

ORIGINAL ARTICLE

A Study of Efficacy of Biomechanical Preparation of Root Canals between hand K-files and Rotary Protaper Files

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ABSTRACT:

Background: An ideal prepared root canal should have a progressively tapering conical shape which preserves the apical foramen and the original canal curvature without transportation. Several studies have concluded that none of the instrumentation techniques or devices currently used can completely clean root canals, especially curved roots. Arguably the cleaning ability of manual root canal instrumentation has been shown to be superior to that of automated device. **Aim of the study:** To study efficacy of biomechanical preparation of root canals between hand K-files and rotary Protaper files. **Materials and methods:** The present study was conducted in the Department of Conservative Dentistry and Endodontics of the Dental institution. For the study, 26 extracted teeth were selected. The inclusion criteria for selection of extracted teeth are that only maxillary central incisors with single root canal, non-carious teeth, completely formed apex and absence of structural and morphological defects. 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). **Results:** In the present study, 26 extracted teeth were selected and were randomly grouped into two groups Group 1 (canals prepared with K-files) and Group 2 (canals prepared with rotary Protaper files). The mean preparation time for K-files was 10.02 minutes and for Protaper files was 7.98 minutes. In case of K-files we observed 3 teeth with blocked canals and 10 teeth with patent canals. In comparison to this, Protaper files showed 1 tooth with blocked canal and 12 teeth with patent canals. **Conclusion:** The mean biomechanical preparation time for root canals was more with K-files as compared to Protaper rotary files; however, the incidence of canal blockage was more in case of K-files as compared to Protaper rotary files.

Key words: Protaper files, NiTi files, K-files, root canals.

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INTRODUCTION:

Cleaning and shaping of the root canal system is one of the main goals in endodontics which can be carried out using different systems and techniques.¹ To reach this aim, stainless steel hand instruments have been traditionally applied. Lack of flexibility of instruments causes errors during endodontic treatments which lead to decreased success rate. After introducing rotary nickel-titanium (NiTi), their usage became popular.² NiTi instruments super elasticity along with their advanced design made them favorable for effective and safe instrumentation of narrow and curved root canals using low torque handpieces.³ An ideal prepared root canal should have a progressively tapering conical shape which preserves the apical foramen and the original canal curvature without transportation.⁴ Several studies have concluded that none of the instrumentation techniques or devices currently used can completely clean root canals, especially curved roots. Arguably the cleaning ability of manual root canal instrumentation has been shown to be superior to that of automated devices.⁵ However, it was recently demonstrated that instrumentation with automated devices using rotary nickel-titanium (Ni-Ti) instruments with various tapers led

to promising results; i.e. less straightening or decentralization of the canal, and a rounder canal preparation even in severely curved root canals.⁶ Hence, we planned the study to study efficacy of biomechanical preparation of root canals between hand K-files and rotary Protaper files.

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, 26 extracted teeth were selected. The inclusion criteria for selection of extracted teeth are that only maxillary central incisors with single root canal, non-carious teeth, completely formed apex and absence of structural and morphological defects. 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). 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 SPSS version 20.0 for windows. The Student’s t-test and Chi-square test were used to check the significance of the data. The p-value less than 0.05 was predetermined as statistically significant.

RESULTS:

In the present study, 26 extracted teeth were selected and were randomly grouped into two groups Group 1 (canals prepared with K-files) and Group 2 (canals prepared with rotary Protaper files). Table 1 shows Mean root canal

preparation time for K-file (hand) and Protaper 0.04 taper (rotary). The mean preparation time for K-files was 10.02 minutes and for Protaper files was 7.98 minutes. These results were statistically significant with p-value less than 0.05 [Figure 1]. Table 2 shows the canal blockage due to debris after canal preparation with K-files (hand) and Protaper (rotary) files. In case of K-files we observed 3 teeth with blocked canals and 10 teeth with patent canals. In comparison to this, Protaper files showed 1 tooth with blocked canal and 12 teeth with patent canals. These results were statistically insignificant with p value greater than 0.05 [Figure 2].

Table 1: Mean root canal preparation time for K-file (hand) and Protaper 0.04 taper (rotary)

Method of instrumentation	Mean preparation time (minutes)	p-value
K-file (hand)	10.02	0.001
Protaper 0.04 taper (rotary)	7.98	

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

Status of canal	K-file	Protaper files	P-value
Blocked	3	1	0.13
Patent	10	12	
Total	13	13	

Fig 1: Comparative analysis of mean root canal preparation time

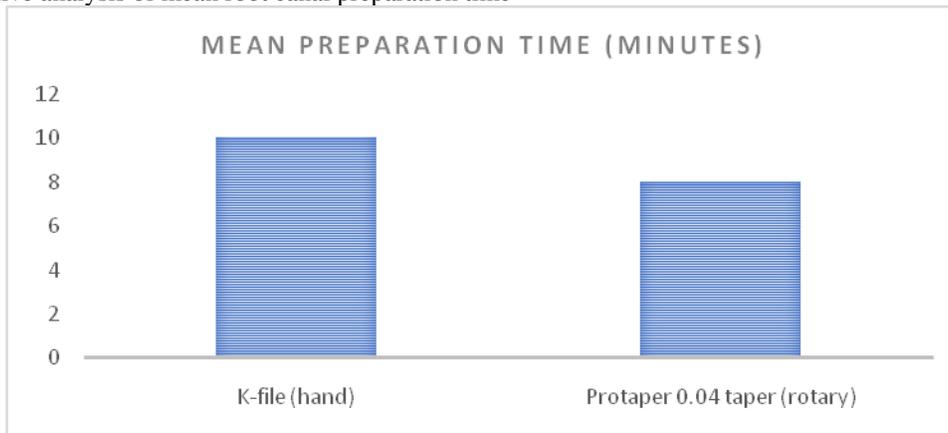
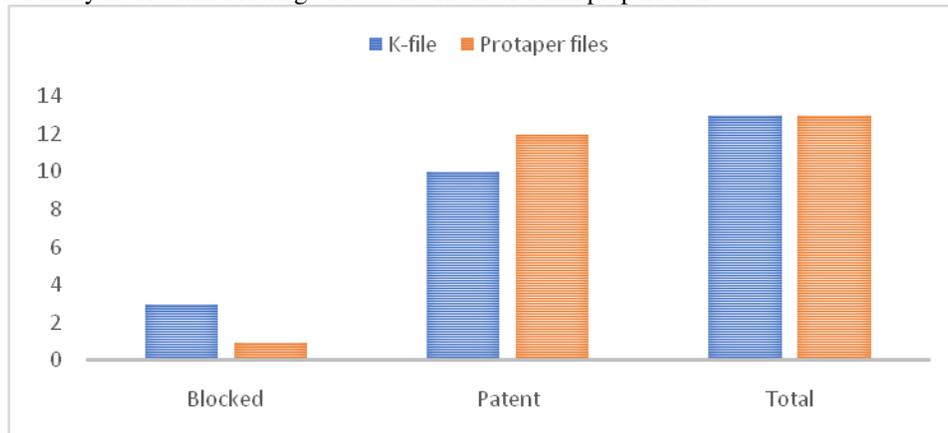


Fig 2: Comparative analysis of canal blockage due to debris after canal preparation



DISCUSSION:

In the present study we compared the preparation of root canal system with hand and rotary instruments. The preparation time for K-files was more as compared to Protaper NiTi files and was statistically significant. Also, the incidence of canal blockage was more observed in case of K-files as compared to Protaper NiTi rotary files; but the results were statistically non-significant. The results were compared with previous studies and results were consistent with previous studies. Talebzadeh B et al compared the severity of postoperative pain after root canal preparation with RaCe rotary system and hand K-Flexo file. A total of 96 mandibular first and second molars were divided into two groups (n=48) based on root canal preparation technique. The teeth in both groups underwent one-session root canal treatment and the severity of postoperative pain was evaluated using visual analog scale (VAS) at 4-, 8-, 12-, 24- and 48-h and 1-week intervals. In addition, the type and dosage of analgesics were recorded. Data were analyzed with repeated-measures ANOVA. Statistical significance was set at 0.05. The difference between the two groups during this period and at subsequent intervals were not significant. There were no significant differences between the two groups in type and the number of analgesics in pain-free subjects. Pedrazzi V et al determined the relative clinical effectiveness of hand instrumentation versus ultrasonic instrumentation alone or in conjunction with hand instrumentation for orthograde root canal treatment of permanent teeth. The search strategy retrieved 226 references from the Cochrane Oral Health Group Trials Register (7), the Cochrane Central Register of Controlled Trials (CENTRAL) (12), MEDLINE (192), EMBASE (8) and LILACS (7). No language restriction was applied. The last electronic search was conducted on December 13th, 2007. Screening of eligible studies was conducted in duplicate and independently. Results were to be expressed as fixed-effect or random-effects models using mean differences for continuous outcomes and risk ratios for dichotomous outcomes with 95% confidence intervals. Heterogeneity was to be investigated including both clinical and methodological factors. No eligible randomized controlled trials were identified. This review illustrated the current lack of published or ongoing randomized controlled trials and the unavailability of high-level evidence based on clinically relevant outcomes referring to the effectiveness of ultrasonic instrumentation used alone or as an adjunct to hand instrumentation for orthograde root canal treatment.^{7,8}

Arya A et al compared the cleaning efficiency of manual and rotary instrumentation in the apical third of the root canal system. In group 1 (n=10), instrumentation was performed with stainless steel K-file; in group 2 (n=10), it was done with hand ProTaper files; and in group 3 (n=10), instrumentation was done with ProTaper rotary. Distilled water was used for irrigation. The apical third was sectioned transversally and histologically processed. The cross sections were examined under optic microscope and debris

was measured using Motic software. Instrumentation with stainless steel K-files showed minimum amount of debris, followed by ProTaper hand files, and rotary ProTaper files were least effective with maximum amount of debris; however, there were no significant differences between the three experimental groups. This was concluded that both the manual and rotary instrumentation are relatively efficient in cleaning the apical third of the root canal system and the choice between manual and rotary instrumentation should depend on case to case basis. Reddy N et al evaluated the efficacy and cleaning ability of Hedstrom files, and ProTaper retreatment instruments in removing gutta-percha from root canals with and without xylene as solvent. Sixty extracted single rooted human teeth were selected and decoronated, straight access established working length determined 1 mm short of canal, chemomechanical preparation done and obturated with gutta-percha and AH plus sealer. Samples were stored for 1 week in humidifier divided into four groups of 15 teeth each. • Group I: Hedstrom files without xylene. • Group II: Hedstrom files with xylene. • Group III: ProTaper retreatment instruments without xylene. • Group IV: ProTaper retreatment instruments with xylene. and the following criteria were assessed - Time taken for initial plunge of instrument into gutta-percha. - Time taken for complete removal of gutta-percha to reach working length - Ability of H files and ProTaper retreatment files with/ without xylene to remove gutta-percha in coronal, middle and apical 1/3 of canal. The teeth were grooved in labiolingual cross section, observed under a stereomicroscope and scored according to gutta-percha debris left in the canal. The least time to reach working length was found with group IV followed by groups III, II and group I respectively. Also, the fastest way to remove maximum gutta-percha was group IV followed by groups III, II, and I respectively with a statistically significant difference among all groups. Apical 1/3 has more amount of remaining gutta-percha debris than middle and coronal 1/3 in all groups. The amount of gutta-percha debris in apical 1/3 was least in group IV followed by groups III, II and I respectively. This was concluded that the fastest technique to remove gutta-percha and the shortest time to reach working length was observed with ProTaper retreatment instruments with xylene followed by ProTaper retreatment files without xylene and Hedstrom files without xylene. After instrumentation for removal of gutta-percha, apical third was found to have more debris compared to coronal and middle 1/3 of the root canal.^{9,10}

CONCLUSION:

Within the limitations of the study we conclude that the mean biomechanical preparation time for root canals was more with K-files as compared to Protaper NiTi rotary files; however, the incidence of canal blockage was more in case of K-files as compared to Protaper NiTi rotary files.

REFERENCES:

1. Zmener O, Pameijer CH, Banegas G. Effectiveness in cleaning oval-shaped root canals using Anatomic Endodontic Technology, ProFile and manual instrumentation: a scanning electron microscopic study. *IntEndod J.* 2005;38:356–63.
2. Mizrahi SJ, Tucker JW, Seltzer S. A scanning electron microscopic study of the efficacy of various endodontic instruments. *J Endod.* 1975;1:324–33.
3. Nekoofar MH, Sheykhrezae MS, Meraji N, Jamee A, Shirvani A, Jamee J, Dummer PM. Comparison of the effect of root canal preparation by using WaveOne and ProTaper on postoperative pain: a randomized clinical trial. *J Endod.* 2015;41(5):575–8.
4. Shahi S, Asghari V, Rahimi S, Lotfi M, Samiei M, Yavari H, Shakouie S, Nezafati S. Postoperative Pain after Endodontic Treatment of Asymptomatic Teeth Using Rotary Instruments: A Randomized Clinical Trial. *Iran Endod J.* 2016;11(1):38–43.
5. Hülsmann M, Stryga F. Comparison of root canal preparation using different automated devices and hand instrumentation. *J Endod.* 1993;19:141–5.
6. Heard F, Walton RE. Scanning electron microscope study comparing four root canal preparation techniques in small curved canals. *IntEndod J.* 1997;30:323–31.
7. Talebzadeh B, Nezafati S, Rahimi S, Shahi S, Lotfi M, Ghasemi N. Comparison of Manual and Rotary Instrumentation on Postoperative Pain in Teeth with Asymptomatic Irreversible Pulpitis: A Randomized Clinical Trial. *Iranian Endodontic Journal.* 2016;11(4):273-279.
8. Pedrazzi V, de Oliveira-Neto JM, Sequeira P, Fedorowicz Z, Nasser M. Hand and ultrasonic instrumentation for orthograde root canal treatment of permanent teeth. *J Appl Oral Sci.* 2010 May-Jun;18(3):268-72.
9. Arya A, Bali D, Grewal MS. Histological analysis of cleaning efficacy of hand and rotary instruments in the apical third of the root canal: A comparative study. *Journal of Conservative Dentistry: JCD.* 2011;14(3):237-240.
10. Reddy N, Admala SR, Dinapadu S, Pasari S, Reddy MP, Rao MS. Comparative analysis of efficacy and cleaning ability of hand and rotary devices for gutta-percha removal in root canal retreatment: an in vitro study. *J Contemp Dent Pract.* 2013 Jul 1;14(4):635-43.

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