A comparative study between hand and rotary protaper instruments on natural extracted teeth

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ABSTRACT

Background: The purpose of this in-vitro study was to evaluate and compare the changes in working length and preparation time after instrumentation with hand and rotary protaper endodontic instruments.

Materials and Methods: mesial canals of thirty human mandibular first molars were used in this study. The mesial canals were prepared alternatively till size F2 using crown-down technique with hand protaper files (group I) and rotary protaper files (group II). Following parameters were evaluated; changes in working length and preparation time.

Results: The results showed that all canals got loss of working length after instrumentation with hand and rotary protaper files, but the difference was insignificant between them. The instrumentation time was shorter for rotary than for hand protaper instruments.

Conclusions: The preparation time with rotary protaper was faster than with hand protaper, and there in no differences between them in working length changes.

Keywords: Protaper nickel titanium instruments, rotary instruments, endodontic instrumentation. (J Bagh Coll Dentistry 2012;24(1):6-8).

INTRODUCTION

The objective of root canal preparation is to clean and shape the canal system to eliminate necrotic materials, micro-organisms, and canal irregularities, and to facilitate the placement of a permanent root filling. The ideal preparation for the root canal is a continuously tapered funnel shape with smallest diameter at the apex and widest diameter at the orifice. This shape can be achieved either by hand or by mechanical preparation [1].

Many reports have described the tendency of root canal preparation techniques to cause canal transportation and other procedural problems such as ledge formation, apical perforation, and mid-root strip perforation. These complications may compromise the long-term success of treatment by failing to eliminate infection of root canal system and making obturation more difficult [2].

Nickel titanium (Ni Ti) instruments have been developed in an attempt to overcome these limitations, because of the unique properties of Ni Ti alloy, such as flexibilities [3]. The protaper system represents a new generation of Ni Ti instruments currently available. These instruments have a convex triangular cross sectional design; a cutting safety tip and a flute design combine multiple tapers with the shaft [4]. The protaper systems are available as a rotary and hand operated instrument, which recommended to be used in a reaming or a modified balance force motion [5].

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MATERIALS AND METHODS

Thirty sound human mandibular first molars of comparable size and length with separate mesial canals and closed apices collected and stored in normal saline solution. A size 10 K-file introduced into mesial canals until it appeared at the apical foramen and the working length established by subtracting 0.5 mm from this measurement. The working length measured from that point to the tip of the cusp and it should be 20 mm (sometimes we did grinding of the cusp to get 20 mm working length). Mesiobuccal and mesiolingual canals alternated among techniques, attempting to control for both tooth and canal variability [6].

Samples randomly divided into two groups of fifteen each:

Group I: mesial canals prepared with hand protaper nickel titanium files.

Group II: mesial canals prepared with rotary protaper nickel titanium files.

For both techniques, each canal irrigated with 1% sodium hypo-chloride solution. Patency of all canals maintained with size 10 K-file.

According to manufacturer instructions, all instruments used to enlarge five canals only. All files visually inspected at 10X magnification lens prior to use to be sure that none of the files distorted. If any distortion found that files eliminated.

Rotary protaper endodontic files were set into permanent rotation (300 rpm) with a 16:1 reduction hand piece powered by a torque-limited electric motor. Instrumentation completed in crown down manner using a gentle in and out motion.

The following instrumentation sequence allowed preparation of the canals without difficulties:

SX file (auxiliary shaping files) was used to 15 mm.

S1 file (shaping file no.1) was used to 16 mm.

S2 file (shaping file no.2) was used to 18 mm.

F1 file (finishing file no.1) was used to 20 mm.

F2 file (finishing file no. 2) was used to 20 mm.

In addition, the crown-down technique used with hand protaper by rotating clockwise with sufficient apical pressure until it engages the dentine, then rotating counter-clockwise to disengage and remove the file from the canal. Repeat rotation motion until desired length achieved. The instrumentation sequence was the same as for rotary protaper [7].

Following the preparation procedure, the final length of each canal was determined by inserting K-file size 25. This length then subtracted from the original length of the canal (20 mm) to give the loss in working distance.

The time taken to enlarge each canal recorded in minutes by the aid of timer. The time logged from the beginning of the preparation procedure and included total active instrumentation, instruments changes within the sequence and irrigation. The data obtained were statistically evaluated using student t-test.

RESULTS

All canals remain patent following instrumentation; thus, none of the canal became blocked with dentin shavings. None of the canal showed over-extension of preparation; where as a loss of working distance found in several canals. The mean changes of working length that occurred because of the preparation of the canals given in table (1).

Statistical analysis of data by using t-test revealed that there is no significant difference between rotary and hand protaper in working length changes files as shown in table (2). The mean times taken to prepare the canals with standard deviation shown in table (3). By using student t-test, a highly significant difference found between rotary and hand protaper nickel-titanium files as shown in table (4).

Table 1: Descriptive statistics of working length changes (in mm) for the two groups

GROUPS	I	II
Mean	0.4	0.4
S.D.	0.052	0.058
Min.	0.3	0.3
Max.	0.45	0.45

Table 2: Student t-test comparison between groups

GROUPS	T-VALUE	SIGNIFICANCE (CONFIDENCE LEVEL 0.05)
I and II	0.00	N.S.

N.S. = non-significant.

Table 3: Descriptive statistics of preparation times (in minute) between the two groups

GROUPS	I	II
Mean	7.78	9.41
S.D.	0.736	0.877
Min.	7.0	8.3
Max.	8.9	10.8

Table 4: Student t-test comparison between groups

GROUPS	T-VALUE	SIGNIFICANCE (CONFIDENCE LEVEL 0.05)
I and II	4.25	H.S.

H.S. = highly significant.

DISCUSSION

In this study, none of the canals blocked with dentine shavings and none of canals showed over-extension of preparation. Thus, the only changes were loss of working distance; these changes may be due to canal straightening during canal enlargement. The results showed that there is no significant differences between both protaper instruments in working length changes, as these instruments have the same shape and degree of taper. This finding is in agreement with observations of other investigators [8, 9, and 10] who observed only small mean changes in working distance occurring with rotary Ni Ti instruments.

Although a brushing action had to be used with rotary protaper files before further advancing, the preparation time with this system was substantially faster than with other groups. This may be due to the large number of rotation per minute (300 rpm) while with hand protaper does not exceed few rotation per minute.

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