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Incidence of post-operative pain using three different endodontic preparation instruments: An in vivo study

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***Abstract*---**Aim: The aim of this study was to evaluate the incidence of post-operative pain after cleaning and shaping with three file system using Hand, Rotary and Reciprocating motion in maxillary and mandibular molars. Materials and Method: A total 60 patients were randomly divided into 3 groups: in group 1 (n=20) teeth were prepared

with hand protaper file system till F2 size. In group 2 (n=20) teeth were prepared with primary wave one gold and in group 3(n= 20) teeth were prepared with protaper gold file system till F2 size. The pre and post-operative pain score was noted using visual analog scale at 12, 24, 48 and 72 hours after preparation. Results: all the pre instrumentation pain values were higher than post-instrumentation. There was significant difference among the groups with highest post-operative incidence in wave one gold followed by hand protaper and protaper gold files after 12 hours. Conclusion: Post- operative pain was significantly lower in patients treated with rotary protaper gold as compared to wave one gold and hand protaper file systems.

***Keywords*---**post-operative pain, visual analog scale, wave one file, protaper gold file, protaper universal files.

Introduction

The main aim of endodontic procedure is the cleaning and shaping of the root canal system to best enable it to receive the obturating material. Traditionally the root canal preparation was done using stainless steel hand K files, but the Ni-Ti files introduced by Walia et al. [1] in 1988 had various advantages over stainless steel hand instruments like low elastic modulus, high corrosion resistance, superelasticity and shape memory leading to improved cutting efficiency with better preservance of root canal anatomy. Various studies [2, 3] have found rotary Ni-Ti files to be more effective in root canal preparation as well as better in bacterial reduction from root canal system as compared to hand file systems [4].

Recently introduced, Protaper Gold instruments (PTG; Dentsply, Tulsa Dental Specialties, Tulsa, OK, USA) were developed with advanced heat treatment and metallurgy having progressive taper and convex-triangular cross-section [5] resulting in reduction in the time of preparation, maintenance of the original canal anatomy leading to less procedural errors like zipping, !edging and perforation [6]. Wave One Gold reciprocating single-file instrument system has a unique parallelogram shaped cross-sectional design with one or two cutting edges depending on the location along the file. These edges significantly reduces torque, minimizes screwing effect on the cutting efficiency, and allowing better removal of debris [7].

During the procedure the unpredicted irritation of periradicular tissue can occur resulting in post-operative pain. In endodontics post-operative pain is defined as the pain experienced by the patient after initiation of the root canal treatment and is reported at a varying degree from 25%- 40% of cases [8]. The occurrence of pain can be affected by various factors like: extrusion of irrigant solution or dentinal debris with micro- organisms, incomplete instrumentation, missed canal, presence or absence of pre- operative pain [9]. Debris extrusion to periradicular area triggers an acute inflammatory response with release of chemical mediators causing post-operative pain [10]. Another study by Pak and White (2011) [11] quoted that the incidence of pain was found to decrease

from 40% in 24 hours to11% after 7 days. The aim of the present study was to compare the incidence of post-endodontic pain associated with Hand Pro taper (manual), Pro taper Gold (rotary kinematics) and Wave One gold (reciprocating kinematics) following root canal preparation in maxillary and mandibular molars at 12 hours, 24 hours, 48 hours and 72 hours post-operatively.

Material and Methods

This study was conducted following the revised CONSORT guidelines in Department of Conservative Dentistry and Endodontics and was approved by institutional ethical committee. Patients with age group 17-60 years diagnosed with symptomatic irreversible pulpitis and fully matured apex were selected in the study. Pre- operative pain readings were noted using Visual analog scale (with 1-10 scores).

Randomization of patient/ samples

Upon clinical examination, 150 patients were diagnosed with symptomatic irreversible pulpitis in the outpatient department (OPD) over the period of 20 days. Out of these cases, 60 patients with pain score from 3-10 in visual analog scale, were selected randomly using the lottery method, neither the patient nor the evaluator knew about the division into 3 groups. So, it was a double-blinded study.

Treatment Protocol

After gaining informed consent, the clinical case history was recorded and the patients were divided into 3 groups (n= 20 each group) according to the file system used for preparation (flow chart 1). Under Local anesthesia (2% lidocaine with 1:200000 adrenaline) and rubber dam isolation, access cavity was prepared and canals were negotiated with #6, #8, #10 and #15 hand k files. The working length determination was done using electronic apex locator (Woodpex V apex locator 5th generation) and confirmed with periapical radiograph. The armamentarium used in the study is depicted in (picture 1).

The root canal preparation for each group was done following the manufacturers instruction:
Group I- Hand Protaper (n=20)- After preparing the glide path with 15 k file, the coronal portion of canals were prepared using hand Protaper SX file and then shaping was done with S1, S2 file and final finishing was done with F2 file (0.25 tip size and 8% taper).
Group II- Wave one Gold (n=20)- The glide path was prepared with 15 k file and then using X smart plus endomotor with Wave One Gold setting, the root canals were prepared with primary Wave One Gold file (0.25 tip size and 7% taper) till full working length.
Group III- Protaper Gold (n=20) - The gilde path was prepared with 15 k file and the endomotor (X smart plus) with pro taper gold setting was used to pre flare the coronal portion of canals with rotary Protaper gold SX file (0.19/ 0.04) and then shaping was done with S1 (0.18/ 0.02), S2 file (0.20/ 0.04)

and final finishing was done with F2 file (0.25 tip size and 8% taper). Copious irrigation of the root canals during the endodontic procedure was done with 5.25% sodium hypochlorite, followed by normal saline and then 17% EDTA agitated with ultrasonic devise to remove the smear layer. The canals were again rinsed with normal saline and final irrigation was done with 2 % CHX solution.

The canals were dried using paper point and after taking a master cone radiograph the obturation was done with gutta-percha point using resin sealer (AH -plus, Dentsply Maillefer, Ballaigues, Switzerland) following cold lateral compaction method. After the procedure the patients were contacted over phone and the pain score was noted using visual analog scale at 12 hours, 24 hours, 48 hours and 72 hours post- instrumentation.

Statistical Analysis

The data collected was statistically analyzed using statistical software. Kruskal Wallis ANOVA non-parametric test was carried out to determine the comparison between the three groups at different time intervals and Mann Whitney U test was used to do the intra group comparison at significant difference of p- value < 0.05.

Results

The summary of the baseline demographic data and features of the three groups of the study had no statistical difference (table no. 1). There were no drop outs in the study follow up and all the patients responded to the follow up at all time period (12 hour, 24hours, 48 hours and 72 hours) evaluated. The value of post-operative pain was lower than pre-operative at all the time intervals. The highest pain levels on visual analog scale (VAS) were seen at 12 hours post-operatively with a significant decline in the values after that. The values of post- operative pain on VAS at different time intervals are shown (table no.2). At 12 hours there was a statistically significant (p-value= 0.011) difference between the post- operative pain score with highest pain score seen in group- 2 (Wave One Gold) followed by group- 1 (Hand protaper) and least in group- 3 (Pro-taper Gold). In the inter-group comparison, as shown in table no. 3 statistically significant difference (p-value= 0.003) was found at 12 hours post-operatively between group- 2 and group-3. There was no statistically significant difference among groups at any other time interval evaluated.

Discussion

The aim of the present study was to evaluate the effect of root canal preparation with different motion kinematics on the post-operative pain incidence using 'two most commonly used file systems for the root canal preparation with manual (Protaper universal) and rotary motion (Protaper Gold) and a recently introduced file system with reciprocating motion (Wave One Gold) using visual analog scale (VAS). It was used to record the pre as well as post- as post-operative pain values as a result of its ease, valid and confirmed reliability of assessment [12].

Patient can experience mild discomfort after endodontic therapy [13]; however the cases of flare ups and post-operative pain reported in the literature range from 3-58% [14]. The major problem in the evaluation of post-operative pain in the clinical scenario is the subjective nature of pain, which is influenced by single and variable experiences along with physical and psychological factors [15]. To minimize the variation in manipulation methods the file systems were used according to the manufacturer's instructions. The Protaper gold continuous rotary system was used in a brushing and pecking motion while the Wave One Gold reciprocating system used has a reverse cutting helix with 150° counter clockwise rotation and smaller 30° clockwise rotation [16].

Considering the irrigation as a potential confounding factor, side-vented 30 gauge, close ended needles were employed in all the groups [8]. The obturation was done using cold lateral compaction technique since it was associated with less post-operative pain as compared to thermal obturation technique [17]. There was statistically insignificant difference among the baseline parameters in various groups, confirming that samples were equally and homogenously distributed. The pre- operative pain values among the groups was statistically insignificant (p-value= 0.295).

The results showed a significant reduction in the post-instrumentation pain as compared to pre-instrumentation pain in all the groups at all time intervals evaluated (12 hours, 24 hours, 48 hours and 72 hours). However, at 12 hours post-operatively statistically significant (p value =0.011) high pain score was recorded on the VAS irrespective of the instrument used for preparation (table-2). The pain values for all the instruments at other time intervals evaluated was not statistically significant. Similar observations were recorded by Pak and White 2011[11] as the pain incidence was 40% in first 24 hours and declined to 11% at 7 days.

Also, the post-operative pain incidence was found to be greatest in Wave One Gold group at 12 hours post-operative interval as compared to hand and rotary Pro-taper file systems, with a statistically significant difference (p=0.003) between rotary Pro-taper Gold and Wave One Gold file systems. This could be due to as the extrusion of debris from the root canal to the peri-apical area. Various studies [18, 19] have proved that all the instrumentation techniques lead to some degree of debris extrusion in the peri-apical region depending on the instrument design and technique of preparation. Also, Burklein and Schafer [20] compared the debris extrusion in rotary and reciprocation motion files systems and found that full- sequence rotary was associated with less debris extrusion. However, on the contrary Tinoco et al [21] found less bacterial extrusion using single- file systems.

The extrusion of micro-organisms, material and detinal debris may cause periapical inflammation. Caviedes - Bucheli et al [22] evaluated the expression of substance P along with calcium gene related peptide (CGRP) in the periodontal membrane and found that the expression of neuropeptide was higher in the canals prepared with Wave One system. These neuropeptide cause sensitization of peripheral neurons causing hyperalgesia, allodynia and moreover the central sensitization is initiated by increase in stimulation of C

fiber causing spontaneous pain [23]. Therefore both central as well as the peripheral sensitization may cause more post-operative pain in Wave one group. The higher pain incidence in the wave one gold group can also be explained by the use of relatively rigid, greater taper file creating a piston effect and pushing the debris through the patent apical foramen and moreover, in the protaper group SX file is used for preflaring the coronal portion of canal which facilitates removal of debris into the access area rather than pushing it periapically [17].

Conclusion

Based on the results of the present study and within the limitations of this study it can be concluded that:-

1. Post-operative pain was significantly higher in the Wave One Gold group as compared to the hand and rotary Pro taper Gold file systems.
2. Post -operative pain was significantly higher after 12 hours of the procedure which reduces over time irrespective of the file system used for preparation.

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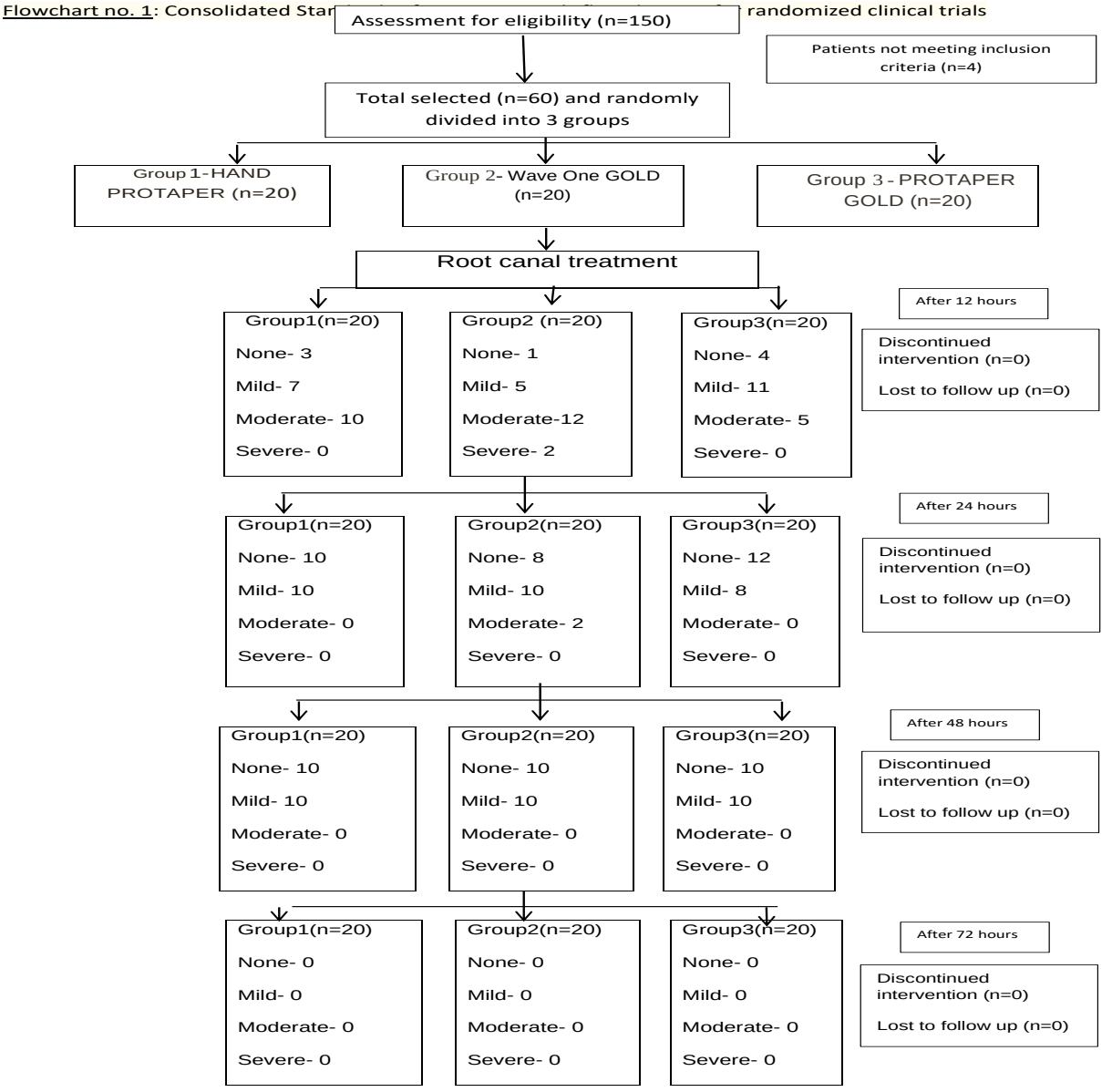
Flowchart no. 1: Consolidated Standards of Reporting Trials flow diagram for randomized clinical trials



PARAMETERS	Hand protaper ,n% N= 30	Protaper Gold n% N= 30	Wave One Gold n% N= 30	TOTAL
MALE	11 (33.33)	11 (33.33)	11(33.33)	33
FEMALE	9 (33.33)	9 (33.33)	9 (33.33)	27
MAXILLARY MOLARS	4 (30.77)	4 (30.77)	5 (38.46)	13
MANDIBULAR MOLARS	16 (34.04)	16 (34.04)	15 (31.31)	47

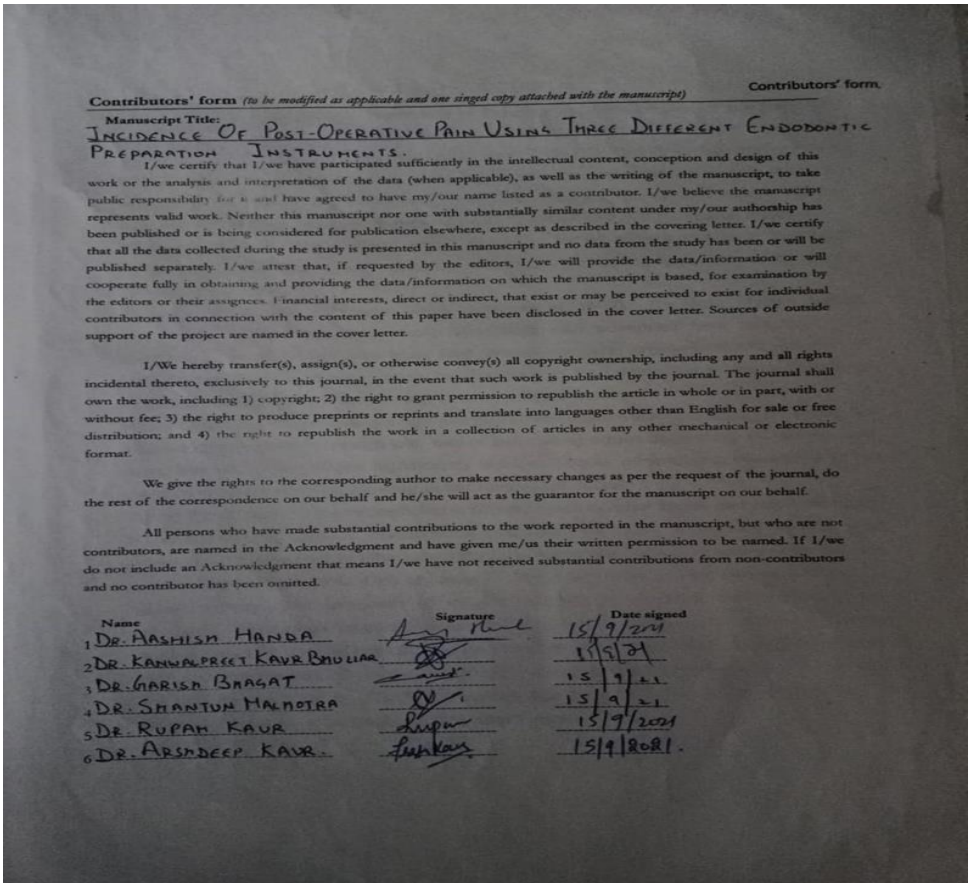
Table no. 1: DEMOGRAPHIC DATA: Pre-endodontic baseline parameters.

Time	Hand Protaper			Wave One Gold			Protaper Gold			P value#
	Mean	± SD	SEm	Mean	± SD	SEm	Mean	± SD	SEm	
Pre-op	5.25	1.943	0.435	5.95	1.820	0.407	4.75	1.446	0.323	0.107; NS
12 hours	3.10	1.997	0.447	4.40	2.113	0.472	2.00	1.892	0.423	0.004*
24 hours	1.05	1.234	0.276	1.75	1.650	0.369	0.80	1.152	0.258	0.150; NS
48 hours	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	1.000; NS
72 hours	0.00	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	1.000; NS

Table No 2: Pain Score in each group at different time of follow up.
Kruskal Wallis ANOVA: NS; $p > 0.05$; Not significant; *$p<0.05$; Significant

Time	Hand Protaper vs Wave one Gold		Hand Protaper vs Protaper Gold		Wave One Gold vs Protaper Gold	
	Z value#	P value#	Z value#	P value#	Z value#	P value#
Pre-op	1.069	0.285	0.992	0.321	2.127	0.033*
12 hours	1.754	0.079	1.730	0.084	3.246	0.001*
24 hours	1.337	0.181	0.671	0.502	1.840	0.066
48 hours	0.000	1.000	0.000	1.000	0.000	1.000
72 hours	0.000	1.000	0.000	1.000	0.000	1.000

Table no. 3: Inter-group Comparison of pain score at each time of follow up.
#Mann-Whitney Test: *$p<0.05$; Significant



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