COMPARISON OF THE INCIDENCE OF POSTOPERATIVE PAIN AFTER USING TWO CONTINUOUS ROTARY FILE SYSTEM WITH CONVENTIONAL NEEDLE AND ULTRASONIC IRRIGATION IN SINGLE VISIT ENDODONTICS: AN INVIVO STUDY

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Conflicts of Interest: Nil

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DOI: <https://doi.org/10.32553/ijmsdr.v5i6.787>

Abstract:

Aim: The aim of this study was to compare the incidence of postoperative pain after using protaper gold (Dentsply Maillefer) and Neoendo (Orikam) rotary file system with conventional needle and ultrasonic irrigation system in single visit endodontics.

Materials and Methods: Sixty patients requiring endodontic therapy were included in this study and divided into four groups, each group consisting of 15 patients. Group I (n = 15), was instrumented using ProTaper Gold followed by needle (Neoendo side vent) irrigation using 2 ml 3% sodium hypochlorite. In Group II, teeth were instrumented using ProTaper Gold followed by 3% sodium hypochlorite irrigant and activated using Endoactivator (Orikam Ultra X) for 30 seconds. In Group III (n = 15), teeth were instrumented using Neoendo (Orikam) rotary file system followed by conventional needle irrigation using 3% sodium hypochlorite as mentioned in Group I. In Group IV (n = 15), teeth were instrumented using Neoendo rotary file system followed by 3% sodium hypochlorite irrigant which were activated using Endoactivator for 30 seconds as mentioned in Group II. Each root canal will be obturated using the single cone technique using Zinc oxide sealer. Postoperative pain response of patients was evaluated using the visual analogue scale (VAS) score. **Results:** For VAS pain scores, a statistically significant difference was found between the PTG and Neo Endo files (p= 0.000). Group II showed the least incidence of pain for a follow up period of one week followed by Group I and Group IV. Group III showed the highest incidence of pain among the four group. **Conclusion:** Within the limitations of this study, we may conclude that the PTG system along with the Passive Ultrasonic Irrigation System is a technique that is able to minimize the risk of postoperative pain after single visit root canal therapy compared to the other technique used in this study. However, all the techniques used in this study significantly reduced the post-operative pain within a time interval of one week.

Key words: Protaper Gold, Neo Endo Files, Passive Ultrasonic Irrigation, Side Vent Needle, Controlled Memory Files

Introduction:

Root canal treatment can be done in either a single or multiple visits. It has been seen that patient normally tolerate and prefer single visit endodontic treatment than multiple visit due to its

advantages of a decreased number of operative procedures. It also decreases risk of inter-appointment leakage through temporary restorations.^{1,2}

Postoperative pain is the pain of any degree that arises post initiation of root canal therapy. The factors for postoperative pain are many-fold and can comprise microbial factors, the effects of chemical mediators, phenomena related to the immune system, cyclic nucleotide changes, psychological factors, and changes in the periapical tissue pressure. Irritants to the periapical tissues that can induce pain sensation include medications or irrigating solutions.⁴ Periradicular inflammation associated with apical extrusion of debris is also a principal cause of postoperative pain.⁵

Several nickel-titanium (NiTi) file systems are used today within the field of dentistry. NiTi rotary file system of good flexibility thus it has decreased the incidence of iatrogenic errors of danger zone, ledge, perforation etc. Thus, contributing to the better efficiency and safety of the root canal preparation.^{6,7}

ProTaper Gold (PTG, Dentsply Maillefer) systems have a design with a triangular cross section and a variable progressive taper. It has features that are similar to those of the PTU, except that the PTG uses CM wire, while the PTU uses conventional NiTi wire. Because of this distinction, the PTG exhibits higher flexibility and better resistance to cyclic fatigue than the PTU system.⁸

Neoendo Flex file is a 3rd Generation Rotary File with 2 Files Shaping System undergone Gold Thermal Treatment provides it extremely flexible and improved cyclic fatigue resistance. With the triangular cross section with sharp cutting edges of these files, cutting efficiency will be increased. Safety tip which is non-cutting avoids accidental apical transportation and also provides extreme flexibility of this canal favours negotiation of any canal.⁹ Disinfection of the root canal system, as part of endodontic therapy, by preparation and irrigation is key in reducing the number of bacteria within the root canal and helping to control periapical disease.¹⁰

Sodium hypochlorite (NaOCl) is the most commonly suggested and a normally used endodontic irrigant. Its benefits are two-fold;

pulpal dissolution and antimicrobial effect. NaOCl which is a strong base (pH>11 acts as an organic solvent, causing amino acid degradation and hydrolysis through the production of chloramine molecules.¹¹

Passive ultrasonic irrigation (PUI) of the root canal involves activation of the irrigant without simultaneous instrumentation by an ultrasonically activated file in the canal.^{12,13} Bigger intensity of an ultrasonic device leads to a bigger oscillation amplitude of the ultrasonic file, causing the irrigation solution around the file and within a canal to move quickly.¹⁴

Ultra x works at 45khz ultrasonic frequencies works with the principle of acoustic microstreaming, agitation and cavitation to reach difficult to instrument areas of the complex root canal system. It can be applied endodontically to disrupt the smear layer and biofilm and open up the plugged dentinal tubules, remove gross dentinal debris, amplify the efficiency of irrigants.¹⁵

Replenishment of the irrigant occurs by intermittent flushing via a syringe or by continuous flow into the canal orifice via a handpiece.¹⁶ The Side Vent Needle is an endodontic irrigation needle with one lateral vent for gentle but active irrigation for root canals. It also helps in avoiding penetration of the apex due to the lateral vent and rounded end, thus the full length of the root canal may be safely irrigated, This thin-walled needle improves flow rate, offers improved irrigation and high flexibility.¹⁷

Based on these studies, the aim of this study was to compare the incidence of postoperative pain after using two continuous rotary file system with conventional needle irrigation system in single visit endodontics.

The null hypothesis was set as there will be no difference in incidence of post operative pain between Protaper Gold and Neo Endo Rotary file system after used with conventional needle irrigation system.

Materials and Methods

All the patients were treated in a single appointment after signing the informed consent.

All patients were recorded their pain level preoperatively using a visual analog scale.

The teeth were locally anaesthetized before rubber dam isolation, antisepsis of the oral cavity were performed by rinsing for 1 min with 10 mL chlorhexidine gluconate mouth wash 0.2 %.

An access cavity was performed. Patency of the root canal were obtained using stainless steel hand k- files size #15 (MANI- MANI, INC. Industrial Park, Utsunomiya, Tochigi, Japan)

Working length were determined using an electronic apex locator then confirmed with intraoral periapical radiograph.

A total of 60 patients between 18 to 35 years were included in this study and were divided into four groups, each group consisting of 15 patients. Patients who had previously taken antibiotics or analgesics and those with preoperative pain were excluded.

The teeth in Group I (n = 15), were instrumented using ProTaper Gold (Depending on the individual tooth, the final instrumentation size were determined as three sizes larger than the first file binding at the working length) followed by conventional needle (Neoendo side vented 30 gauge) irrigation using 2 ml 3% sodium hypochlorite. 5 ml of 17% EDTA were used at the end of the procedure to remove the smear layer. 5 ml of saline solution was the final irrigant used to neutralize all the previously used solutions.

In Group II, teeth were instrumented using ProTaper Gold followed by 3% sodium hypochlorite irrigant and activated using Endoactivator (Orikam Ultra X) for 30 seconds. 5ml of 17% EDTA was used to remove the smear layer. 5 ml of saline solution was used as the final irrigant.

In Group III (n = 15), teeth were instrumented using Neoendo (Orikam) rotary file system followed by conventional needle irrigation using 3% sodium hypochlorite as mentioned in Group I.

In Group IV (n = 15), teeth were instrumented using Neoendo rotary file system followed by 3%

sodium hypochlorite irrigant which were activated using Endoactivator for 30 seconds as mentioned in Group II.

Each root canal was obturated using the single cone technique using Zinc oxide sealer . All patients were instructed to record pain level on the pain scale chart after 2 hours, 6 hours, 1st day untill 7th day.

The patients were instructed to submit the pain scale charts after the 7th day. Patients were referred for final restorations. Any patient who reported the intake of an analgesic during this period was recorded.

The severity of pain was evaluated using a visual analogue scale (VAS) score, validated previously.¹⁸

No pain (0): The treated tooth felt normal. Patients do not have any pain

Mild pain (2-4): Recognizable, but not discomforting, pain which required no analgesics

Moderate pain (4-6): Discomforting, but bearable pain (analgesics if used, were effective in relieving the pain)

Severe pain (6-10): Difficult to bear (analgesics had little or no effect in relieving the pain).

VAS pain scores were compared using one-way ANOVA and *post-hoc* Tukey test. A value of $P < 0.05$ was required for statistical significance.

Results

Results are shown in Table No.1. For VAS pain scores, a highly statistically significant difference was found between all the four Groups ($P = 0.000$). Statistically significant difference was also found between Protaper Gold and Neo Endo Rotary files System ($P = 0.002$).

Single visit root canal therapy performed in the Group II showed the lowest incidence of post-operative pain followed by Group IV and GROUP I. The highest incidence of post-operative pain was showed by the group of people who received endodontic treatment using Neo Endo rotary file system and conventional needle

irrigation technique (Group III) compared to the Protaper Gold File used ($P = 0.002$).

None of the patients reported pain at 2 hours whereas, 20% of the patients in the Group III had mild pain after 6 hours of the treatment. When comparing post-operative pain on the first day, Group III had severe pain(20%) which was subsided on the consecutive days.

By the end of the 5th day, incidence of pain found to be reduced in all the groups. None of the patients in Group II had pain at 6th day, whereas 6.6% of the other three groups had mild pain.

The highest incidence of post-operative pain was showed by the group of people who received endodontic treatment where syringe irrigation technique is used compared to the passive ultra-sonic irrigation technique.

At the seventh day of the treatment, none of the patients who received endodontic therapy had pain.

Patients who had taken analgesics found to be higher at the first and second day of the treatment. Pain was found to be reduced after the 4th day where all patients found to stop taking analgesics.

Table 1: Overall incidence of postoperative pain in percentage at various time interval after using Protaper Gold and Neo Endo Files with conventional needle irrigation technique

Groups	No Pain (0) %		Mild Pain(2-4) %		Moderate Pain (4-6) %		Severe Pain(6-10) %	
I (n=15) PTG + CNI	2 hour	15(100%)	2 hour	0 (0%)	2 hour	0(0%)	2 hour	0(0%)
	6 hour	15(100%)	6 hour	0 (0%)	6 hour	0 (0%)	6 hour	0 (0%)
	Day 1	12 (80%)	Day 1	3 (20%)	Day 1	0 (0%)	Day 1	2(13.3%)
	Day 2	9 (60%)	Day 2	2(13.3%)	Day 2	3 (20%)	Day 2	1 (6.6%)
	Day 3	8 (53.3%)	Day 3	1 (6.6%)	Day 3	6 (40%)	Day 3	0 (0%)
	Day 4	11(73.3%)	Day 4	3 (20%)	Day 4	1 (6.6%)	Day 4	0 (0%)
	Day 5	13 (86.6%)	Day 5	2(13.3%)	Day 5	0 (0%)	Day 5	0 (0%)
	Day 6	14(93.3%)	Day 6	1 (6.6%)	Day 6	0 (0%)	Day 6	0 (0%)
	Day 7	15(100%)	Day 7	0 (0%)	Day 7	0 (0%)	Day 7	0 (0%)
II (n=15) PTG + PUI	2 hour	15(100%)	2 hour	0 (0%)	2 hour	0 (0%)	2 hour	0 (0%)
	6 hour	15(100%)	6 hour	0 (0%)	6 hour	0 (0%)	6 hour	0 (0%)
	Day 1	11(73.3%)	Day 1	4(26.6%)	Day 1	0 (0%)	Day 1	0 (0%)
	Day 2	10(66.6%)	Day 2	3 (20%)	Day 2	2(13.3%)	Day 2	0 (0%)
	Day 3	9 (60%)	Day 3	4(26.6%)	Day 3	2(13.3%)	Day 3	0 (0%)
	Day 4	13(86.6%)	Day 4	2(13.3%)	Day 4	0 (0%)	Day 4	0 (0%)
	Day 5	15(100%)	Day 5	0 (0%)	Day 5	0 (0%)	Day 5	0 (0%)
	Day 6	15(100%)	Day 6	0 (0%)	Day 6	0 (0%)	Day 6	0 (0%)
	Day 7	15(100%)	Day 7	0 (0%)	Day 7	0 (0%)	Day 7	0 (0%)
III (n=15) Neo Endo + CNI	2 hour	15(100%)	2 hour	0 (0%)	2 hour	0 (0%)	2 hour	0 (0%)
	6 hour	12 (80%)	6 hour	3 (20%)	6 hour	0 (0%)	6 hour	0 (0%)
	Day 1	8 (53.3%)	Day 1	1 (6.6%)	Day 1	3 (20%)	Day 1	3 (20%)
	Day 2	6 (40%)	Day 2	3 (20%)	Day 2	4(26.6%)	Day 2	2(13.3%)
	Day 3	10(66.6%)	Day 3	2(13.3%)	Day 3	2(13.3%)	Day 3	1 (6.6%)
	Day 4	11(73.3%)	Day 4	1 (6.6%)	Day 4	3 (20%)	Day 4	0(0%)
	Day 5	12 (80%)	Day 5	2(13.3%)	Day 5	1 (6.6%)	Day 5	0 (0%)
	Day 6	14(93.3%)	Day 6	1 (6.6%)	Day 6	0 (0%)	Day 6	0 (0%)
	Day 7	15(100%)	Day 7	0 (0%)	Day 7	0 (0%)	Day 7	0 (0%)

IV (n=15) Neo Endo + PUI	2 hour	15(100%)	2 hour	0 (0%)	2 hour	0 (0%)	2 hour	0 (0%)
	6 hour	13 (86.6)	6 hour	2(13.3%)	6 hour	0 (0%)	6 hour	0 (0%)
	Day 1	9 (60%)	Day 1	5(33.3%)	Day 1	0 (0%)	Day 1	1 (6.6%)
	Day 2	11(73.3%)	Day 2	1 (6.6%)	Day 2	3 (20%)	Day 2	0 (0%)
	Day 3	12 (80%)	Day 3	2(13.3%)	Day 3	1 (6.6%)	Day 3	0 (0%)
	Day 4	12 (80%)	Day 4	2(13.3%)	Day 4	1 (6.6%)	Day 4	0 (0%)
	Day 5	13(86.6%)	Day 5	3 (20%)	Day 5	0 (0%)	Day 5	0 (0%)
	Day 6	14(93.3%)	Day 6	1 (6.6%)	Day 6	0 (0%)	Day 6	0 (0%)
	Day 7	15(100%)	Day 7	0 (0%)	Day 7	0 (0%)	Day 7	0 (0%)

Discussion

In this study, Visual analogue Rating Scale was used as it is frequently used scale for measuring pain. It is proved that postendodontic pain is reduced significantly following the treatment. The results from the present study show that pain was significantly different among all the four groups. No pain at 2 hours and 6 hours in any groups except in the Group III (20%) and Group IV(13.3%), mild pain at 6 hours was reported. This could be due to the anesthetic effect present in all the individuals at these time interval.

Single visit root canal therapy performed in the Group II showed the lowest incidence of post-operative pain. The endodontic files used here is Protaper Gold. ProTaper Gold instruments have the same geometry as that of ProTaper Universal (Dentsply Maillefer, Ballaigues, Switzerland) but offer increased flexibility. The manufacturer claims that during preparing curved canals, the ProTaper Gold instruments have resistance to cyclic fatigue and maintain canal centering. The ProTaper Gold has a convex triangular cross-section and a progressive taper. It also has a noncutting tip design, allowing the instrument to follow the original shape of the root canal.²¹

In the present study, comparing Group I and Group II, statistical difference was found ($P < 0.05$) between them. Pain was reported to be more in Group I where Protaper gold rotary files used with syringe irrigation technique. By 4th day of the endodontic therapy, none of the patients had pain in Group II whereas Group I patients had mild pain (6.66%) at 6th day.

When comparing Group III and Group IV, statistical difference was found ($P < 0.05$)

between them. Incidence of the pain in Group IV found to be subsiding more quickly as compared to the Group III. At the day six, 93.3% of the patients reported no pain in both the groups.

Chaudhury et al reported that Protaper Gold system owing to its off-centred mass and centring ability, ensures a greater percentage of dentin thickness retention in root canal, facilitating higher bacterial elimination.²²

Neo Endo flex files are controlled memory files with a triangular cross-section, sharp cutting edges and are extremely flexible. Neo Endo flex having larger speed (350 rpm) and improved cutting efficiency showed more number of cracks.²³

In the present study, teeth treated with passive ultrasonic irrigation exhibited lowest pain incidence compared with the one used with syringe irrigation technique. Passive ultrasonic irrigation (PUI) of the root canal includes activation of the irrigant without simultaneous instrumentation by an ultrasonically activated file in the canal. Higher intensity of an ultrasonic device leads to an increased oscillation amplitude of the ultrasonic file, producing the irrigation solution around the file and within a canal to move rapidly.²⁴

In a study conducted by Annil Dhingra et al to evaluate the effect of two passive ultrasonic irrigation methods on removal of dentin debris from root canal systems, the results exhibit that the PUI method is an efficient method of irrigation, which helps in eliminating debris from the root canals effectively. The continuous method of PUI shown to be a have better method of irrigation than the intermittent passive

irrigation method.¹⁶ This is in accordance with the present study.

Protaper Gold System files have an offset design that makes a traveling mechanical wave of motion along the active portion of a file. This swaggering effect assists to reduce the engagement between the file and dentin compared to the action of a fixed tapered file with a centered mass of rotation. Reduced engagement limits unwanted taper lock, the screw effect, and the torque on any given file. A file with an offset design affords more cross-sectional space for loading, improved cutting and augering debris out of a canal compared to a file with a centered mass and axis of rotation. Many instruments break as a result of excessive intrablate debris packed between the cutting flutes over the active portion of a file..

Conclusion

Within the limitations of this study, It can be concluded that the difference in the postoperative pain is related to the rotary file system and irrigation techniques used. Protaper Taper Gold system along with the Passive Ultrasonic Irrigation System is a technique that is able to minimize the risk of postoperative pain after single visit root canal therapy compared to the other technique used in this study. However, all the techniques used in this study significantly reduced the post-operative pain within a time interval of one week.

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