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ORIGINAL RESEARCH

Effect of ultra sonic, sonic and conventional irrigation methods on postoperative pain in Acute irreversible pulpitis cases

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ABSTRACT

Objective: The aim of this study was to evaluate the effect of ultrasonic, sonic and conventional irrigation methods on postoperative pain in acute irreversible pulpitis cases after single-visit endodontic treatment. **Material and Methods**: A total of 60 patients with acute irreversible pulpitis in mandibular first molars with no periapical pathology were selected and divided into three groups on the basis of irrigation method used, with 20 patients in each group (n=20). In Group A canals were irrigated with side vent endodontic needle (NI). In Group B ultrasonic activation was performed using ultrasonic tips(PUI) and in Group C sonic activation was performed by using Endoactivator(EA)(DENTSPLY).Patient pain intensity after the root canal treatment was recorded at 24,48, and 72 hours using Visual Analogue Scale (VAS). **Results**: Data was analysed using SPSS version 21. Means of the three groups were compared after 24 hours, 48 hours and 72 hours using one way ANOVA. In the present study, the mean scores of PP on VAS scale in conventional irrigation group were significantly higher than other 2 groups at 24 hr, 48 hr and 72hr although no significant difference was observed between ultrasonic and endoactivator groups. The least pain scores were recorded in endoactivator group. **Conclusion:** After root canal treatment in lower molar teeth with symptomatic irreversible pulpitis, the highest post operative pain was recorded in conventional needle irrigation group in the first 24 hrs.

Keywords: Conventional Irrigation, passive ultrasonic irrigation,Sonic Irrigation, post operative pain

INTRODUCTION

Root canal treatment is a common procedure performed to save diseased teeth.The success of root canal treatment depends on many factors including elimination of existing bacteria from root canal space, removing debris, biofilm, necrotic tissues from root canal space.[1]Irrigation is often regarded as the most important part of endodontic treatment in particular for the eradication of root canal microbes.[2]

Conventional manual irrigation with a syringe and needle remains a widely accepted technique in RCT. However, this method has been shown to be incapable of reaching areas that are difficult to access such as the apical and isthmus regions. Different agitation techniques have been recommended to increase the penetration of irrigant into the complexities of root canal morphologyfor better disinfection and cleaning of root canal system.[1,3]These techniques include the use of ultrasonic,sonic irrigation, activation of irrigation solution with gutta percha cones, canal brushes, laser systems and negative pressure irrigation systems.[4]

PUI refers to the activation method where the solution's efficiency is enhanced by the activation of an ultrasonic tip placed within the canal at the working length.[5]The vibration of the ultrasonic tips results in acoustic streaming that generates shear stress which dislodges the debris from the canal. Ultrasonic waves also produce microcavitations that implode, shaking the solution inside the canal and improving the removal of the smear layer as well as improving the penetration of the liquid into the apical third of the root canal system further increasing the dissolving action of sodium hypochlorite.[6]

EA (Dentsply Sirona, Ballaigues, Switzerland), anothersonic irrigation activation device, uses sonic energy andconsists of a handpiece and three different sized (15, 0.02,25, 0.04 and 35, 0.04.) flexible polymer tips. EA activatesthe solution by generating energy between 33 and 167 Hz.[7]

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Inspite of meticulous endodontic treatment, various chemical, mechanical and microbial factors may lead to post operative pain (PP) in patients undergoing RCT.[8] The occurrence of post operative pain variesbetween 3% and 58%.[9] Studies have assessed the association between different irrigation solutions and related irrigation techniques on PP in patients undergoing root canal treatment.[10] Determination of the degree of post- operative pain after different activation techniques is of prime importance to choose the least painful and the most efficient technique in cleaning of root canals. The present study was designed to compare the effect of different irrigation methods on postoperative pain. The primary objective of this study was to assess the intensity of postoperative pain using visual analogue scale at different time intervals i.e. 24,48 and 72 hours after chemomechanical preparation.

MATERIALS AND METHODS

The present study was conducted in the Department of Dentistry Government Medical College and Associated Hospital Rajouri.The study was conducted to evaluate the effect of ultrasonic,sonic and conventional irrigation methods on postoperative pain in Acute irreversible pulpitis cases using sodium hypochlorite as primary irrigant. A total of 60 patients with acute irreversible pulpitis in mandibular first molar with no periapical pathology were selected and divided into three groups on the basis of irrigation method used, with 20 patients in each group (n=20).Group A canals were irrigated with side vent endodontic needle (NI).Group B ultrasonic activation was performed using utrasonic tips(PUI) and in Group C sonic activation was performed,using Endoactivator(EA)(DENTSPLY)respectively;
patient pain intensity after the root canal treatment were recorded at 24,48, and 72 hours.

Inclusion criteria

- Patients in good health with no systemic disease: (American Society of Anesthesiologists/ASA Class I or II).
- Age range between 18 to 50 years.
- Patients having symptomatic irreversible pulpitis in mandibular first molar (vital pulp) with no periapical involvement.
- Patients who could understand visual analogue scale (VAS).
- Patients able to sign informed consent.

Exclusion criteria

- Medically compromised patients.
- Pregnant or lactating females.
- Need for prophylactic antibiotic.
- Psychologically disturbed patients.
- Patients with a history of allergy to any medication used in the study were excluded.
- Patients who had taken pre-operative drugs as anti-inflammatory analgesic or antibiotics in the 12 hours preceding the procedure.
- Patients with swelling or acute peri-apical abscess.

Treatment procedure

The endodontic procedures on all patients were performed by expert endodontist with more than 3 years of experience. Teeth were anesthetized using local anesthetic solution containing 2% lignocaine with 1:80000 epinephrine. After rubber dam isolation access cavity was prepared using endoaccess burs, coronal preparation was done with orifice shaper SX (Dentspty) and working length was determined by Root Zx (J Morita) apex locator and later confirmed by radiograph. Every canal was terminated 0.5mm from the apex.Glide path was established with 15 No. K file.Apical preparation was completed with hand instrumentation by using files three sizes larger than the first file binding at the working length.Middle third was prepared using stepback technique. During instrumentation process each canal was irrigated with 5ml of 5.25% sodium hypochlorite solution using side vent endodontic needle. The final irrigation procedure after canal preparation was divided into three groups as follows:

Group 1(NI)

After completing the root canal preparation procedure,each root canal was irrigated with a total of 5 ml of 5.25%NaOCl with a 31 G irrigation needle (NaviTip) located 2 mm short of the WL. Final irrigation was then done with 2 ml of 17% ethylenediamine tetra acetic acid (EDTA) solution in each canal for 1 min. Final irrigation procedure with 2 ml of saline solution was administered in each root canal 2 mm short of the WL to wash out all irrigation residues.

Group 2 (PUI)

In the PUI group, the irrigation solution was agitated for 20 s 3 times using an ultrasonic tip (IRRI S 21/25; VDW, Munich, Germany) with an ultrasonic device (VDW Ultra; VDW, Munich, Germany) 2 mm short of the WL always using 1 ml of fresh 5.25% of NaOCl—root canals were then again irrigated with another 2 ml of 5.25% NaOCl. An ultrasonic tip was activated without touching the dentinal walls: enabling it to vibrate freely. Then, 2 ml of 17% EDTA solution was activated for 30 s as described above. Final irrigation was performed following the same procedure on group 1.

Group 3 (SI)

In the EA group, the irrigation solution was agitated for 20s 3 times with an EA medium tip (25/0.04) 2 mm short of the WL always using 1 ml of fresh 5.25% of NaOCl and then root canals were again irrigated with another 2 ml of 5.25% of NaOCl. An EA tip was activated using short pumping motions in 2–3 mm vertical strokes. Then 2 ml of 17% EDTA solution

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was activated for 30s as described above. Final irrigation was performed following the same procedure on group 1.

All the canals were then dried with paper points and obturated using lateral condensation technique with MTA fillapex sealer and gutta-percha. The coronal access cavity was then restored with composite resin.

Post-operative Pain Evaluation

Post-operative pain was assessed using a visual analogue scale (VAS). The scale consists of a 10 cm line with 11 marks from 0 to 10 from left to right. The pain experienced was graded as follows: no pain :0, mild pain :1-3, moderate pain :4-6 and severe pain :7-10.[11] The participants were made familiar with the scale and were then enquired telephonically at the intervals of 24 hrs, 48 hrs and 72 hrs after completion of the procedure. The individual scores of all the participants at these intervals were then grouped and mean values were calculated.

Statistical analysis

Data was analyzed using SPSS version 21. One Way ANOVA test was used to compare the mean of three groups after 24hours, 48 hours and 72 hours. A Tukey post hoc test at 5% statistical significance was used to compare pairs of groups.

RESULTS

The mean PP scores associated with each final irrigation technique at different time intervals are shown in Table 1. Means of the three groups were compared after 24 hours, 48 hours and 72 hours using one way ANOVA.

There was a statistically significant difference between groups as determined by one-way ANOVA ($p < 0.05$). A Tukey post hoc test using statistical significance of 5% revealed that the pain scores were significantly higher in conventional irrigation group as compared to the either the PUI or SI groups at 24 hrs, 48 hrs and 72 hrs intervals.

The pain intensity scores in conventional needle irrigation group were significantly higher than the sonic and ultrasonic groups at all intervals. However, there was no significant difference between the sonic and ultrasonic groups across the intervals. In all the groups, the highest PP scores were recorded at 24 hours and subsequently decreased over time..

Postoperative pain score at	Group 1	Group 2	Group 3	p-value
24 hrs	5.8±1.74	4.15±1.50	3.85±1.35	<0.05
48 hrs	4.2±1.47	2.2±1.36	1.70±0.87	<0.05
72 hrs	1.85±1.23	0.85±0.81	0.5±0.61	<0.05

DISCUSSION

The basic goal of endodontic treatment is cleaning, shaping and disinfection of the root canal followed by 3-dimensional obturation of the root canal.[12]Pain management during endodontic procedures and the postoperative stages is one of the most important goals of clinicians.[13] Several etiologic factors are attributed to postoperative pain (PP) including a history of preoperative pain, periapical disease, and extrusion of debris and/or irrigation solution into the periapical tissue.[14,15]

Most of the time moderate to severe postoperative pain occurred on the first day after endodontic treatment and last for 72 hr as reported by various previous studies so 24 hr, 48 hr and 72 hr post op intervals were chosen.[16,17]There are many scales and methods used for PP measurement and assessment. In the present study, the VAS scale with values between 0 and 10 was used owing to its validity, reliability and ease of use.[18,19]

Previous studies have shown that incidence of postoperative pain was found to be more in molars that were treated compared to other teeth.[20,21] Also the maximum number of endodontic treatments are performed in molars[22,23] so lower molars were chosen for the study.

Symptomatic irreversible pulpitis cases were selected as the main inclusion criterion because itis the most common pulpal pathology that requires urgent treatment with spontaneous pain and it has been reported that PP may be associated with preoperative pain (83%) as compared to asymptomatic teeth (16%).[24]

Single visit root canal treatment was performed in all cases as it has advantagessuch as reduced flare up rate, decreased number of operative procedures,no risk of interappointment leakage through temporaryrestorations, patient acceptance and reduced post operative pain. Moreover, various previous studies have asserted that thenumber of visits did not affect the incidence orintensity of postoperative pain.[25]

Root ZX apex locatorwas used for the determination of the working lengthof the root canals because of its high accuracy.Radiographic X-ray was taken to confirm workinglength. This greatly helps clinicians to confine the preparation to within the root canal system, thereby preventing the over-instrumentation that is considered to be one of the reasons for postoperative discomfort.[26]

In the present study, the mean scores of PP on VAS scale in conventional irrigation group were significantly higher than other 2 groups at 24 hr, 48 hr and 72hr although no significant difference was observed between ultrasonic and endoactivator groups. The least pain scores were recorded in endoactivator group. This is in accordance with previous study which also showed that EA caused least pain when compared to NI group.[27]

The relatively lesser pain scores in groups 2 and 3

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could be explained on the basis of the fact that Ultrasonic irrigation system and Endoactivator produce microcavitations and acoustic streaming which enhances the disruption of smear layer and intracanal biofilm along with disinfection into various intracanal fins and anastomoses.[6] Previous studies have also reported that PUI resulted in better disinfection of the root canal system than conventional needle irrigation.[28][Nagendrababu et al, Digourdi]

Moreover ultrasonic and sonic irrigation prevent the apical extrusion of irrigant and debris unlike syringe needle irrigation. Irrigant and debris extrusion into the periapical area has been considered one of the main causes of postoperative pain as it may cause chemical irritations in the periapical zone and result in PP.[14]

CONCLUSION

Within the limitations of the present study, the highest recording of PP at the end of the 24th h was detected in the NI group and the lowest in the endo activation group. In all the irrigation methods, the pain showed a decrease after 24th h and the difference between the PP levels related to the irrigation methods disappeared.

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