

COMPARATIVE EVALUATION OF POST-OPERATIVE PAIN FOLLOWING SINGLE VISIT ROOT CANAL TREATMENT

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ABSTRACT

The root canal system is instrumented, disinfected, and obturated in a single visit using single-visit root canal therapy. The occurrence of post-endodontic pain is one of the most prevalent problems documented in single-visit root canal treatments. The goal of this study was to assess postoperative pain with manual, rotary, and reciprocating file systems, as well as two distinct irrigation methods: a side-vented needle and passive ultrasonic irrigation. A total of 120 patients were treated by a single operator using a single-visit root canal. Except for the third molars, all maxillary and mandibular molars were chosen. Each group was divided into 40 patients at random. Group 1 used hand K files with a step-back technique, group 2 used Pro Taper Next rotary files, and group 3 used Wave One Gold reciprocating files for cleaning and shaping. Each group was further divided into two subgroups, each consisting of 20 patients receiving side-vented needle irrigation and 20 patients receiving passive ultrasonic irrigation. Postoperative pain was measured using a numerical rating pain scale at 6, 12, 24, and 7 days. Patients in the hand file group reported the most discomfort, while those in the reciprocating file group. In endodontic therapy, choosing a reciprocating instrument rather than a rotary instrument or a hand file is linked to the lowest rate of postoperative pain. The use of a side-vented needle versus passive ultrasonic irrigation does not affect postoperative discomfort.

Key words: Hand files, Post-operative pain, Single visit root canal treatment, Reciprocating files, Rotary files.

Introduction

The root canal system is instrumented, disinfected, and obturated in a single visit using single-visit root canal therapy. Because of patient compliance, single-visit root canals have recently been the preferred option over several visits. The occurrence of post-endodontic pain is relatively common among the many problems described in single-visit root canal treatments [1]. Rotary instrumentation with crown-down technique is used in modern endodontic practice over manual instrumentation with step-back technique. Increased efficiency [2], more flexibility [3], less chance of instrument fracture, more removal of pulp tissue and debris, less extrusion of debris [4], ability to instrument curved canals, increased cutting efficiency, creating centered preparation, and decreased canal transportation are some of the advocated advantages reported in various studies. Though rotary instrumentation provides a channel for the passage of root canal debris from root canals thus reducing periapical extrusion of debris as compared to the reciprocating system [5], however in a few studies it has been reported that the use of reciprocal instrumentation produces less postoperative pain than rotary instrumentation, regardless of irrigation system being used [6]. Apical extrusion is also affected by the procedure of shaping canals, the protocol of irrigation, master apical file, instrument design, and technique employed. Stainless steel files extrude more debris than Ni-Ti rotary files [7]. Mechanical cleaning and debridement with hand and rotational devices reduce the bacteria count within the root

canal system [8]. Because biofilm may be left behind during instrumentation, a large portion of the root canal wall may be left. Irrigation to disrupt the biofilm is therefore essential for mechanical debridement of the root. Different irrigants can have additive bactericidal and tissue-dissolving properties. Development of different techniques aid in overcoming the limitations associated with a conventional syringe. Passive ultrasonic irrigation is one of the approaches that has lately resurrected the use of ultrasonics in root canal therapy [9]. The irrigant is activated by passive ultrasonic irrigation (PUI) of the root canal without the need for an ultrasonically actuated file in the canal [10]. When compared to conventional needles with apical openings, needles with side or beveled openings offer fewer advantages for irrigation of the apical portion of the root. However, these modified needle tips reduced the pressure generated at the apical foramen, which can reduce the risk of extrusion into periapical tissues. This study used hand, rotary, and reciprocating file systems with side vent needles and passive ultrasonic irrigation to assess the degree of postoperative discomfort.

Materials and Methods

A total of 120 patients were selected from the Department of Conservative Dentistry and Endodontics, Inderprastha Dental College and Hospital, Sahibabad, Ghaziabad. The study's goals and design were explained to all patients, and formal consent was acquired.

Inclusion criteria

Permanent molars with asymptomatic irreversible pulpitis except for third molars of adult patients, 18 years and above with closed apices and favorable root morphology (no excessive curvature) exhibiting periapical periodontitis (with no or radiolucency not more than 1mm) with no tenderness on percussion were taken for the study.

Exclusion criteria

Previously root canal treated teeth/ requiring surgical treatment/exhibiting periodontal pathologiessuch as furcation involvement/ with dentoalveolar abscess or swelling/ with internal or external resorption/ presence of pain or tenderness in the last 5days were excluded from the study. Also, failure to obtain authorization from patient/pregnant females wasnot taken for the study.

Group 1

(n=40) Single visit root canal with hand fileSubgroup 1a(n=20) Irrigation with side vent needle.

Subgroup 1b(n=20) Passive ultrasonic irrigation.

Group 2

(n=40) Single visit root canal with ProTaper next rotary files.

Subgroup 2a(n=20) Irrigation with side vent needle.

Subgroup 2b(n=20) Passive ultrasonic irrigation.

Group 3

(n=40) Single visit root canal with Wave One Gold reciprocating files

Subgroup 3a(n=20) Irrigation with side vent needle.

Subgroup 3b(n=20) Passive ultrasonic irrigation.

2% lignocaine (Lignox) was used for local anesthesia, and an intrapulpal anesthetic was used if any of the patients felt pain during instrumentation. The tooth to be treated was isolated with a rubber dam (Hygienic, Coltene) after anesthesia.

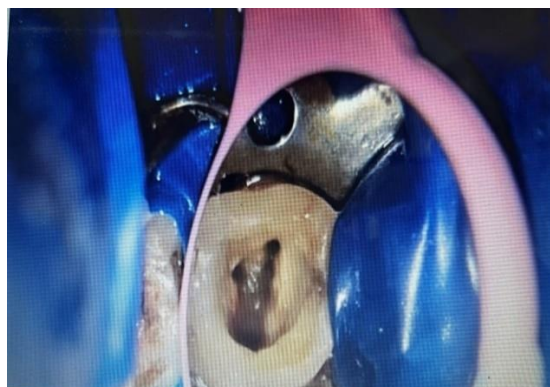


Figure 1. Access cavity preparation

With an aerator handpiece (NSK) and air-water spray, the access cavity was created with an endo access bur (DENTSPLY International, York PA). No 15 K –file ((DENTSPLY Mallifer Bellaigues, Switzerland)) was used to check the canal's patency. An apex locator (Woodpecker V gold standard) was used to determine working length, which was then validated using a digital radiograph.

Group 1: The canal was cleaned and shaped by hand, using K-files and the step-back technique. In small canals, apical preparation was completed with a no. 25 K-file; in broader palatal and distal canals, apical preparation was completed with a no. 35 K-file. The step-back technique was used to repeat the master apical file three times. As a lubricant, EDTA (Avue prep) was employed. **Subgroup 1a:** Irrigation was performed with 2.5 percent NaOCl (Novo Dental Goods, Mumbai, India) using a 27 gauge side vented needle (Acteon) and 17 percent EDTA (Amdent India) during the preparation, followed by final irrigation with normal saline (.9% w/v). **Subgroup 1b:** Irrigation with 2.5 percent NaOCl and 17 percent EDTA was performed during the preparation, the canals were kept filled with 2.5 percent NaOCl, and the ultrasonic file (Mani Inc.) was kept short by 2mm from the working length and free from the canals before passive ultrasonic irrigation was performed for 1 minute (**Figure 2**).

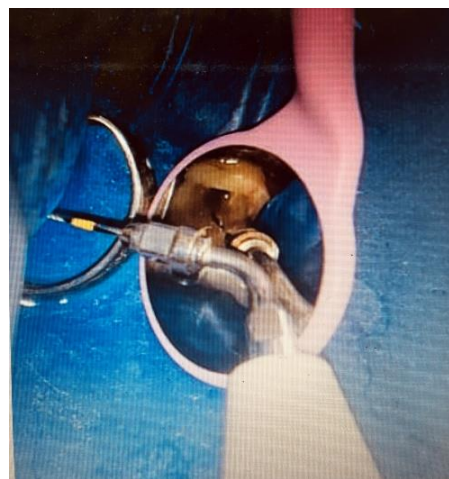


Figure 2. Using Passive Ultrasonic Irrigation

In both, the subgroups obturation was done with gutta-percha master cone corresponding to last master apical file with cold lateral condensation technique using seal apex sealer(Kerr Endodontics).

Group 2: The ProTaper Next crown down technique was used for cleaning and shaping. Glyde was used to lubricate the canals during the preparation process (Dentsply Mallifer). Preparation began with X1, then X2, then X3, with apical rotation at 300 rpm and torque of 2-5.2N/s using the X smart plus endo-motor (Dentsply, USA). Apical

preparation was done until X4 for broader distal and palatal canals. **Subgroup 2a:**

Table 1. Comparative evaluation of post operative pain on various days

Timeline	Groups	Score				p-value	
		0	1	2	3		
6 h	Hand file	Count	21	7	6	6	0.099
		%	52.50	17.50	15.00	15.00	
	Rotary	Count	25	8	4	3	
		%	62.50	20.00	10.00	7.50	
	Reciprocating	Count	32	6	2	0	
		%	80.00	15.00	5.00	0.00	
12 h	Hand file	Count	19	7	7	7	0.015
		%	47.50	17.50	17.50	17.50	
	Rotary	Count	23	6	4	7	
		%	57.50	15.00	10.00	17.50	
	Reciprocating	Count	33	6	1	0	
		%	82.50	15.00	2.50	0.00	
24 h	Hand file	Count	24	6	5	5	0.031
		%	60.00	15.00	12.50	12.50	
	Rotary	Count	24	7	4	5	
		%	60.00	17.50	10.00	12.50	
	Reciprocating	Count	36	4	0	0	
		%	90.00	10.00	0.00	0.00	
7 days	Hand file	Count	32	4	2	2	0.091
		%	80.00	10.00	5.00	5.00	
	Rotary	Count	35	4	1	0	
		%	87.50	10.00	2.50	0.00	
	Reciprocating	Count	40	0	0	0	
		%	100.00	0.00	0.00	0.00	

Irrigation with 2.5 percent NaOCl and 17 percent EDTA was done throughout the preparation, and final irrigation was done with normal saline using a 27 gauge side vented needle. **Subgroup 2b:** Irrigation with 2.5 percent NaOCl and 17 percent EDTA was done during the preparation, [11] the canal was kept filled with 2.5 percent NaOCl, and the ultrasonic file was kept short by 2mm from the working

length and free from the canals, then passive ultrasonic irrigation was performed for 1 minute (three cycles of 20 seconds each). Obturation was performed utilizing a single cone approach with a gutta-percha cone equivalent to the last master apical file and a seal apex sealer in both subgroups.

Table 2. Comparative evaluation of post operative pain with side vented and passive ultrasonic irrigation groups

Timeline	Sub group	Score				p-value	
		0	1	2	3		
6	Side vent needle	Count	37	10	7	6	0.66
		%	61.7	16.7	11.70	10.0	
	Passive ultrasonic irrigation	Count	41	11	5	3	
		%	68.3	18.3	8.	5.0	
12	Side vent needle	Count	36	8	8	8	0.53

		%	60.0	13.3	13.30	13.3	
24	Passive ultrasonic irrigation	Count	39	11	4	6	0.35
		%	65.0	18.3	6.70	10.0	
	Side vent needle	Count	40	7	6	7	
		%	66.7	11.7	10.0	11.7	
7 days	Passive ultrasonic irrigation	Count	44	10	3	3	0.50
		%	73.3	16.7	5.0	5.0	
	Side vent needle	Count	53	4	1	2	
		%	88.3	6.7	1.7	3.3	
Passive ultrasonic irrigation	Count	54	4	2	0		
	%	90.0	6.7	3.3	0.0		

Group 3: Cleaning and shaping were carried out with Wave One Gold reciprocating files (DENTSPLY, Mallifer) using gentle inward motion. During preparation, canals were lubricated with glide. Withdrawing the file every 3mm to remove debris. Shaping was achieved at the definitive working length with Xsmart plus endomotor. **Subgroup 3a:** During the preparation, irrigation was done with 2.5% NaOCl using a 27 gauge side vented needle and with 17% EDTA, final irrigation was carried out with normal saline. **Subgroup 3b:** Irrigation with 2.5 percent NaOCl and 17 percent EDTA was performed during the preparation. The canal was kept filled with 2.5 percent NaOCl and the ultrasonic file was kept short by 2 mm from the working length and free from the canals, after which passive ultrasonic irrigation was performed for 1 minute (three cycles of 20 seconds each). In both, the subgroups' obturation was carried out using the single cone technique using a sealapex sealer. Evaluation of pain in all the subgroups was recorded at 6, 12, and 24 hours and 7 days. For the patient's categorization of pain, a numeric pain scale [12] was utilized. The patient was asked to rate his or her pain. This scale consisted of a 10-cm-long line with two extremes, with 0 cm denoting no pain and 10 cm denoting the most excruciating suffering. The following will be used to determine the intensity and level of pain:

- 0 - No pain
- (1-3) - Mild pain that could be ignored
- (4-6) - Moderate pain.
- (7-10) - Severe pain.

No antibiotics were prescribed, and the patient was asked to take pain killer (NSAIDS) if required.

Results and Discussion

The chi-square test was used for statistical analysis. There was no statistically significant difference between the patient's age and gender. Patients with reciprocating files have the least discomfort, followed by rotary files, and finally, hand files. Patients with hand files have the most pain.

The difference in postoperative pain between the groups was not statistically significant after 6 hours and 7 days, but it was statistically significant at 12 hours and 24 hours. At the 12-hour mark, 82.5 percent of patients in the reciprocating file group reported no pain, 57.5 percent in the ProTaper Next group reported no pain, and 47.5 percent in the hand files group reported no pain. Only 60% of patients in the rotary and hand file groups reported no pain after 24 hours, but 90% of patients in the reciprocating file group reported no pain after 24 hours (**Table 1**).

The number of patients with severe pain was more with side vent needle subgroups in every group at different points of time but it was not statistically significant (**Table 2**).

Single-visit endodontics was done in all the cases, many studies support the fact that the incidence of postoperative pain and success rate of single and multiple visits are similar [13, 14].

The type of the tooth was standardized by selecting only maxillary and mandibular molar teeth with exception of third molars since susceptibility to post-operative pain is greater [15]. This may be because of canal complexities which lead to difficulty in debridement due to more roots and canals increasing the risk of post-operative complications [16].

The use of Ni-Ti rotary instruments is effective in reducing post-operative pain as compared to hand instruments [17]. Various studies support less post-endodontic pain with rotary files as compared to hand files [18]. Apical extrusion of debris has been studied comprehensively because of its important clinical relevance, particularly flare-ups may result, caused by the introduction of bacteria, remnants of pulp, and irrigating solutions into the periapical area. In the rotary system groups, the crown-down technique was used to prepare the root canals, and it was reported that by enlarging the coronal third of the root canal, a pathway for debris to exit was provided, resulting in less extrusion of debris from the root apex and less postoperative pain severity [19, 20]. Furthermore, the step-back approach with

watch winding and in and out filing motion created piston-like movements in the trials indicated above, resulting in enormous amounts of debris and irrigation solution ejection. There have been reports stating that instrumentation using rotary instruments extruded significantly more debris in comparison with reciprocating files [21]. The current study showed the least post-endodontic pain with the reciprocating system as compared to rotary and hand files which can be explained by the least periapical debris extrusion with the reciprocating system. Christine Men Martins [22] conducted a systematic review and meta-analysis which reported the same.

Wave One Gold's results are superior to ProTaper Next's because reciprocating single-file systems move fewer germs periapical than multife rotational systems. During the first 6 hours, 15% of patients in the hand file group and 7.5 percent of patients in the ProTaper Next group complained of significant discomfort, whereas none of the patients in the reciprocating group did. To remove the danger of bias, all of the treatment was done by a single operator in all of the groups and subgroups using distinct files.

There was a reduction in post-instrumentation pain at all periods, including 12 hours, 24 hours, and 7 days. In all three study groups, the most severe mean pain occurred in the first 12 hours, with significant reductions in pain ratings during the subsequent observation periods of 24 hours and 7 days. Pak and Whit conducted a comprehensive review and found similar results [23].

Each group is then separated into two subgroups with different irrigation procedures in the current study. When compared to a standard irrigating needle, side vent needle tips lowered the pressure created at the apical foramen, potentially lowering the danger of irrigant extrusion into periapical tissues. They have a lateral vent that allows for gentle but effective root canal irrigation. Passive ultrasonic irrigation (PUI) has been demonstrated to be a significant addition to cleaning root canals in studies. Acoustic micro streaming with cavitation is the basis of passive ultrasonic irrigation. It results in rapid movement of irrigating solution around a vibrating file in a circular manner which causes the removal of the maximum amount of planktonic bacteria, organic tissues, and debris present in dentine as compared to irrigation with a syringe. The use of a needle versus passive ultrasonic irrigation had no statistically significant differences. Pafford *et al.* [24] found that whether ultrasonic irrigation was utilized or not following hand and rotary instrumentation, the incidence of pain was the same. The study by Rodrigues RC [25] also reported similar results that are, no significant improvement in disinfection with or without passive ultrasonic irrigation.

However, the number of patients with severe pain was more with side vent needle subgroups in every group at different points of time but it was not statistically significant. The nature of pain (mild, moderate, and severe) after 6, 12, 24

hours, and 7 days was examined as a secondary outcome. Numerical rating pain scale was used to record the nature of pain. Hand file caused more events of pain as compared to rotary and reciprocating confirming the hypothesis that conventional manual instrumentation causes more postoperative pain after endodontic treatment.

Since there was a significant difference between the three file groups, the null hypothesis was rejected.

Conclusion

When compared to rotary instruments and hand files, choosing a reciprocating instrument in endodontic therapy is associated with the least amount of post-operative pain. The use of a side vent needle or passive ultrasonic irrigation does not affect postoperative discomfort.

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