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The Incidence of Pain after Root Canal Treatment Using Different Irrigation Methods

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Key words
safety irrigator, post-pain, endoactivator, root canal treatment.

Abstract

The aim of this study was to compare the postoperative level of pain after root canal therapy using different irrigation protocol. Materials and method: in a clinical trial, 90 asymptomatic single-rooted teeth were treated endodontically with different irrigation techniques. The teeth were randomly assigned into three groups. In group I(n = 30), procedures were performed using an endodontic irrigating syringe (Vista, Appli-vac). The group II (n = 30) used an irrigation device based on subsonic system Endoactivator (Dentsply Tulsa Dental Specialist). In group III (n = 30) used Safety Irrigator (Vista Dental Products, WI). Pain levels were assessed by an analog scale questionnaire after 4, 24, and 48 hours. Results: during the all time intervals after treatment, the pain experience with group III was significantly lower than the other methods. In conclusion, an irrigation/evacuation system Safety Irrigator resulted in significantly less postoperative pain than subsonic Endoactivator and conventional needle irrigation.

Introduction

Root canal treatment (RCT) or endodontic treatment is a common procedure in dentistry. Postoperative pain is defined as pain of any degree that occurs after initiation of RCT, whereas flare-up has been defined as the onset or continuation of pain and/or swelling after endodontic treatment. Flare-up is subset of postoperative pain[(1,2)]. The development of postoperative pain after RCT is usually due to acute inflammatory response in the periradicular tissues. It commences within few hours or days after endodontic treatment. It is a poor indicator of pathosis and unreliable predictor of long-term success[(3,4)]. Patients might consider postoperative pain and flare-up as a benchmark against which the clinician's skills are measured. It might undermine patients' confidence in their dentists or patient satisfaction with the treatment. The factors for postoperative pain are many-fold and can include microbial factors, the effects of chemical mediators, phenomena related to the immune system, cyclic nucleotide changes, psychological factors, and changes in the local adaptation and the periapical tissue pressure[(5)]. Irritants to the periapical tissues that can evoke pain sensation include medications or irrigating solutions[(5)].Chemomechanical debridement is an important part of endodontic treatment. Elimination of pulpal tissue, microbiota and their by-products, and organic and inorganic debris removal by using instruments and intracanal irrigants are objectives of this important phase of treatment[(6)]. Several studies have proven the effectiveness of sodium hypochlorite for bacterial reduction in addition to mechanical cleaning and shaping[(6)]. Other irrigants with similar antimicrobial effects include chlorhexidine[(7)]and MTAD (mixture of tetracycline, acid, and detergent)[(8)]. Only sodium hypochlorite, however, has also proven highly effective

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in tissue dissolution[9] and the removal of bacterial biofilm[9]. Because tissue dissolution is a prerequisite for antimicrobial action[10], sodium hypochlorite is considered the most important antimicrobial irrigant in root canal therapy[9]. Sodium hypochlorite works because of its ability to hydrolyze and oxidize cell proteins, its release of free chlorine, and its pH of 11 to 12[10].Sodium hypochlorite carries risk of extrusion into periapical tissues causing inflammation, ecchymoses, hematoma, and sometimes even necrosis and paresthesia [11,12]. Accordingly, any root canal irrigation delivery system that reduces the risk of sodium hypochlorite extrusion into the periapical tissues would greatly benefit patient care. Manual irrigation with hypodermic or endodontic needle by using positive pressure is the most commonly used endodontic irrigation system. Instances of expressing irrigants into periapical tissues and causing significant tissue damage and postoperative pain have been reported with the use of positive pressure[11,12]. Recently different new irrigation system, were introduced to endodontics. The Endoactivator (Dentsply Tulsa Dental Specialist, OK) irrigate root canal system. This system has 2 components, a subsonic handpiece and activator tips (Yellow 15/02, Red 25/04, Blue 35/04)[13]. The battery-operated handpiece activates from 2,000–10,000 cycles/min. On placing irrigant into the canal and chamber, passively fitting tips are activated at 10,000 cycles/min for 30–60 seconds. In a recent study[14], the safety of various intracanal irrigation systems was analyzed by measuring the apical extrusion of irrigant. They conclude that Endoactivator had a minimal although statistically insignificant amount of irrigant extruded out of the apex. When delivering the subsonic activation of the irrigant into the pulp chamber and canal. Manual group had significantly greater amount of extrusion compared with Endoactivator. The Safety irrigator (Vista Dental Products, WI) is an irrigation/evacuation system, designed for single hand use in apical irrigation and evacuation, the safety irrigator uses negative pressure to provide irrigation during endodontic procedure[13]. Safety irrigator delivers the irrigant through thin needle containing a lateral opening, and evacuates the solution through large needle at the root canal orifice. The disposable instrument also includes a needle tip that can be cut to the desire working length[13].The aim of this study was to evaluate and compare the post operative pain after the use of different irrigation protocol.

Materials and Methods

In this clinical trial, single-visit root canal treatments were performed. A questionnaire was given to the participants to note postoperatively the intensity of pain. Postoperative pain was measured by using a visual analogue scale (VAS) of 1 (no symptom) to 4 (severe pain and/or swelling)[15]. VAS was taught to the participants as well as reporting the postoperative clinical conditions after 4, 24 and 48 hours. Patients were contacted by telephone if they did not return the VAS form .Ninety patients fitting the inclusion criteria described later were included in this study. All patients were treated by a single operator in a private practice specializing in endodontics over a period of 24 months. Only single-rooted teeth with one canal were selected for this investigation. A diagnosis was asymptomatic irreversible pulpitis caused by carious exposures. The individual diagnosis was confirmed by obtaining the dental history, periradicular radiographs, periodontal evaluation, percussion, and cold test. The diagnostic findings were verified by comparing them with adjacent sound teeth with vital pulps. Only patients who had a noncontributory medical history and did not take analgesic medication at the initiation of the root canal treatment were asked to participate in the study. The treatment and the study design were explained to the qualifying patients. Patients were informed that participation was voluntary and did not affect the treatment. All patients who agreed to participate in this study signed an informed consent.

Endodontic Protocol

Each patient was anesthetized with local anesthetic solutions. After anesthesia, a rubber dam was placed and disinfected with 3% hydrogen peroxide, and the tooth was accessed using sterile carbide burs. In cases with deep carious lesions, the main decay was excavated before accessing the pulp to prevent the introduction of microorganisms into the root canal system. A glide path was established with stainless steel hand instruments up to a size #15. The working length to the apical constriction was confirmed by an electronic apex locator and periapical radiographs. After conventional access preparation, canals were shaped by using a crown-down technique with Endosequence, rotary nickel titanium instruments (Brasseler USA Dental Instrumentation, Savannah, GA) to a master apical file (MAF) size of #50/04. MAF is defined as the largest file that binds slightly at correct working length after straight-line access. All teeth were obturated in the same session using gutta-percha size #50/04 (Brasseler, Savannah, GA) with single cone technique. The root canal sealant used was AH26. all teeth were temporized using a sterile cotton pellet and Cavit.

Irrigation Protocol

Group I: Irrigation needle (Vista, Appli-vac):
Irrigation in this group was performed with a 27-G (Appli-Vac) needle and syringe. The needle was placed short of the binding point or 2mm from the working length and 1 ml of 2.5% NaOCl irrigant was expressed over 30 seconds.
Group II: Endoactivator (Dentsply Tulsa Dental Specialist, OK):
1 ml of 2.5% NaOCl Irrigant delivered into the pulp chamber and Endoactivator tips placed within 2mm of working length and activated while moving in and up-down motion for 30 seconds.
Group III: Safety Irrigator (Vista Dental Products, WI):
1ml of 2.5% of NaOCl Irrigant delivered into the canal with thin needle containing a lateral opening placed within 2mm of working length and irrigant was expressed over 30 seconds.
For all groups final irrigation had been done with 1ml of 2.5% NaOCl irrigant.

Patient Questionnaire

All participants received a questionnaire for the evaluation of pain for each root canal procedure at 4, 24, and 48 hours after the endodontic treatment was completed. The question recorded the level of pain 4h, 24h, and 48h after completion of the treatment. The four pain categories were follows:
1= No pain
2= Mild pain, which is recognizable, but not discomforting.
3= Moderate pain, which is discomfort. Pain relieved by analgesics
4= Sever pain, discomfort which is difficult to bear. Pain not relieved by simple analgesics
The patients who had sever pain or discomfort, or other side effect after treatment could contact us to receive a device or medication The data analyzed at a confidence level of 95% using Chi-Square test. Differences were considered significant when the probabilities were equal to or less than.05.

Results

All questionnaires were obtained and evaluated by statistical analysis. The patient's age ranged from 16 to 55, of total 90 patients, 57 were male and 33 were female. Table (1) shows the minimum and maximum pain levels for all groups. Pain levels:
Table (2) described the minimum and maximum pain that was experienced by the participants as well as the statistical analysis of patient's pain level. For all groups, some patients did not experience any pain or did not take any analgesic medication, regardless the time interval after treatment. In group (I), the maximum pain level described by 3 patients within the 0-4 hour time interval after treatment and only one patient described sever pain within 4-24 hours time interval after

treatment. In group (II), only one patient described sever pain within 0-4 time interval. For group (III), the maximum pain level was moderate for 0-4 time intervals only. For all groups the maximum pain decreased over time. Within the 4-to-24-hour time period, the maximum pain level in group (I) was sever in 3.3% of patients (n=1), while in group (II) the pain intensity decreased to moderate in 6.6% of patients (n=2), also in group (III) the maximum pain level, decreased to mild in 10% of the patients (n=3).During the 24-to-48-hour time interval, all patients experienced no pain or only mild pain levels. Within this time 33.3% and 10% of patients in group (I) and (II) respectively experienced still mild pain.

Statistical analysis of post operative pain (4h to 48h) between the three groups using chi-square showed significant difference ($P< 0.05$) between the three groups.

Discussion

The purpose of this study was to compare the differences in postoperative pain after endodontic therapy after using different irrigation protocols. In this study, great care was taken to rule out avoidable preoperative factors and to minimize any unavoidable causes of postoperative pain. Teeth with apical periodontitis, necrotic teeth, or re-treatment cases were not incorporated, and a meticulous aseptic protocol was maintained to reduce the risk of exacerbation by residual microorganisms or the introduction of bacterial contamination. Therefore, only teeth with the diagnosis of irreversible pulpitis were treated. The study was also limited to asymptomatic teeth because preoperative pain is one of the most predictable indicators for postoperative pain[16]. Only teeth in which a single canal incorporated to minimize the risk of iatrogenic errors because of missed or complicated root canal anatomy and to make sure the same amount of irrigation solution would pass by each canal. All teeth were instrumented and obturated in one session to eliminate intracanal medication as another possible factor for postoperative flare-up. Furthermore, only patients without a contributing medical history who did not take analgesic medication recently were included so that no other pain source or drug interaction could interfere with pain resulting from the endodontic therapy. Even with all the precautions taken, one cannot be sure in a clinical study if pain is coming from the single factor under investigation. All possible sources of pain can never be controlled completely. Therefore, under the particular circumstances of this study, postoperative pain may have been related to apical trauma because of over instrumentation or extrusion of debris, sealer, or gutta-percha rather than sodium hypochlorite. Bacteria may have been introduced from decay, canal anatomy may have been missed, the soft tissues may have been hurt because of the application of the rubber dam or injection, or the patient may have developed unrelated orofacial pain. Taking into consideration that all patients underwent the same treatment protocol, with the only difference being the irrigation technique, the statistically significant outcome allow the conclusion that, indeed, the particular irrigation protocol had significant impact on the level and time of postoperative pain. The results of this study showed that the irrigation protocol in the safety irrigator group result in less incidence of post operative pain. Many studies showed that negative pressure irrigation is a controlled effective method to deliver irrigant into the apical third of the canal system[14,17]. Other studies showed[18,19] that positive pressure irrigation may extrude irrigants into the periapical tissue. Mitcheel et al.[19] compared extrusion of irrigant out the apex by using different irrigation protocol, their result showed that negative pressure irrigation technique result significantly less extrusion of irrigant into the periapical tissue; hence, chemical irritation of the periapical tissue leading to postoperative pain may not be likely .Because the majority of root canal irrigants are cytotoxic to the periapical tissue, the irrigation solution should be restricted to within the root canal system. In this study, all techniques were either used according to manufacturer's

recommendation or, if not available, according to the common protocol. To be safe and to simulate the clinical situation with a normal irrigation method, the irrigation needle in all groups was placed no closed than 2mm from WL. In a study conducted by Condim et al[20] in 2010 showed that the use of Endovac irrigation system as a negative apical pressure irrigation result in a significant reduction of postoperative pain levels in comparison to conventional needle irrigation, even when the needle of Endovac system place to the WL. In conclusion, an irrigation/evacuation system Safety Irrigator resulted in significantly less postoperative pain than subsonic Endoactivator and conventional needle irrigation.

Table (1):- Descriptive analysis of minimum and maximum pain levels.

Method		Min	Max
Group I Irrigation needle	**Pain 4h**	**1**	**4**
	Pain 24h	**1**	**4**
	Pain 48h	**1**	**2**
Group II Endoactivator	**Pain 4h**	**1**	**4**
	Pain 24h	**1**	**3**
	Pain48h	**1**	**2**
Group III Safety Irrigator	**Pain 4h**	**1**	**3**
	Pain 24h	**1**	**2**
	Pain48h	**1**	**1**

Table (2):- Pain intensity distribution during three time intervals.

Pain intensity distribution		**0-4h**		**4-24h**		**24-48h**	
method	**intensity**	**frequency**	**%**	**frequency**	**%**	**frequency**	**%**
Group I n=30	**Non**	**8**	**26.6**	**8**	**26.6**	**20**	**66.7**
	Mild	**7**	**23.3**	**8**	**26.6**	**10**	**33.3**
	Moderate	**12**	**40**	**13**	**43.3**	**-**	**-**
	sever	**3**	**10**	**1**	**3.3**	**-**	**-**
Group II n=30	**Non**	**13**	**43.3**	**20**	**66.7**	**27**	**90.0**
	Mild	**11**	**36.7**	**8**	**26.7**	**3**	**10.0**
	Moderate	**5**	**16.7**	**2**	**6.6**	**-**	**-**
	sever	**1**	**3.3**	**-**	**-**	**-**	**-**
Group III n=30	**Non**	**23**	**76.7**	**27**	**90.0**	**30**	**100**
	Mild	**5**	**16.7**	**3**	**10.0**	**-**	**-**
	Moderate	**2**	**6.6**	**-**	**-**	**-**	**-**
	sever	**-**	**0**	**-**	**-**	**-**	**-**
Chi-square		X^2=2.47, P< 0.05	*Sig.	X^2=2.33, P < 0.05	*Sig.	X^2=2.38, P< 0.05	*Sig.

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