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Comparison of Post Endodontic Pain Using Different NaOCL Consistencies (In Vivo Study)

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ABSTRACT
Background the main objective of endodontic treatment is to clean and fill the root canal system without post-operative discomfort. **Objectives** the effects of 5.25% of NaOCl solution and gel on post endodontic pain. **Materials and Methods** Sixty six patients were diagnosed with necrotic pulp and chronic apical periodontitis. They divided into two groups randomly, group (I) as a control group to be treated with 5.25% of NaOCl solution (NS), while group (II) was an experimental group which treated with 5.25% of NaOCl gel (NG). The root canal was prepared using rotary files then irrigated with 5 ml of 5.25% Naocl solution for (NS) group while, 5 ml of normal saline with the 5.25% Naocl gel coat each rotary file before insertion into canal for (NG) group. A questionnaire was given for all patients to be filled out at 24, 48 hours and 7 days for pain assessment. A chi-square assessment was performed to find out the significant differences. **Results** for (NS) group, 36.4 % of patients have moderate pain during the first 24 hours, while only 27.3% of (NG) group shows moderate pain during the same suggested time. The moderate pain was gradually decreased to become 27.3% for (NS) group and 18.2% for (NG) group during the first 48 hours. After 7 days only a 9.1% in (NS) group show mild pain and no pain reported with (NG) group. **Conclusion** NaOCl gel can reduce the incidence of post endodontic pain, however, it was non-significant when compared to NaOCl solution.

Keywords: Chronic apical periodontitis; necrotic pulp; sodium hypochlorite gel; sodium hypochlorite solution; post endodontic pain.

Introduction

The main aim of root canal therapy (RCT) is to clean, shape and fill the whole root canal system without postoperative pain (POP) (Udoye and Aguwa, 2010). Despite the precautions taken during endodontic treatment, some patients may suffer from pain or flare-up after RCT. Such a condition is an undesirable situation for both endodontists and patients.

Furthermore, it is considered a poor indicator of the long term success of RCT (Thomas, 2015). Therefore, prevention of post endodontic pain is considered an important part of endodontic treatment (Siqueira et al, 2000; Thomas, 2015). Sodium hypochlorite solution reported that it has strong antimicrobial and histolytic properties (Okino et al, 2004), which made it considered a standard endodontic irrigation solution for root canal cleaning and disinfection (Zehnder, 2006). However, NaOCl at high concentration can be cytotoxic to periapical tissue (Dunavant et al, 2006; Tanomaru et al, 2002) and this may cause POP if NaOCl extravagated into these tissues (Jeansonne and White, 1994). To avoid this problem, many modalities have considered during RCT procedure, such as straight-line access opening with coronal flaring; preoperative diagnostic radiograph; using of laterally orifices needle; accurate working length; needle tip freely move in the canal; and avoid excessive digital pressure (Mathew, 2015). NaOCl in gel form was introduced to provide improved control and reduce the possibility of apical extrusion to periapical tissue (Zand et al, 2016; AlSudani and Alomar, 2011). Therefore, this study designed to evaluate the effect of NaOCl in the form of solution and gel on post endodontic pain.

Material and Methods

Patient selection

The population sample of this prospective clinical study was from patients who seek dental treatment in a private clinic over one year. The sample involved in this study needed RCT after diagnosis of necrotic pulp with chronic apical periodontitis, in permanent single-rooted teeth (anterior and premolar). All participants were over eighteen years old; pulp necrosis was confirmed by the negative response to cold and electrical test and no bleeding when entering the pulp chamber. The patients qualified for this study participation if they had not used antibiotics, anti-inflammatories or analgesics for no less than a week before the study treatment, and with no preoperative pain. However, they disqualified if they had incomplete root formation, persistent exudate, deep periodontal pockets, calcified teeth, or if apical patency was not realized. Besides, patients with immunosuppression or immune-compromised were similarly disqualified (Almeida et al, 2012). All volunteers were informed about the purpose of the study and provided a written declaration form to sign it to be approved. Sixty-six patients (male = 33, female = 33) had been participating in this research, the patients were randomly divided into 2 equal treatment groups according to NaOCl forms using a simple cone flip method. Group I as a control group with a 5.25 % of sodium hypochlorite in solution form (chloraxd 5.25% solution, cerkmed, Poland), and group II as an experimental group with a 5.25% of sodium hypochlorite in gel form (chloraxd 5.25% gel, cerkmed, Poland). Gender distribution for each group as follow: Group I (male = 16, female = 18), Group II (male 17, female = 15).

Endodontic procedure

The RCT for all participated patients was accomplished by the same endodontist. The patients were anesthetized by one cartridge of 2% lidocaine with 1:80000 epinephrine (3M Xylestesin), followed by the placement of a rubber dam to isolate the infected tooth, then access opening was performed. The working length was determined using electronic apex locator (Morita Root ZX II Mini Apex Locator) with k-file size 15 (stainless steel, Dentsply M-access K-File), the file inserted into the canal until the screen of apex locator indicate the apex, then withdrew the file till the flashing bar on display reach

area between 0.0 and 1, the rubber stopper was adjusted to reach the reference point then the working length determined and confirmed by a radiograph. The root canal preparation was carried using the rotary endodontic file system (Protaper universal, Dentsply Maillefer, Switzerland) the instrumentation used according to the manufacturer instructions. Between each instrument changing step, the canal was irrigated as follows: in group (I) control group, the root canal irrigated with 5 ml of 5.25% sodium hypochlorite solution, while in the group (II), a 5 ml of normal saline with the 5.25% of sodium hypochlorite gel-coated each rotary file before its insertion into the canal. A 30-gauge irrigation needle was used for both treated groups and it was inserted into root canal about 2 mm shorter than the working length. Also, irrigation solutions had been delivered to the root canal slowly and passively. Furthermore, a size 10 k file was employed for maintaining apical patency throughout the instrumentation process. In both groups and when the preparation of the canal completed, root canals were irrigated with a 10 ml sterile saline solution. Next, the canals were dried with sterile paper points (Dentsply Maillefer, Switzerland) analogous to the master apical file. Then, a sterilized dry cotton-wool had been placed in the pulp chamber and the cavity had been filled with temporary cement (Cavit. ESPE Dental AG, Seefeld, Germany).

Pain assessment

A questionnaire with a self-explanatory scale was given for all participant patients to be filled out after 24, 48 hours and 7 days. This is to assess the pain rate. According to many reported researches, the severity of pain was categorized into four-point scale, 0= no pain, 1= mild pain (no need for analgesia), 2= moderate pain (comforted by analgesia) and 3= severe pain (not comforted by analgesia) (Direnzo et al, 2002; Glennon et al, 2004; Yoldas et al, 2004; Oginni and Udoye, 2004). The analgesic described for all patients was paracetamol tab of 500mg three times a day (on need). Furthermore, each participant in research received a recall from a researcher assistant to remind them to score the pain experience and to help them to fill the form properly.

Statistical Analysis

Chi-square test was used in this study for pain-intensity comparison between the two groups at 24, 48 hours and after 7 days following the procedure. Levels of significance had been set at the P-value of (P=0.05).

Results

Sixty-six patients (male = 33, female = 33) were enrolled in this research, with the age ranging between 18 to 61 years old. All the participants completed the study questioning sheet form and return to hand it. Generally and at each period, results revealed non-significant differences between assessed groups. The patients in each group showed no suffering from severe pain at any stage, and significant differences were almost lacking ($p > 0.05$) as shown in Table (1). The pain level was reduced as time goes forward after the procedure. It was shown that 24 hours after the treatment procedure was the hardest time. 36.4 % of NaOCl solution group patients of 12 out of 33 have a moderate pain during the first 24 hours, while only 27.3% in the NaOCl gel group with 9 patients out of 33 shows moderate pain during the same period. However, during the first 28h, the differences were still statistically non-significant. The moderate pain was gradually decreased to become 27.3% (9/33) for the patients with NaOCl solution and 18.2% (6/33) for the patients treated with gel. After 7 days only 9.1%

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(3/33) patients in the solution group show mild pain and no patient assessed with any type of pain in the NaOCl gel group.

Table (1): Results of the 4-point scale questionnaire.

Pain intensity	24 hour		48 hour		7 days	
	Frequency N=33	Percentage	Frequency N=33	Percentage	Frequency N=33	Percentage
NaOCl solution						
0	6	18.2	15	45.5	30	90.9
1	15	45.5	9	27.3	3	9.1
2	12	36.4	9	27.3	0	0
3	0	0	0	0	0	0
NaOCl gel						
0	12	36.4	21	63.6	33	100
1	12	36.4	6	18.2	0	0
2	9	27.3	6	18.2	0	0
3	0	0	0	0	0	0

Pain intensity: 0= no pain, 1=mild (no need for analgesia), 2= moderate (comforted by analgesia) and 3= severe (not comforted by analgesia).

Discussion Pain after RCT is usually caused by periapical tissue response to one or more factors, which can include mechanical, chemical, or microbial. Over-instrumentation can be considered as a mechanical factor, whereas, the extrusion of irrigation solution, intracanal medicament or filling material through apical foramen can be considered as a chemical factor. The microbial factor due to poor cleaning and shaping procedures may leave infected debris inside the canal (Siqueira and Barnett, 2004) (Figini et al, 2008). Among these factors, microbial is considered as the utmost mutual reason for POP, then further causes which may comprise mechanical or chemical injury to pulpal or periapical tissues. There have been strong interaction indicators among periapical tissues and microorganisms. Since flare-ups are further probable to happen in necrotic cases than in vital cases (Thomas, 2015), it is why only patients with necrotic pulp and chronic apical periodontitis were selected to be included in this study (Siqueira et al, 2000). Additionally, patients with preoperative pain were excluded from this study sample because it considers as one of the strongest predictors for POP (Glennon et al, 2004). The only instrumentation phase (without obturation) was applied, and the measurement of post endodontic pain was evaluated to avoid any risk of root canal filling materials that may be extruded and cause the POP which may affect the results of the present study. Several studies reported that extrusion of filling material leads to POP (Harrison et al, 1983; Seltzer, 2004; Gondim et al, 2010). Furthermore, Alonso- Ezpeleta et al, in 2012 a researcher concluded that POP was suggestively connected to the obturation method employed throughout RCT (Alonso-Ezpeleta, 2012). The patient's subjective evaluation considers one of the major difficulties in studying and measuring pain, this is why questionnaire design is crucial and should be entirely understood by patients and easily explained by investigators. (Arias et al, 2009). Herein, POP was measured using a questionnaire and 4-point pain intensity, similar to methods used in several previous studies (Direnzo et al, 2002; Glennon et al, 2004; Yoldas et al, 2004; Oginni and Udoye, 2004). NaOCl is presently the irrigant of choice due to its chemical properties that make it an active cleanser and disinfectant of the root canal system and an outstanding solvent for organic tissues (Zehnder, 2006). A concentration of 5.25% was selected to guarantee the powerful antimicrobial action (than that of a lower concentration NaOCl) and stability of histolytic activity (Jeansonne and White, 1994). Since high concentration solutions might have a superior potential for dissolution of debris in areas that cannot be reached by endodontic instrumentation (Okino et al, 2004). Nonetheless, high concentrations substantially rise irrigant cytotoxicity and, in cases of extravasation result in acute injuries to periapical tissue which include ulceration, hemolysis and damage to fibroblast and endothelial cells that cause swelling, trismus and sensory-motor destruction, which lead to POP (Dunavant et

al, 2006) (Guivarc'h et al, 2017). In contrast; NaOCl gel 5.25% has a minor risk of extrusion through the apex (Vahid et al, 2016) that might decrease post endodontic pain. Although many studies were compared the antibacterial effects of different concentrations of NaOCl solution versus gel and evaluated their effect in eliminating microorganisms from infected root canals (Vahid et al, 2016; Nejad et al, 2017; Claudio et al, 2010). Yet, no paper shows the effect of different NaOCL forms on POP. Therefore, in the present study, two forms of 5.25% NaOCl in solution and gel form were used to evaluate their effect on the POP. The present study findings clearly showed that no significant differences were observed relating to POP at any period of suggested time and between the 5.25% of NaOCl treatment of both the solution and gel form that used for irrigation during endodontic therapy. The major reasons for POP were mechanical, chemical, or microbial injuries to the periapical tissues which result in serious inflammation. It is challenging to regulate if a single or multiple factors elicit pain in a clinical examination. If a root canal system was not washed appropriately, the enduring infection can result in exacerbation by imbalances in the host-bacteria relationship, synergistic or additive microbial interactions, or the existence of conclusively pathogenic bacteria before treatment began (Clark and Eldeeb, 1993). The review of literature lacked an evaluation of the outcome of diverse NaOCl forms on post endodontic pain. However, Vahid et al, 2016 showed that 2.5% of NaOCl gel was effective in reducing E. faecalis count. Furthermore, Nejad et al, 2017 were found NaOCl 5.25% solution and gel showed the same antimicrobial effectiveness. Therefore, NaOCl 5.25% in the form of a gel can be recommended as a safe and controllable intracanal irrigant. The equivalent antibacterial activity of 5.25% NaOCl solution and gel, and these facts can explain the results of the present study. According to the previous literature review, the preoperative pain had a significant impact on POP (Gondim et al, 2010; Ali et al, 2012; Applebaum et al, 2015; Law et al, 2015). Therefore, in this study, to prevent bias due to the presence of preoperative pain, only patients with lacking preoperative pain were included and this can be another interpretation for the results of such study.

Conclusion

Within the study limitations, both NaOCl forms that used in this research were associated with low pain incidence, No patients within each group suffer from severe pain. A 5.25% NaOCl gel usage can reduce the incidence of post endodontic pain; however, it was non-significant when compared to 5.25% NaOCl solution.

Conflict of interest

We are the author's (Eanas I. Jellil, Mustafa N. Abdulghani, and Baidaa M. Zaidan) state that the manuscript for this paper is original, and it has not been published previously (or part of MSc. dissertation or Ph.D. thesis) and is not under consideration for publication elsewhere, and that the final version has been seen and approved by all authors.

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