

ORIGINAL RESEARCH

Comparison of the Incidence of Post-operative Pain and Time Taken for Instrumentation Using Manual and Rotary Techniques and Obturation in Single-Visit Endodontics, in Young Permanent Teeth - An *in Vivo* Study

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ABSTRACT

Introduction: The present study was undertaken to compare the frequency of post-operative pain and time taken after ProTaper (NiTi) rotary and manual step-back root canal preparation techniques in single-visit endodontics.

Methodology: The study was conducted in the Department of Pedodontics and Preventive dentistry, J.N Kapoor D.A.V. (C) Dental College and Hospital, Yamuna Nagar, Haryana, according to the specified inclusion criteria. Exclusion criteria were strictly maintained. Patients after selection were randomly divided into two groups. In Group I: Root canals were prepared by ProTaper (NiTi) rotary instrument (Dentsply, Maillefer, Ballaigues, Switzerland). In Group II: Root canals were prepared by manual step back technique using hand files. During the procedure in both the groups, time T1 (instrumentation time), T2 (obturation time), and T3 (T1+T2) were recorded. After the procedure, the modified verbal scale (MVD) was explained to patients and instructions were given and were asked to mark the severity of pain on MVD scale at 12 h, 24 h, 48 h, 72 h, and 1 week. All patients were appointed after 1 week and evaluated for post-operative pain.

Result: Less time was taken with rotary NiTi instrument as compared to manual technique, with no difference in the incidence of post-operative pain in both the groups.

Conclusion: Statistically significant difference ($P < 0.001$) was found for the time taken for root canal therapy in both the groups, whereas no statistical difference ($P = 0.586$) was seen in the incidence of post-operative pain between patients treated with ProTaper (NiTi) rotary and manual step-back root canal preparation technique in single-visit endodontics.

Keywords: Manual step-back technique, Post-operative pain, ProTaper (NiTi) rotary, Single-visit endodontic.

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INTRODUCTION

The main aim of endodontic treatment is to treat infected and necrotic dental pulp and prevention or treatment of apical periodontitis, thereby maintaining the natural form and function of teeth. Endodontic treatment comprises of three main phases: Biomechanical preparation (cleaning and shaping), disinfection, and obturation of canals.

In root canal therapy, canal preparation is considered to be the most important step that involves removal of soft and hard tissue containing bacteria and provides a path for irrigants to the apical third and a continuous taper for subsequent obturation to provide complete sealing of the root canal system to prevent oral pathogens from colonizing and reinfecting the root and periapical tissues.^[1] Canal preparation can be carried out by manual or rotary instrumentation using single or multiple visit technique. Conventionally, manual technique with stainless steel files for biomechanical preparation has been more popular, but their usage has been associated with undesirable canal curvature or root canal that is difficult to fill.^[2] Furthermore, they are more time consuming and may lead to extrusion of infected remnants or debris to the periapical tissues, thus causing more post-operative pain and flare-ups.^[3] Hence, attention has been directed toward the development of better root canal preparation techniques.

To fulfill the ultimate aim of root canal conventionally, the endodontic treatment was carried out in multiple visits. Dr. Grossman advocated root canal treatment to be performed in multiple visits primarily to ensure sterility of root canal system before obturation.^[4,5] However,

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with the availability of better-advanced instruments, better understanding of irrigation systems, and availability of better, biocompatible obturating materials have been made single sitting root canal treatment more feasible and convenient.

Irrespective of the number of the visits involved endodontic treatment can sometimes lead to post-operative pain which is an unpleasant experience for both patient and clinician.

Numerous *in vitro* studies have shown that traditional manual step-back technique is associated with more extrusion of the debris as compared to newer ProTaper (NiTi) rotary technique.^[6] However, in this regard, *in vivo* studies are few; therefore, it is worthwhile to conduct a study that can clinically evaluate the results of these two root canal preparation techniques in terms of post-operative pain.^[6]

Hence, an *in vivo* study was planned to compare the incidence of post-operative pain and time taken for instrumentation and obturation in single-visit endodontics using manual and rotary technique.

METHOD

The study was conducted in the Department of Pedodontics and Preventive dentistry, JN Kapoor D.A.V. (C) Dental College and Hospital, Yamunanagar, Haryana. In this study, a total of 60 teeth which required endodontic treatment were randomly divided into two equal groups of 30 teeth each. Here,

1. Group I teeth were instrumented with rotary technique using rotary ProTaper files.
2. Group II teeth were instrumented with manual technique using step-back method of cleaning and shaping.

The study was approved by the ethical committee, and the clinical procedure was explained to either the parents or legal guardians. Patients in the age group of 9–16 years with non-significant medical history, pain, and pulpal exposure without any sinus or periapical lesion, and with fully formed apices were included for the study.

Subjects with the presence of sinus tract (intraoral/extraoral) and periapical radiolucency, calcified canals, and internal or external resorption *were excluded from the study*. All the treatments *were performed in single sitting*.

Procedure

After explaining the procedure to the parent or the guardians, adequate anesthesia was administered and rubber dam/cotton rolls isolation was done as per the patient acceptance followed by complete caries excavation and standardized access preparation.

An estimated working length was measured by ISO K#15 file (Mani, Stainless Steel) on pre-operative periapical radiograph.

Group I (ProTaper [Ni–Ti] Rotary Group): ProTaper (Ni–Ti) rotary (Dentsply,

Maillefer, Ballaigues, Switzerland) was used in a crown-down manner according to the manufacturer's instructions as follow:

A gliding path was formed by inserting a manual file size ISO# 10 to the working length. Shaping file (S1) was introduced with a brushing movement into the canal, 3 mm short of the estimated working length.

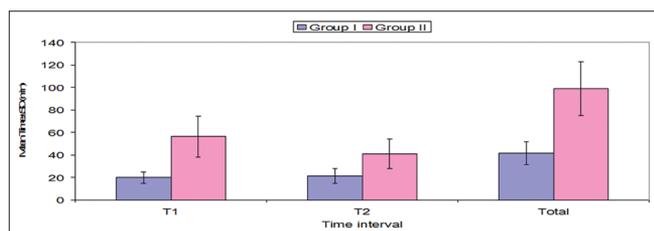
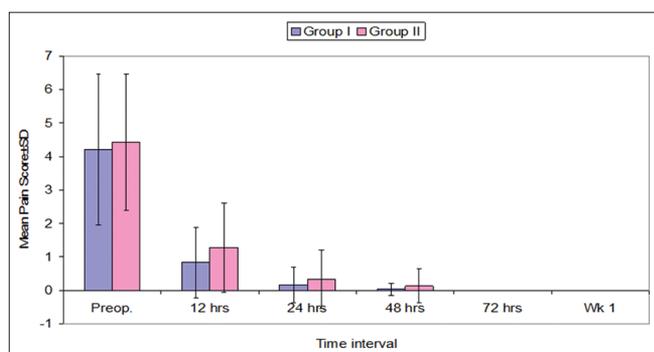
- The ISO # 15 file was used to ascertain the working length.
- Shaping file (S1) was used to the working length.
- Shaping file (S2) was used to the working length.
- Finishing file (F1) was used to the working length for 1 s, and the canal was then assessed with an ISO#20 file. If it fits snugly at the apex, the preparation was considered completed.
- When the ISO # 20 file did not fit properly at the apex, instrumentation was continued with the finishing file (F2) and the canal assessed with ISO # 25 file. Once again, if it fits snugly at the apex, instrumentation was completed;
- Otherwise, it was continued with finishing file (F3).
- ISO K# 15 file (Mani, Stainless Steel) was used at the working length each shaping and finishing file to avoid apical blockage.

Group II (manual step-back group): After obtaining working length on a periapical radiograph by ISO #15 file, further ISOK-file instruments (Mani Stainless Steel) were used in a step-back manner, first with a quarter clockwise rotational motion followed by a pull-back motion. The apical region was shaped by using initial binding files to a final master apical file size 35 or 45; each consequentially larger instrument was introduced 1.0 mm less into the canal to form a taper. In between placing each larger instrument, the master apical file was introduced to the working length for recapitulation. In both the groups, 5.25% sodium hypochlorite was used as an irrigant between each file. Finally, canal was dried by ProTaper (Group I)/ISO standardized (Group II) paper points and obturated with ProTaper (Group A)/ISO standardized (Group II) gutta-percha points using sealer. The teeth were sealed with the temporary restoration (Cavit).

For each group, total time taken (T3), i.e., time for instrumentation (T1) and time for obturation (T2) was recorded, and an immediate post-operative radiograph was taken to evaluate the quality of filling (voids, overfilled, or underfilled).

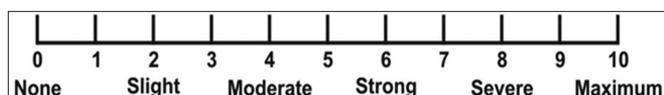
Table 1: Statistical evaluation of the comparison of total time taken for the procedure by Group I and Group II (irrespective of sealer)

Step	Group I (n=30)				Group II (n=30)				Significance of difference (Mann-Whitney U-test)	
	Median	Mean	SD	Range	Median	Mean	SD	Range	Z	P
T1	20	20.0	5.09	15–30	60	56.50	18.11	30–90	6.605	<0.001
T2	20	21.5	6.71	10–45	45	41.17	13.11	20–75	5.710	<0.001
Total	40	41.5	10.18	25–75	95	99.00	23.83	60–150	6.594	<0.001

**Graph 1:** Comparison of total time taken for the procedure by Group I and Group II**Graph 2:** Comparison of the mean values of pain score of two different Groups (I and II) at different time intervals

The patients were given the modified verbal descriptor scale form and were asked to mark on the scale the pain experienced after post-operative periods of 12 h, 24 h, 48 h, 72 h, and 1 week. Reminder was given to them telephonically to note their pain readings and to know about their well-being. The patients were then recalled after 1 week.

Modified verbal descriptor scale instrument:



Follow-Up Evaluation

The patients were recalled after 1 week for clinical evaluation of hard and soft tissues in relation to the tooth treated. They were clinically evaluated for pain, sensitivity to percussion, swelling, sinus tract, mobility and depressability, gingival inflammation, status of the coronal restoration, or any other relevant findings they felt till that day. Pain descriptor scale that was marked by the patients was also collected.

All the collected data, for time and pain, were then statistically analyzed.

RESULTS

Data were analyzed using the Statistical Package for the Social Sciences version 15.0. All the distributions were checked for normality at subgroup level. As pain was recorded on modified verbal descriptor score which, in itself, is an ordinal variable when time taken was evaluated at subgroup level, the data were asymmetric both for T1 and T2 as well as total time at different time intervals; moreover, as the sample size was small ($n = 15$) at subgroup level, a non-parametric evaluation was planned. Intersubgroup differences were assessed using non-parametric ANOVA (Kruskal-Wallis test) and Mann-Whitney U-test (non-parametric equivalent to student *t*-test), and within-group differences were assessed using Wilcoxon signed-rank test (non-parametric equivalent to paired *t*-test) [Tables 1 and 2, Graphs 1 and 2].

DISCUSSION

In clinical dentistry, both operator and patient want time saving and a comfortable procedure with no pain. Pain is obviously a deterrent factor both for dentist and patient.^[7] Hence, today in the field of endodontics, the introduction of better diagnostic aids, instrumentation systems, disinfection protocols, and obturation techniques have incorporated single-visit endodontics into everyday clinical practice both for adults and pediatric patients.^[4]

Although a number of studies in the literature have shown that there is no significant difference between the manual and rotary endodontic treatment as far as incidence and intensity of post-operative pain are concerned, there is a lack of evidence-based data to reinforce this.^[6] However, high incidence of post-operative pain was reported after step back root canal preparation (11.4%) as compared to nickel-titanium rotary profile system.^[8]

Management of post-operative pain is the prime concern of root canal treatment. Post-operative pain after non-surgical root canal treatment has been reported to range from approximately 3% to more than 50%.^[8] To measure the pain experienced, various pain scales had been used such as visual analog scale, modified visual analog pain scale, and modified verbal pain scale in previous studies.^[7] In this study, modified verbal scale was

Table 2: Statistical evaluation of pain score at different time intervals between Group I and II

Time interval	Group I (n=30)				Group II (n=30)				Significance of difference (Mann-Whitney U-test)	
	Median	Mean	SD	Range	Median	Mean	SD	Range	Z	P
Pre-operative	4	4.20	2.25	1–10	4	4.43	2.03	1–8	0.545	0.586
12 h	0	0.83	1.05	0–4	2	1.28	1.33	0–4	1.256	0.209
24 h	0	0.17	0.53	0–2	0	0.33	0.88	0–4	0.764	0.445
48 h	0	0.03	0.18	0–1	0	0.13	0.51	0–2	0.626	0.531
72 h	0	0	0	0	0	0	0	0	0	1
Week 1	0	0	0	0	0	0	0	0	0	1

used, which is a combination of verbal descriptor scale of slight pain to maximum pain and numeric scale range from 0 to 10.^[7] When properly designed and administered, a modified verbal descriptor scale is considered to be a valid and reliable ratio scale instrument for the measurement of human pain intensity and unpleasantness.^[8]

Recent systematic reviews found no difference in post-operative pain between single and multiple visit endodontic treatment.^[9]

In this present study, in Group I (rotary ProTaper), pain scores at base level ranged from 1 to 10 with a mean value of 4.20 ± 2.25 , whereas in Group II (manually), pain scores ranged from 1 to 8 with a mean value of 4.43 ± 2.03 . Statistically, the difference between two groups was not significant ($P = 0.586$).

In nutshell, significantly there was no difference in the post-operative pain between the groups. In 2003, relatively high incidence of post-operative pain with stainless steel hand file preparation was found as compared to NiTi rotary.^[6] In the present study, post-operative pain in all cases subsided with the use of mild analgesics. Moreover, none of the patients developed swelling and so antibiotics were not required in any case. This is in agreement with studies^[7,10] which found that endodontic pain is best managed by eliminating the source of infection or inflammation as completely as possible, and whenever drugs are required, the judicious use of non-opioid analgesics can be beneficial and provide the first course of action.

CONCLUSION

Thus, it was concluded in this study that single-visit treatment can be completed in significantly shorter time, with rotary instruments as compared to the manual method of instrumentation, with no difference in the incidence of pain in both the groups. Post-operative pain if present subsided with use of mild analgesics only and none of the patients

required antibiotics. Though, single visit endodontic therapy has become the choice of treatment for today's fast paced society still its implementation should be based on case selection, proper asepsis, treatment procedures and protocols, time management and duration of appointment.

REFERENCES

- Bouillaguet S, Shaw L, Barthelemy J, Krejci I, Wataha JC. Long-term sealing ability of pulp canal sealer, AH-plus, guttaFlow and epiphany. *Int Endod J* 2008;41:219-26.
- Ali SG, Mulay S, Palekar A, Sejpal D, Joshi A, Gufran H, et al. Prevalence of and factors affecting post-obturation pain following single visit root canal treatment in Indian population: A prospective, randomized clinical trial. *Contemp Clin Dent* 2012;3:459-63.
- Mothana AL, Mujeeb AA. Single visit root canal treatment: Review. *Saudi Endod J* 2012;2:80-4.
- Silva LA, Leonardo MR, Nelson-Filho P, Tanomaru JM. Comparison of rotary and manual instrumentation techniques on cleaning capacity and instrumentation time in deciduous molars. *J Dent Child (Chic)* 2004;71:45-7.
- Kenrick S. Endodontics: A multiple-visit or single-visit approach. *Aust Endod J* 2000;26:82-5.
- Ahmed MA, Dall AQ, Khoso NA, Jouhar R. Comparison of postoperative pain after protaper rotary and manual step back root canal preparation techniques in single visit endodontics. *JPDA* 2012;21:103-7.
- Raju TB, Seshadri A, Vamsipavani B, Abhilash K, Subhash AV, Kumari KV, et al. Evaluation of pain in single and multi-rooted teeth treated in single visit endodontic therapy. *J Int Oral Health* 2014;6:27-32.
- Wang C, Xu P, Ren L, Dong G, Ye L. Comparison of post-obturation pain experience following one-visit and two-visit root canal treatment on teeth with vital pulps: A randomized controlled trial. *Int Endod J* 2010;43:692-7.
- Sathorn C, Parashos P, Messer H. The prevalence of post-operative pain and flare-up in single- and multiple-visit endodontic treatment: A systematic review. *Int Endod J* 2008;41:91-9.
- Mickel AK, Wright AP, Chogle S, Jones JJ, Kantorovich I, Curd F, et al. An analysis of current analgesic preferences for endodontic pain management. *J Endod* 2006;32:1146-54.