

Comparison of Single Visit Post Endodontic Pain Using Mtwo Rotary and Hand K-File Instruments: A Randomized Clinical Trial

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Abstract

Objectives: Pain is an unpleasant outcome of endodontic treatment that can be unbearable to patients. Instrumentation techniques may affect the frequency and intensity of post-endodontic pain. This study aimed to compare single visit post endodontic pain using Mtwo (NiTi) rotary and hand K-file instruments.

Materials and Methods: In this randomized controlled trial, 60 teeth with symptomatic irreversible pulpitis in 53 patients were selected and randomly assigned into two groups of 30 teeth. In group A, the root canals were prepared with Mtwo (NiTi) rotary instruments. In group B, the root canals were prepared with hand K-file instruments. Pain assessment was implemented using visual analog scale (VAS) at four, eight, 12 and 24 hours after treatment. The acquired data were analyzed using chi-square, Mann-Whitney U and Student's t-test ($P < 0.05$).

Results: Patients treated with rotary instruments experienced significantly less post-endodontic pain than those treated with hand instruments ($P < 0.001$).

Conclusions: The use of Mtwo (NiTi) rotary instruments in root canal preparation contributed to lower incidence of postoperative pain than hand K-files.

Keywords: Pulpitis; Pain; Endodontics; Root Canal Therapy

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INTRODUCTION

Root canal preparation is known as one of the most important steps in root canal therapy [1]. This step comprises pulp tissue removal, cleaning, shaping, and decontamination of root canals with endodontic instruments and irrigating solutions [2].

A primary reason for unsuccessful endodontic treatment is believed to be failure to eliminate potential irritants such as microorganisms, microbial by-products, and pulpal tissues from the root canal system [3]. Absolute chemo-mechanical preparation of the root canal system is a requisite for a successful endodontic treatment [4,5].

Even when endodontic instruments do not overpass the apical foramen, nearly all preparation techniques tend to extrude dentinal

flakes, pulpal tissue residues, necrotic tissues, microorganisms and irrigants through the apical foramen into the periapical region [6-11]. A relation has been shown between apically extruded materials and periradicular inflammation and development of post-operative pain and flare-ups [12-14].

Studies performed on the context of apical extrusion revealed that techniques using up and down strokes extrude more debris apically than techniques which use instruments in a rotational manner; hence motor-driven instruments are associated with rather less extrusion than custom hand filing methods. Besides, flutes of these rotary instruments tend to pull debris coronally [9,10,13,15,16].

Numerous studies reported the use of rotary NiTi instruments to be effective in reducing post-

endodontic pain compared to hand instruments [17-22]. Another study found no significant difference in frequency of post-endodontic pain between patients treated with rotary and hand instruments [23]. Another study found the variability in post-endodontic pain to be related to the instrumentation techniques [24].

Many researchers reported no significant difference in post-endodontic pain following single or multiple visits [25-30]. Some studies reported higher frequency of post-endodontic pain following multiple visits [31,32], while some others reported higher frequency of pain following single-visit treatments [33-36].

The Mtwo system was initially introduced in 2002. The cross-section of Mtwo files is an italic S with two cutting edges and a non-cutting tip. Also, Mtwo is designed with minimum radial contact plus large and deep flutes, which permit continuous upward shifting of dentin chips [37]. Various studies have been done to evaluate pain after root canal preparation with a diversity of instruments and techniques [17-24]; however, seemingly few have examined Mtwo instruments in this regard. The purpose of this study was to compare single visit post-endodontic pain using Mtwo (NiTi) rotary and hand K-file instruments.

MATERIALS AND METHODS

This randomized controlled clinical trial was registered at the Iranian Registry of Clinical Trials (IRCT) with registration number IRCT2014031216973N1. Ethical committee approved the study (Grant#305121), and written informed consent was obtained from all patients who referred to the Department of Endodontics, Faculty of Dentistry, Babol University of Medical Sciences and participated in this study. Patients were asked to quantify preoperative pain on a 10 cm horizontal VAS. The inclusion criteria were teeth with a single root canal requiring root canal therapy because of symptomatic irreversible pulpitis with moderate to severe pain (VAS 4-10).

The exclusion criteria were teeth with acute apical periodontitis, teeth with necrotic pulp and patients presenting with abscess or cellulitis. In addition, patients who took medications up to six hours prior to the treatment were excluded from the study. Sixty teeth in 53 patients between 17 to 52 years were selected and randomly (by picking envelopes containing letters and numbers) assigned into two groups, each containing 30 teeth.

In group A, the root canals were prepared with Mtwo rotary files (VDW, Munich, Germany). In group B, the root canals were prepared with hand K-files (Mani, Tochigi, Japan) using manual step-back method. Initially, 1.5 mL of 2% lidocaine with 1:80,000 epinephrine (Darou Pakhsh, Tehran, Iran) was used as local anesthetic agent. Alternately, 3% mepivacaine (Inibsa, Barcelona, Spain) was used in cases for whom, the use of vasoconstrictor was contraindicated. After preparing the access cavity, rubber dam was applied for isolation. The estimated working length was measured using ISO K#15 file on the preoperative periapical radiograph.

Group A (Mtwo rotary group): Initially, a gliding path was created to the canal using #15 K-file and the working length was confirmed by taking a periapical radiograph. Afterwards, Mtwo files (VDW, Munich, Germany) were used with the single length technique [37,38,39] in the following sequence: 15/.05, 20/.06, 25/.06, 30/.05, 35/.04, 40/.04, and 25/.07. The single length technique was performed so that each instrument was gradually reached to working length using brushing movement and without pressure. As soon as the working length was reached, the instrument was changed with the next one in sequence. The rotary files were mounted on and handled by Endo-Mate DT micromotor (NSK, Tochigi, Japan) with speed and torque control and auto-reverse function. When the preset torque level was exceeded, the auto-reverse function was activated automatically in order to keep instrument from locking.

Table 1: The pain scores (VAS) reported by patients (values are presented as mean \pm SD)

	Rotary group	Hand group	P-value*
P ₀	5.03 \pm 1.40	6.63 \pm 2.39	0.001
P ₄	1.33 \pm 2.24	4.40 \pm 3.20	0.000
P ₈	1.00 \pm 2.16	3.66 \pm 3.52	0.001
P ₁₂	0.73 \pm 1.72	3.53 \pm 3.70	0.000
P ₂₄	0.86 \pm 2.19	2.46 \pm 3.32	0.002

*: Acquired by Mann-Whitney U test

P₀: Preoperative pain; P₄: Pain after 4 hours; P₈: Pain after 8 hours; P₁₂: Pain after 12 hours; P₂₄: Pain after 24 hours

Subsequently, the Gates-Glidden drills (Mani, Tochigi, Japan) were used in a step-back manner with the following sequence: #2, #3 and #4 for coronal flaring.

Group B (hand K-file group): The root canals were cleaned to a master apical file size #40 and the subsequent files were used in step-back manner, so that the first file right after the master apical file was used 0.5-1mm short of the working length, and the following files were utilized each 0.5-1mm short of the previous.

Meanwhile, recapitalization was achieved by taking the master apical file to the working length between the shaping files. Normal saline (0.9% sodium chloride, Darou Pakhsh, Tehran, Iran) was used for irrigation in both groups. Finally, the root canals were dried with paper cones (Gapadent, Tian Jin, China) and obturated with standardized gutta-percha cones (Gapadent, Tian Jin, China) and AH26 sealer (Dentsply DeTrey, Konstanz, Germany) with lateral condensation technique. After the treatment, the patients were instructed to quantify pain intensity at four, eight, 12 and 24 hours on a VAS scale, and return after 24 hours for assessment. Ibuprofen was prescribed for pain relief every four-six hours (to a maximum dose of 3200 mg/day). As a substitute, those who suffered from gastrointestinal conditions were advised to take acetaminophen (to a maximum dose of 4000 mg/day). The patients in this study were not aware of the type of treatment method they received; thus this was a single-blind study.

The acquired data from the two groups were analyzed using SPSS 17 software applying chi-

square test to compare pain incidence, Mann-Whitney U test to compare pain incidence with respect to severity, and student's t-test to compare the mean pain intensity. P-value less than 0.05 was considered statistically significant.

RESULTS

Out of 72 participants who received root canal treatment, nine patients did not return for assessment, six patients left incomplete data, and four were excluded for some other reasons. Eventually, the data were collected from 60 cases. The mean (\pm SD) age was 32.5 \pm 10.6 years for the rotary group and 30.8 \pm 10.1 years for the hand K-file group. The sex distribution was normal between the two groups. The pain VAS scores, scored by patients, are listed in Table 1. A total of 18 patients did not have pain after the treatment; out of which, 17 were from the rotary group (56.7%), and one was from the hand K-file group (3.3%). The difference in the incidence of postoperative pain between the two groups was significant (P<0.001; Table 2, Fig. 1).

DISCUSSION

Our results showed that root canal preparation with NiTi rotary instruments was associated with less postoperative pain as compared to hand instruments. It is remarkable that only four patients in the rotary group felt the need to take analgesics after the treatment (13.3%), as opposed to 17 in the hand K-file group (56.7%); nevertheless, the pain incidence in the hand K-file group was higher.

The results of our study were similar to the

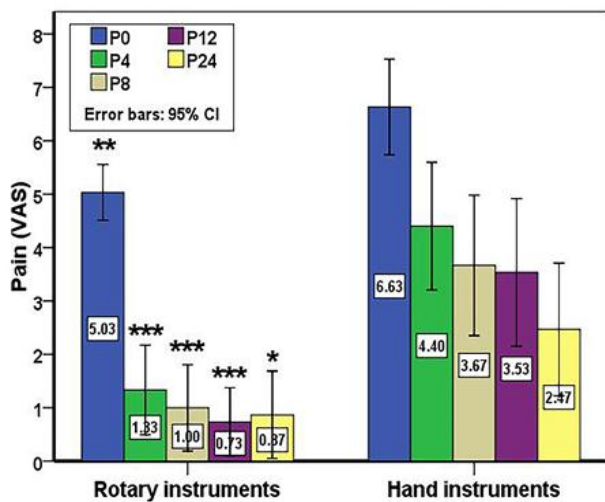


Fig. 1. The mean pain intensity based on VAS scores (P₀: Preoperative pain; P₄: Pain after 4 hours; P₈: Pain after 8 hours; P₁₂: Pain after 12 hours; P₂₄: Pain after 24 hours; *: P<0.05; **: P<0.01; ***: P<0.001)

findings of Al-Jabreen [22]. In his study on maxillary central incisors, he used three different instrumentation techniques to assess postoperative pain: Stainless steel K-files with step-back technique, Profile 0.04-29% series and Profile GT system both using crown-down pressure-less technique.

The incidence of postoperative pain within the

first 48 hours in the step-back group was significantly higher compared to that in Profile 0.04-29 and Profile GT groups, without any significant difference between Profile 0.04-29 and GT groups. However, his study was done on teeth with necrotic pulp. Also, our findings were similar to the results obtained by Wei et al [21]. They used Profile Ni-Ti rotary and hand K-Flexofile to examine the effect of using NiTi rotary instruments on postoperative pain. The incidence of postoperative pain in the hand group was higher and this difference was statistically significant; however their study was done on molar teeth with pulpal and/or periapical involvement, as opposed to our study on single-canal teeth with pulpal involvement only.

Huang et al, [19] also attained similar results as we did. They performed a study to compare postoperative pain after vital pulp root canal preparation with K3 nickel-titanium rotary instruments and hand instruments. What they found was high incidence of postoperative pain in stainless steel hand K-file group (55.84%), against 29.76% in K3 rotary group.

Conversely, Ahmed et al. [23] failed to find any

Table 2: Incidence of post-endodontic pain within 24 hours, and The frequency (%) of post-treatment analgesic use

	Pain	Rotary group	Hand group	P-value*
After 4 hours	None	19 (63.3)	3 (10.0)	0.000
	Mild	6 (20.0)	12 (40.0)	
	Moderate	2 (6.7)	7 (23.3)	
	Severe	3 (10.0)	8 (26.7)	
After 8 hours	None	22 (73.3)	10 (33.3)	0.001
	Mild	5 (16.7)	5 (16.7)	
	Moderate	2 (6.7)	7 (23.3)	
	Severe	1 (3.3)	8 (26.7)	
After 12 hours	None	24 (80.0)	11 (36.7)	0.000
	Mild	3 (10.0)	5 (16.7%)	
	Moderate	3 (10.0)	8 (26.7)	
	Severe	0 (0.0)	6 (20.0)	
After 24 hours	None	25 (83.3)	12 (40.0)	0.003
	Mild	1 (3.3)	13 (43.3)	
	Moderate	3 (10.0)	1 (3.3)	
	Severe	1 (3.3)	4 (13.3)	
Total**		13 (43.3)	29 (96.7)	
Analgesic use		4 (13.3)	17 (56.7)	
Pain on percussion***		1 (3.3)	4 (13.3)	

*: Acquired by Mann-Whitney U test; **: Experiencing pain at least at one assessment time point; ***: After 24 hours

significant difference in pain incidence between patients treated with ProTaper rotary and those treated with manual step-back technique. However, such contradictory findings could be because of including patients with merely moderate pain (VAS 4-6) as opposed to our study including patients with moderate to severe pain (VAS 4-10); as the greater the preoperative pain, the greater the postoperative pain [31,40-43]. Moreover, they assessed pain after 48 hours in one single VAS.

Nonetheless, in the current study, it was notable that the mean preoperative pain intensity in hand group was relatively higher than that in rotary group (Fig. 1), and this could be responsible for higher levels of postoperative pain and intensity in the hand group to some extent, according to the concept mentioned above. We limited our postoperative pain assessment intervals to 24 hours because the highest degree of pain is often experienced in the first 24 hours, and after 48 hours the level of pain significantly subsides. We excluded the teeth with necrotic pulp since they usually demand more aggressive instrumentation and cleaning, which conceivably induce more pain. We excluded the teeth with acute apical periodontitis as well, since tenderness on percussion deceives patient's perception of post-endodontic pain and misleads the results.

All instrumentation techniques are accompanied by extrusion of root canal contents into the periapical region [8,16,44,45]. This extrusion may lead to inflammation and immunological reactions [6]. Studies revealed that rotary systems could reduce the amount of extrusion of debris, since the flutes of these instruments tend to pull debris back towards the orifice [46-51]. Oppositely in the manual step-back method, the file acts as a piston in the apical one-third tending to plunge debris through the apical foramen, leaving not enough space to expel it coronally [12,46,48,52]; thus, it is more likely to cause inflammation and pain. As far as the limitations of this study permitted, we tried to choose the

most suitable inclusion and exclusion criteria, and eliminate the confounding factors as much as possible. Thus, we believe that minimizing the apical extrusion of debris should be a fundamental goal in endodontic treatment, leading to less complications such as pain. Hence, we recommend using instruments and techniques, which result in less extrusion.

CONCLUSION

Use of Mtwo (NiTi) rotary system for preparing root canals caused less post-endodontic pain as compared to hand K-files; however, further research is needed in this respect.

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