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Comparison of The Cleaning Ability of K3 and Protaper Rotary Nickel Titanium Systems with Manual Instruments in Permanent teeth (In Vitro Study)

Running title: Cleaning ability of rotary nickel titanium system with manual instruments

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ABSTRACT

Aims: The aim of present study is to compare the effectiveness of manual K-files and two rotary systems K3 and Protaper for root canal preparation in permanent teeth.

Materials and Methods: India ink is injected to forty-five permanent single rooted teeth. The teeth is randomly divided into three experimental groups. In each experimental group, either manual instruments (K-file) or rotary nickel titanium instruments (K3 and Protaper) are used to prepare root canal. After preparing, cleaning of the canals and clearing of teeth, ink removal was evaluated with stereomicroscope (10x magnification). Statistical analysis was done with Kruskal–Wallis and Mann Whitney tests.

Results: There were significant differences in cleaning ability between manual and rotary instruments, but, Rotary files performed significantly better cleaning ability in the apical, middle and coronal thirds than manual instruments. No significant differences between two rotary groups (K3 and Protaper) in the apical, middle and coronal thirds of root canals .

Conclusions: Manual K-files, (K3and Protaper) rotary systems showed acceptable cleaning ability in permanent root canals, but, Rotary instruments (K3 and Protaper) reported better cleaning ability than manual one .

Keywords: permanent tooth, root canal preparation, root canal therapy.

INTRODUCTION

The removal of organic debris is the main purpose of filing in endodontic procedures in permanent teeth [(1)]. Root canal preparation is performed with files, reamers, sonic instruments or mechanical apparatus, and with nickel-titanium (Ni-Ti) rotary file systems. Since most hand preparation techniques are time consuming and may lead to iatrogenic errors (i.e. ledging, zipping, canal transportation and apical blockage), much attention has been directed toward root canal preparation techniques with Nickel-Titanium rotary instruments [(2)] .The design and flexibility of Nickel Titanium alloy instruments allow files to preserve the original anatomy of root canals and reduce procedural errors[(3,4)] .In addition, because of the funnel-shaped canal preparation, a more predictably uniform paste filling can be obtained in permanent teeth [(2)] . Rotary files also favor the patient's cooperation by shortening treatment time for cleaning canals[(4)] . However, the high cost of Nickel Titanium rotary systems and need for training to learn the technique are disadvantages of Nickel Titanium rotary files [(2)] .One generation of Nickel Titanium rotary files appeared with the K3 endodontic instruments. The basic series(standard set) of K3 rotary files includes canal shaping files which are available with a fixed taper of .02, .04 or .06. The .02 tapered K3 files are available in 15-45 tip sizes and 21, 25 and 30mm lengths, the .04 and .06 tapered K3 files are available in 15-60 tip sizes and 21, 25 and 30 mm lengths. This system has a slightly positive rake angle ,a variable core diameter , three radial lands , asymmetrically placed radial lands as well as unequal land widths, flute widths and flute depths , an "Axxess" handle design, which shortens the file handle by approximately 5 mm without affecting the working length of the file , a variable flute pitch , a color-coding to distinguish between different tip sizes and tapers, a safe ended cutting tip[(5)].Another rotary Nickel Titanium system is the Protaper system, which consists of one file as an orifice opener (SX),two shaping files (S1, S2) and five finishing files(F1-F5). The files have a

variable tapered shaft that is designed for the crown-down technique. File tips range in size from 20 to 50, and tapers of 0.07, 0.08 and 0.09 are available[6]. A crown-down technique is recommended for Protaper instruments, in which larger files are used before smaller ones and canals are prepared with a coronal-to-apical approach[7] .Several studies have compared the effectiveness of rotary Nickel Titanium files and manual instruments in cleaning root canals in permanent teeth. Most have concluded that Nickel Titanium rotary systems are faster than manual files , reduce errors during root canal preparation, and preserve root canal shape [8] .Gu et al. reported that both K3 and Protaper systems are effective and faster than manual files in the preparation of permanent curved molar canals [7] . The purposes of present study is to compare the effectiveness of manual K-files and two rotary systems K3 and Protaper for root canal preparation in permanent teeth.

MATERIALS AND METHODS

All teeth were stored in distilled water at 37°C immediately after extraction. They were then immersed in 0.5% sodium hypochlorite for 1 week for disinfection, and again stored in distilled water at 37°C. Standard coronal access was achieved with diamond fissure burs. All the canals were checked radio graphically for apical patency and root canal conditions by inserting a no. 15 K-file into the canals. Teeth with no abnormalities such as internal or external root resorption or canal calcification were selected. All specimens were then rinsed, and root canals were filed with India ink with a 30-gauge insulin syringe. A no. 15 K-file was introduced into the canal to assure penetration of the ink and prevent bubble formation. The teeth were left in wet conditions at room temperature for 48 h, and were then randomly divided into three experimental groups. Each one contained 15 teeth.

Group 1: specimens were instrumented with manual K-files; in group 2:K3nickel titanium rotary files were used, and in group 3: Protaper nickel titanium rotary files were used.All root canals were prepared by the same operator. The working length was recorded as the length of the initial file at the apical foramen minus 1 mm under stereomicroscopeat (×10) .

In group 1, all 15 root canals were instrumented manually with K-files (Mani Co, Tokyo, Japan) with the step-back technique up to file no. 35-40.

In group 2 all 15 canals were cleaned with the K3 rotary system (Sybron Endo, Mexico, China) using 25 mm files. The instruments were used by crown-down technique. The instrumentation sequence was 40/.06, 35/.06, 30/.06, and 25/.06. Instrument up to working length using very light pressure and never force instruments to working length. The flutes of the file wiped after every insertion. Most often during instrumentation, take 2-3 repetitions of the given file sequence to allow the file to reach the total working length.

In group 3, all 15 root canals were cleaned with the Protaper system (Dentsply-Maillefer, Ballaigues, Switzerland) in a crown-down technique with five instruments were used in the following sequence: S1 in the coronal third of the root canal, S2 in the middle third, and (F1, F2, F3) at the working length[9].

The two nickel titanium rotary systems instruments were used with contra-angle rotary hand piece at a rotational speed of 300 rpm and torque 3 N cm .In all three experimental groups the canals were flushed with 5 ml distilled water and dried with absorbent paper points. The pulp chamber was filled with temporary cement and teeth were then stored in wet conditions. To analyze cleaning capacity, the teeth were placed separately in 5% nitric acid for 7days(decalcification), in ethanol 85%, 90%, 99%, successively for 12 hours, 1hour, and 3hours respectively(dehydration). Then the teeth were cleared using methyl salicylate solution for 6 hours [10]. Two observers examined the transparent teeth under a stereomicroscope (Motic, China) at ×10 magnification and scored the amount ofIndia ink remaining in the coronal, middle, and apical thirds of the canal on a scale of 0 to 2, as show in figure (1-"a, b, c ") :

0 = total clearing in which the whole canal was completely clean.
1 = partial ink removal.
2 = no ink removal
Statistical analyses of the data were done with the nonparametric Kruskal–Wallis and Mann-Whitney tests at ($P \leq 0.05$).

RESULTS

Under stereomicroscope at ×10 magnification the prepared canal walls showed variable amounts of remnant ink in canals. Comparisons between three experimental groups indicated that all the instruments in the three experimental groups that compared were able to remove the ink.

Kruskal–Wallis test showed statistically significant differences in cleaning efficacy of walls atapical, middle and coronal thirds of three experimental groups. Mann-Whitney U test showed statistically significant differences in cleaning efficacy of walls at apical ,middle and coronal thirds of two rotary groups(K3 and protaper) from manual group (k-file); but there was no statistically significant differences in cleaning efficacy of walls at apical, middle and coronal thirds between two rotary groups(K3 and Protaper) at $p \leq 0.05$.

DISCUSSION

The ink penetration and clearing technique is useful for studying the cleaning ability of the instrumentation and the morphology of human teeth because it makes the teeth transparent so that the pulp cavity and root canal walls can be diagnosed [(11)].The importance of root canal cleaning is reflected in the many studies that have focused on different manual instruments and rotary systems for root canal preparation [(9)] .

In this study, Kruskal- Willas tests and Mann Whitney U tests showed that there was statistical significant differences in the degree of cleaning efficiency between manual and rotary instruments at ($P \leq 0.05$).In agreement with our findings Crespo etal founded that the use of rotary files had more efficient when compared with manual K files .However, others reported that nickel titanium instruments had similar effect than hand files. Mokhtare et al found that M two files were as effective as manual K-files for preparing root canals of primary and permanent teeth[(11)] .The differences in the findings between this study and other studies probably reflect differences in the type of teeth, type of rotary instrument and techniques used, irrigation solutions, and operator experience[(13)] .

There were statistical differences between the three thirds of the roots that prepared by rotary instruments from that prepared by hand instruments, This may be due to design features of rotary files (K3 and Protaper) such as progressive taper of protaper file along its shank to reduce torsional loading, had a negative rake angle, the instrument cuts and clean the canal very effectively. While the K3 had slightly positive rake angle this results in optimum cutting and cleaning efficiency, superior debris removal due to increase helical angle from tip to the handle, also had three fluted file with three radial lands (broad, recessed and narrow) that minimize resistance, the combination of three lands keeps the file centered in the canal and produce optimal cleaning efficiency. All these factors directed toward the elimination of microorganisms from the three thirds of the roots, shorter working time, effective root canal (preparation, shaping and cleaning) .Also, the abrupt cervical constriction and dentinal shelf covering the canal orifice should be removed to improve the straight-line access and reduce the risk of instrument separation. Hence utilizing the intro-file at the coronal third was necessary to remove any impediments to gain further progress into the root canal and avoid lateral perforation or over instrumentation of the inner root structure, the root canals which were prepared by rotary files produced a direct coronal access and conical pathway allowing effortless entrance of obturating paste and therefore less overfilling and with the irrigation solution produce preferable canal preparation.

CONCLUSIONS

Manual K-files and (K3, Protaper) rotary systems showed acceptable cleaning efficiency in the root canals of permanent teeth .The K3 files were as effective as Protaper files for preparing and cleaning root canals of permanent teeth at the (apical, middle, coronal) thirds .However, both rotary files (K3 and Protaper) reported better cleaning efficiency than the manual K-files.

RERERENCES

[1]. Pinkham JR, Casamassimo PS. Pediatric dentistry: Infancy through adolescence. 4th ed. Philadelphia, PA: WB SaundersCo;2005.7:300-390.
[2]. Moghaddam K, Mehran M, Zadeh H.Root Canal Cleaning Efficacy of Rotary and Hand Files Instrumentation in Primary Molar. Iran Endod J; 2009 . 4 : 53–57.
[3]. Guelzow A, Stamm O, Martus P, Kielbassa A. Comparative study of six rotary nickel-titanium systems and hand instrumentation for root canal preparation. Int Endod J; 2005. 38:743-752.
[4]. Kuo C, Wang Y, Chang H, Huang G, Lin C, Li U, et al. Application of Nickel-Titanium rotary files for pulpectomy in primarymolars. J Dent Sci;2006. 1: 5-10 .
[5]. Mounce R.E. The K3 Rotary Nickel Titanium Instrument System :IN: Endodontics 2nd ed ., **Mosby St Loius**, Ch 21; pp.580-589.
[6]. The next progression in proficient performance. Available from:
[7]. http://store.maillefer.com/lit2/pdfs/ProTaperBrochure_web.pdf[last cited on 2012 Apr 4].
[8]. Gu YX, Zhu YQ, Du R. A comparative study of three different rotary Nickel Titanium systems in the preparation of curved molar canals. Shanghai Kou Qiang Yi Xue; 2009.18:147-151.
[9]. Soares F, Varella CH, Pileggi R, Adewumi A, Guelmann M. Impact of Er,Cr: YSGG laser therapy on the cleanliness of the root canal walls of primary teeth. J Endod; 2010. 34:474-477.

[10]. Azar M, Safi L, Nikaein A. Comparison of the cleaning capacity of Mtwo and ProTaper rotary systems and manual instruments in primary teeth. Dent Rese J; 2012. l9:146-149.
[11]. Mumar N,Poiul P, Shivanna V. A Comparison of the Relative Efficacies of Hand and Rotary Instruments in the Removal of Guttapercha from the Root Canal during Retreatment Using Stereomicroscope (An In Vitro Study). Jour of Endo; 2011. 4: 508-611.
[12]. Mokhtare M , Reza A Rotary Mtwo system versus manual K-file instruments: Efficacy in preparing primary and permanent molar root canals.Ind Dent Jour; 2011. 22: 50-56.
[13]. Crespo S, Gortes O, Garica C, Perez L. Comparison between rotary and manual instrumentation in primary teeth. J Clin PediatDent; 2008. 32:295-298 .
[14]. Sipert C, Hussne R, Nishiyama C. Comparison of the cleaning efficacy of the FKG race system and hand instrument in molar root canal .J Appl Oral Sci; 2006. 14:6-9.
[15]. Kuo C.I, Wang Y.L, Chang H.H, Huang G.F, Lin C.P, Guo M.K, Li U.M. Application of Nickel-Titanium rotary files for pulpectomy in primary molars. J of Dent Scien; 2012. 1: 5-10.

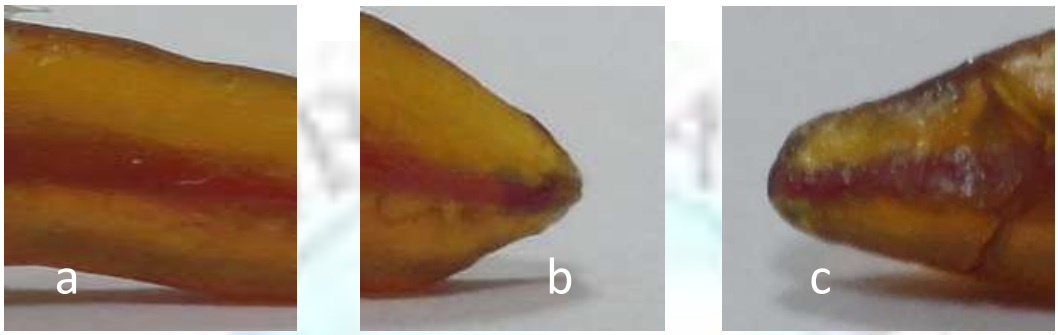

Figure (1) Show the amount of India ink remaining in the apical, middle and coronal thirds of the canals . (a) Score "0" at the coronal third. (b) Score "1" at the apical third . (c) Score" 2" at the apical third .