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Evaluation of Different Concentrations of Irrigants on Postoperative Pain Following Single-Visit Root Canal Treatment: A Randomized Clinical Study

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Abstract **Original Research Article**

Aim: To compare the effects of different concentrations of NaOCl and chlorhexidine solution on postoperative pain following single-visit root canal treatment. ***Methodology:*** A total of 123 patients who had teeth with irreversible pulpitis were treated. The patients were randomly divided into three groups according to the concentration of NaOCl used and chlorhexidine. Postoperative pain was evaluated using the visual analogue scale. Data were analyzed by independent t-test, chi-square and Mann–Whitney tests. ***Results:*** Pain reported by 123 patients who were eligible to be included in the study was analyzed. No significant differences were found in the age and gender of the patients between the two groups (P = 0.50, P = 0.51, respectively). The patients who had 5.25% NaOCl reported significantly lower postoperative pain compared to those who had 2.5% NaOCl during the first 72 h following treatment. ***Conclusion:*** 5.25% NaOCl was associated with significantly lower postoperative pain compared to 2.5% NaOCl during the first 72 h following one-visit root canal treatment of teeth with irreversible pulpitis.

Keywords: Irrigation, Pain, Postoperative, Single Visit, Sodium Hypochlorite.

INTRODUCTION

Root canal treatment can improve the quality of life by relieving dental pain [1]. However, some patients report moderate-to-severe pain following root canal treatment [2, 3]. Pain management during and following root canal treatment is an important issue for both patients and practitioners [4, 5]. Several investigations have evaluated postoperative pain following use of different types of root canal irrigants [6-8] however, there are concerns over the limited number of evidence-based investigations that compare irrigants. The most popular endodontic irrigant is 5.25% sodium hypochlorite (NaOCl), which has been used well over four decades. Although it is an effective antimicrobial agent and an excellent organic solvent [9] it is known to be highly irritating to the periapical tissues [10] mainly at high concentrations. For this reason, the search for another irrigant with a lower potential to induce adverse effects is desirable 2% Chlorhexidine gluconate (CHX) has been suggested as an alternative irrigating solution that could replace NaOCl. CHX is a cationic bisguanide that seems to act by adsorbing onto the cell wall of the microorganism and causing leakage of intracellular components. At low concentration, CHX has a bacteriostatic effect and at high concentration it has a bactericidal effect because of precipitation and/ or coagulation of intracellular constituents [11] It's optimal antimicrobial activity is at pH 5.5-7.0[12]CHX has a broadspectrum antimicrobial activity, targeting both grampositive and gram-negative microbes[13]. In general, in vitro studies suggested that CHX and NaOCl have comparable antibacterial effect when used in similar concentrations [14]. Therefore, the aim of this study was to determine postoperative pain following the use of 2.5% or 5.25% of NaOCl and 2% chlorhexidine solutions when used as irrigants in teeth with irreversible pulpitis that were treated in one visit.

MATERIALS AND METHODS

Patients reporting to the department of conservative dentistry and endodontics Govt. Dental College and Hospital Srinagar were evaluated and selected according to the following criteria:

Inclusion criteria

Individuals without systemic diseases and single rooted teeth diagnosed with irreversible pulpitis, mild sensitivity to percussion, spontaneous pre-treatment pain, not having taken any medication for at least 6 h before the treatment visit, at least 18 years of age and no allergic reaction to lidocaine containing epinephrine at a concentration of 1: 80 000.

Exclusion criteria

Exclusion criteria were as follows: pregnancy and lactation, severe periodontal disease, over instrumentation or overfilling beyond the root canal space, teeth that could not be isolated with rubber dam, root canal calcification, root resorption and teeth that were not suitable for further restoration.

Procedural steps

A thorough history was recorded from the patients. Informed consent was obtained, and a clinical examination was administered. The examination included cold pulp testing, heat testing, electric testing, percussion and palpation and a periapical radiograph. All past and present symptoms of the involved tooth were recorded. A pulpal diagnosis was determined from the data collected in the examination and was recorded. Only those patients with a diagnosis of symptomatic irreversible pulpitis were included in the study. A total of 123 patients were randomly assigned to three groups using a random- digit table. Before initiating treatment, the patients were asked to rate their pre-treatment pain on a visual analogue scale from 0 to 9. Informed consent was obtained from patients before start of endodontic procedure. The tooth was anaesthetized, isolated with rubber dam and access gained to the root canal system. Following complete access, the canal orifices were enlarged using orifice shapers. Initial glide path was obtained by using #10 K-file of 0.02 taper. Working lengths were determined with an apex locator (Root ZX; J Morita Mfg. Corp, Kyoto, Japan) and confirmed radiographically. The root canals were instrumented in a crown-down technique with Protaper Next (Dentsply, Tulsa Dental, Oklahoma, Japan) to an apical ISO size of 30 using different root canal irrigants.the patients were randomly divided into three groups. In Group 1, 2% chlorhexidine solution (Consepsis, Ultra dent, South Jordan, USA), in Group 2, 2.5% NaOCl (sodium hypochlorite) and in Group 3, 5.25% NaOCl were used as an endodontic irrigants. All root canals were irrigated with 30-gauge Max-i-Probe syringe that had been placed down the canal and 3 mm short from apex. During irrigation, the needle was repeatedly moved up and down to prevent locking in the canals. The volume of irrigant used was 2 mL between each instrument. At the end of root canal preparation and before canal filling, the smear layer was removed from the root canal walls by irrigating with 3 mL 17% ethylenediaminetetraacetic acid (EDTA) followed by 5 mL normal saline irrigation. At the same visit, the root canals were dried with paper points (Meta Biomed Co., Chungcheongbuk, Korea) and then filled with gutta-percha (Meta Biomed Co.) and AH plus (Dentsply De Tery, Konstanz, Germany) cement using the cold lateral condensation technique. Each patient was given forms to complete a numerical visual analogue scale (VAS) to record the severity of pain from 0 to 9 during the 7-day period following treatment, A t-test was used for normally distributed continuous data and for nonparametric data the Mann–Whitney U-test was used. Chi-square test was employed to compare categorical data between the groups. Differences between the groups were considered significant at $P < 0.05$.

RESULTS

None of the patients developed severe swelling, pain or other side effects necessitating removal from the study. Table 1 shows the mean pain scores of different groups at various time intervals. Based on the inclusion and exclusion criteria, a total of 123 patients were eligible to participate in the study. No adverse effects were reported by the patients receiving either concentration of the irrigants up to 7 days following the treatment visit. The mean age of the patients in the three groups was 28.76, 28.56 and 28.34 years, respectively. In 2% CHX group 23 males, 18 females participated, In the 2.5% NaOCl group, 19 males and 22 females Participated, whilst in the 5.25% NaOCl group, 20 males and 21 females were treated. There were no significant differences in age and gender of the patients between the two groups ($P = 0.50$ and $P = 0.51$, respectively). The results showed that during the first 72 h following treatment, the patients receiving 5.25% NaOCl as the irrigant had significantly lower pain compared to those who had 2.5% of the same irrigant and CHX group; however, no significant difference was found between the groups for the rest of the study period (i.e. 4–7 days). When the pain was categorized as no pain to mild pain and moderate pain to severe pain, the patients who received 5.25% NaOCl had significantly less pain during the first 72 h following the treatment Figure 1. shows the mean scores of pain reported by the patients during the 7-day period following treatment.

Table-1: Comparison of mean VAS scores between the three groups

Groups	Pre-op	6hrs	24hrs	4^{th} day	7^{th} day	p-value
Group 1	3.45	2.30	4.5	1.6	1.2	<0.001*
Group 2	3.35	2.15	3.5	1.4	1	<0.001*
Group 3	3.15	1.95	2	1.3	.75	<0.001*
p-value	0.383	0.620	0.006	.659	.738	

Highly significant

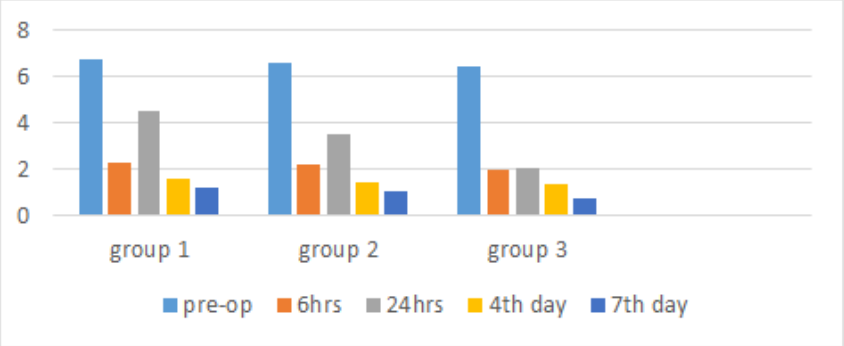

Fig-1: Mean of pain scores

DISCUSSION

In the present study, the results of single-visit root canal treatment teeth with irreversible pulpitis with the use of 2% CHX, 2.5% or 5.25% NaOCl as root canal irrigants revealed that the latter solution was associated with significantly less pain during the first 72 h after treatment. There is no general agreement regarding the optimal concentration of NaOCl for root canal preparation.

Higher concentrations of NaOCl exhibit more cytotoxicity, whilst providing more tissue-dissolving properties [15] Most studies of postoperative pain have used 2.5–5.25% or higher concentrations of NaOCl [7, 16, 17] Several clinical investigations have compared 2.5% and 5.25% concentrations of NaOCl to evaluate their efficacy in eliminating microorganisms from infected root canals [18, 19] Therefore, in the present study, two common concentrations of NaOCl (i.e. 2.5% and 5.25%) were used. The patients who received 5.25% NaOCl reported significantly lower pain during the first 72 h following the treatment. The higher antibacterial activity of 5.25% compared to 2.5% concentration may not have significant impact on lowering pain following endodontic treatment because only patients with irreversible pulpitis without periapical pathosis were included. The exact reason for less pain when higher concentration of NaOCl was used is unclear. However, it is possibly related to the inclusion criteria where only patients with inflamed pulps without periapical pathosis were included. No periapical radiolucency and the presence of normal periapical structures may prevent extrusion of the irrigant as well as debris despite the higher dissolution capacity of 5.25% NaOCl. Also the higher dissolution capacity of 5.25% NaOCl may dissolve the remaining apical pulp tissues more effectively and therefore not let them to release signaling molecules that may upregulate inflammation in the periapical tissues. Debris extrusion is a problem with all instrumentation techniques; however, crown-down instrumentation technique [20] and the balanced force techniques [21] cause less extrusion than others. Profile instruments induce less extrusion of debris and irrigant than step-back technique. It is well known that pain perception is a highly subjective and variable experience modulated by multiple physical and psychological factors. Pain reporting is influenced by many factors other than the experimental procedure. Despite the effects of a number of factors influencing patient reaction to pain, the use of the VAS to evaluate severity of pain is well established [22] When properly designed and administered, VAS is considered to be a valid and reliable ratio scale instrument for the measurement of human pain intensity and unpleasantness [23] The data from the present study show that endodontic treatment resulted in a significant change in the mean pain scores over time for both the treatment groups. These findings are consistent with those of other clinical trials which have demonstrated a significant reduction in pain after root canal treatment [24, 25]. Even though the mean VAS score was more for CHX group during preoperative and procedure time compared to NaOCl, it decreased gradually from 6th hour to 7th day. The probable reason for less pain with progress of time in chlorhexidine group may be its substantivity effect. In vitro studies have shown that CHX exhibits sustained antimicrobial activity in the root canal for 72 hours after being used as an endodontic irrigant [26] However, Rosenthal *et al*. [27] found that the treatment with a 2% CHX solution induced substantivity for up to 12 weeks. Molars In the present study, both two and four-level pain categorization systems were used to compare the effect of two different NaOCl concentrations on postoperative pain. The results showed that changing the pain categorization system had no influence on the results at different time intervals after treatment, which is in accordance with Attar et al. [28] who reported a high correlation between different questionnaires and categorization used for recording postoperative endodontic pain.

CONCLUSION

Up to 3 days following root canal treatment, the use of 5.25% NaOCl as an irrigant was associated with significantly less pain than the use of 2.5% of NaOCl and 2% Chlorhexidine.

REFERENCES

1. Hamasha AA, Hatiwsh A. Quality of life and satisfaction of patients after nonsurgical primary

root canal treatment provided by undergraduate students, graduate students and endodontic specialists. International endodontic journal. 2013 Dec;46(12):1131-9.
2. Pak JG, White SN. Pain prevalence and severity before, during, and after root canal treatment: a systematic review. Journal of endodontics. 2011 Apr 1;37(4):429-38.
3. Su Y, Wang C, Ye L. Healing rate and post-obturation pain of single-versus multiple-visit endodontic treatment for infected root canals: a systematic review. Journal of endodontics. 2011 Feb 1;37(2):125-32.
4. Parirokh M, Satvati SA, Sharifi R, Rekabi AR, Gorjestani H, Nakhaee N, Abbott PV. Efficacy of combining a buccal infiltration with an inferior alveolar nerve block for mandibular molars with irreversible pulpitis. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2010 Mar 1;109(3):468-73.
5. Parirokh M, Abbott PV. Various strategies for pain-free root canal treatment. Iranian endodontic journal. 2014;9(1):1.
6. Sulong MM. The incidence of postoperative pain after canal preparation of open teeth using two irrigation regimes. International endodontic journal. 1989 Sep;22(5):248-51.
7. Torabinejad M, Shabahang S, Bahjri K. Effect of MTAD on postoperative discomfort: a randomized clinical trial. Journal of Endodontics. 2005 Mar 1;31(3):171-6.
8. Taschieri S, Fabiani C, Franco V, Weinstein T, Del Fabbro M. Effect of sodium hypochlorite with the addition of a proteolytic enzyme on postoperative discomfort: a multicenter randomized clinical trial. Minerva Stomatol. 2009 Sep;58(9):415-23.
9. Gordon TM, Damato D, Christner P. Solvent effect of various dilutions of sodium hypochlorite on vital and necrotic tissue. Journal of endodontics. 1981 Jan 1;7(10):466-9.
10. Hwang WS, Sherman RL, Cotton WR, Montgomery S, Pelleu GW. Effect of sodium-hypochlorite on periapical tissues. Injournal of dental research 1619 duke st, alexandria, va 22314: amer assoc dental research.1980 ;(59):967- 976.
11. McDonnell G, Russell AD. Antiseptics and disinfectants: activity, action, and resistance. Clinical microbiology reviews. 1999 Jan 1;12(1):147-79.
12. Russell AD, Day MJ. Antibacterial activity of chlorhexidine. Journal of Hospital Infection. 1993 Dec 1;25(4):229-38.
13. Delany GM, Patterson SS, Miller CH, Newton CW. The effect of chlorhexidine gluconate irrigation on the root canal flora of freshly extracted necrotic teeth. Oral surgery, oral medicine, oral pathology. 1982 May 1;53(5):518-23.
14. Jeansonne MJ, White RR. A comparison of 2.0% chlorhexidine gluconate and 5.25% sodium hypochlorite as antimicrobial endodontic irrigants. Journal of Endodontics. 1994 Jun 1;20(6):276-8.
15. Gonçalves LS, Rodrigues RC, Junior CV, Soares RG, Vettore MV. The effect of sodium hypochlorite and chlorhexidine as irrigant solutions for root canal disinfection: a systematic review of clinical trials. Journal of endodontics. 2016 Apr 1;42(4):527-32.
16. Gondim Jr E, Setzer FC, Dos Carmo CB, Kim S. Postoperative pain after the application of two different irrigation devices in a prospective randomized clinical trial. Journal of Endodontics. 2010 Aug 1;36(8):1295-301.
17. Ali SG, Mulay S, Palekar A, Sejpal D, Joshi A, Gufran H. Prevalence of and factors affecting post-obturation pain following single visit root canal treatment in Indian population: A prospective, randomized clinical trial. Contemporary clinical dentistry. 2012 Oct;3(4):459.
18. Ercan E, Özekinci T, Atakul F, Gül K. Antibacterial activity of 2% chlorhexidine gluconate and 5.25% sodium hypochlorite in infected root canal: in vivo study. Journal of endodontics. 2004 Feb 1;30(2):84-7.
19. Siqueira Jr JF, Rôças IN, Paiva SS, Guimarães-Pinto T, Magalhães KM, Lima KC. Bacteriologic investigation of the effects of sodium hypochlorite and chlorhexidine during the endodontic treatment of teeth with apical periodontitis. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2007 Jul 1;104(1):122-30.
20. Ruiz-Hubard EE, Gutmann JL, Wagner MJ. A quantitative assessment of canal debris forced periapically during root canal instrumentation using two different techniques. Journal of Endodontics. 1987 Dec 1;13(12):554-8.
21. McKendry DJ. Comparison of balanced forces, endosonic, and step-back filing instrumentation techniques: quantification of extruded apical debris. Journal of Endodontics. 1990 Jan 1;16(1):24-7.
22. Habib S, Matthews RW, Scully C, Levers BG, Shepherd JP. A study of the comparative efficacy of four common analgesics in the control of postsurgical dental pain. Oral surgery, oral medicine, oral pathology. 1990 Nov 1;70(5):559-63.
23. Price DD, McGrath PA, Rafii A, Buckingham B. The validation of visual analogue scales as ratio scale measures for chronic and experimental pain. Pain. 1983 Sep 1;17(1):45-56.
24. Genet JM, Wesselink PR, Van Velzen ST. The incidence of preoperative and postoperative pain in endodontic therapy. International endodontic journal. 1986 Sep;19(5):221-9.
25. Genet JM, Wesselink PR, Van Velzen ST. The incidence of preoperative and postoperative pain in endodontic therapy. International endodontic journal. 1986 Sep;19(5):221-9.

26. White RR, Hays GL, Janer LR. Residual antimicrobial activity after canal irrigation with chlorhexidine. Journal of endodontics. 1997 Apr 1;23(4):229-31.
27. Rosenthal S, Spångberg L, Safavi K. Chlorhexidine substantivity in root canal dentin. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2004 Oct 1;98(4):488-92.
28. Attar S, Bowles WR, Baisden MK, Hodges JS, McClanahan SB. Evaluation of pretreatment analgesia and endodontic treatment for postoperative endodontic pain. Journal of endodontics. 2008 Jun 1;34(6):652-5.