 and SigmaPlot 2001 v. 7.101 softwares. After crown opening, working length was determined, root canals were instrumented and new CT scans were taken for assessment of root dentin thickness. Pre- and post-instrumentation data were compared and analyzed statistically by ANOVA and Tukey's post-hoc test for significant differences ($p=0.05$). Based on the findings of this study, it may be concluded that regarding dentin removal from root canal walls during instrumentation, neither of the techniques can be considered more effective than the other.^{10, 11} Schäfer E et al compared the effect of hand instruments and rotary nickel titanium FlexMaster files used by eight experienced dentists in private practice on the extent of straightening of curved root canals. In patients, 110 canals were prepared by FlexMaster instruments, and 84 canals were enlarged using hand instruments. After instrumentation, all canals were obturated. Preoperative and postoperative radiographs were taken of each tooth using customized bite blocks. Straightening of the canal curvatures was determined with a computer image analysis program. Preparation time and size of the master apical file were also recorded. The use of FlexMaster instruments resulted in significantly less straightening and a shorter preparation time ($p < 0.0001$) compared with hand instrumentation. Master apical file sizes were significantly greater for FlexMaster than for hand instruments ($p < 0.01$). This clinical study indicates that FlexMaster instruments prepared curved canals rapidly and with only minimal straightening.¹²

CONCLUSION:

From the results of the present study, we evaluated that the mean preparation time for canals was less in case of K-files as compared to Protaper NiTi rotary files. But, the incidence of canal blockage was more in case of K-files as compared to Protaper NiTi rotary files.

REFERENCES:

1. West JD, Roane JB, Goerig AC. Cleaning and shaping the root canal system. In: Pathways of the pulp. 6th ed. Cohen S, Burns RC, eds. St. Louis: CV Mosby, 1994:179-218.
2. Stabholz A, Friedman S, Tamse A. Endodontic failures and re-treatment. In: Pathways of the pulp. 6th ed. Cohen S, Burns RC, eds. St. Louis: CV Mosby, 1994:690-729.
3. Deplazes P, Peters O, Barbakow F. Comparing apical preparations of root canals shaped by nickel-titanium rotary instruments and nickel-titanium hand instruments. J Endod 2001;27:196-202.
4. Rödiger T, Hulsmann M, Muhge M, Schäfers F. Quality of preparation of oval distal root canals in mandibular using nickel-titanium instruments. Int Endod J 2002;35:919-928.
5. Garala M, Kuttler S, Hardigan P, Steiner-Carmi R, Dorn S. A comparison of the minimum canal wall thickness remaining following preparation using two nickel-titanium rotary systems. Int Endod J 2003;36:636-642.
6. Hülsmann M, Rummelin C, Schäfers F. Root canal cleanliness after preparation with different endodontic handpieces and hand instruments: a comparative SEM investigation. J Endod 1997;23:301-6.
7. Drukteinis S, Balciuniene I. A scanning electron microscopic study of debris and smear layer remaining following use of AET instruments and Kflexofiles. Stomatologija 2006;8:70-5.
8. Katge F, Chimata VK, Poojari M, Shetty S, Rusawat B. Comparison of cleaning Efficacy and Instrumentation Time between Rotary and Manual Instrumentation Techniques in Primary Teeth: An in vitro Study. International Journal of Clinical Pediatric Dentistry. 2016;9(2):124-127.
9. Azar MR, Mokhtare M. Rotary Mtwo system versus manual K-file instruments: Efficacy in preparing primary and permanent molar root canals. Indian J Dent Res 2011;22:363
10. Taşdemir T, Aydemir H, Inan U, Unal O. Canal preparation with Hero 642 rotary Ni-Ti instruments compared with stainless steel hand K-file assessed using computed tomography. Int Endod J. 2005 Jun;38(6):402-8.
11. Limongi O, Albuquerque DS, Baratto Filho F, Vanni JR, Oliveira, Motcy de EP, Barletta FB (2007). In vitro comparative study of manual and mechanical rotary instrumentation of root canals using computed tomography. Brazilian Dental Journal, 18(4), 289-293.
12. Schäfer E, Schulz-Bongert U, Tulus G. Comparison of Hand Stainless Steel and Nickel Titanium Rotary Instrumentation: A Clinical Study. Journal of endodontics VOL. 30, NO. 6, JUNE 2004.

Source of support: Nil

Conflict of interest: None declared

This work is licensed under CC BY: *Creative Commons Attribution 3.0 License*.