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Original Research Article

Comparison of Postoperative Pain in Root Canal Treatment by Using Sodium Hypochlorite and Chlorhexidine-based Root Canal Irrigants

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Abstract: *Postoperative pain following root canal treatment remains a common clinical concern and may be influenced by the type of irrigant used during the procedure.* ***Objective:*** *To compare the frequency of postoperative pain observed in root canal treatment by using sodium hypochlorite and chlorhexidine-based root canal irrigants.* ***Methods:*** *This study was conducted on 168 patients diagnosed with irreversible pulpitis in posterior teeth who underwent root canal treatment, and were allocated via lottery into two equal groups. Group A received irrigation with 5.25% sodium hypochlorite, while Group B received 2% chlorhexidine. Postoperative pain was evaluated in both groups using a 10-point Visual Analogue Scale (VAS), with a score of ≥3 indicating significant pain at 45 days after treatment. SPSS 23 was used for analysing the data.* ***Results:*** *Postoperative pain was reported significantly more frequently in the sodium hypochlorite group, with 26 (31.0%) cases experiencing pain, compared with 13 patients (15.5%) in the chlorhexidine group (p=0.01). The incidence of postoperative swelling was 10.7% in Group A and 4.8% in Group B. Postoperative bleeding was observed in 8.3% and 6.0% cases, respectively, in both groups.* ***Conclusion:*** *The present study found that the frequency of pain was lower in root canal treatment with chlorhexidine as the root canal irrigant compared with sodium hypochlorite.*

Keywords: Postoperative pain, Root canal irrigation, Sodium hypochlorite, Chlorhexidine, Irreversible pulpitis, Visual Analogue Scale.

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Introduction

Several antimicrobial irrigants are used to assist in shaping and cleaning the root canal, particularly in cases with complex canal anatomy where instruments cannot reach, with the primary goal of eradicating microorganisms. Additionally, the use of endodontic instruments creates a smear layer that occludes dentinal tubules, delaying effective canal disinfection (1-3). Ideal root canal irrigants should be non-toxic, possess antibacterial characteristics, be capable of dissolving both the organic and inorganic tissue, and effectively debride the entire root canal system (4, 5).

They should also provide lubrication to prevent instruments from binding throughout canal preparation. Sodium hypochlorite (NaOCl) is generally used in clinical practice at concentrations ranging from 0.5% to 5.25%. NaOCl is alkaline, demonstrating both tissue-dissolving effects and antimicrobial activity. However, it has numerous limitations, including the unpleasant taste, failure to remove the smear layer, and relatively mild antibacterial activity. Another extensively employed irrigant is 2% chlorhexidine (CHX). This is a strong base with potent antibacterial properties, but it is not recommended as the sole irrigant in routine endodontic management because it cannot remove necrotic tissue residues (5, 6).

Several studies have explored the influence of irrigants on post-endodontic pain. One study compared 5.25% NaOCl and 2% CHX regarding postoperative discomfort, finding that only 3% of patients in each group experienced moderate pain at 24 hours after treatment. However, no statistically significant differences were documented between the two irrigants (7-10). Another study using the same methodology observed no significant differences in pain at 48 hours. However, one study reported pain occurrence rates of 33.3% with NaOCl and 16.7% with CHX during root canal treatment (11).

Postoperative pain after root canal treatment is a common clinical concern that can affect patient comfort. NaOCl is widely used for its tissue-dissolving and antimicrobial properties, while CHX is valued for its robust antibacterial activity but cannot dissolve necrotic tissue. Comparing postoperative pain associated with NaOCl and CHX irrigants is therefore essential to guide clinicians in choosing the most effective and patient-friendly irrigation protocol, enhancing both disinfection and postoperative comfort during endodontic treatment.

Methodology

This comparative study was conducted from 21 July 2024 to 21 January 2025 in the Department of Operative Dentistry and Endodontics, Rehman Medical Institute, Peshawar. The study commenced after ethical approval from the hospital's IRB. The sample size for the study was determined using the World Health Organization sample size calculator, based on the anticipated frequency of postoperative pain of 33.30% for sodium hypochlorite and 16.70% for chlorhexidine, taken from a previous study, with a confidence interval 95% and a power of 80%, the sample size was 168. Consecutive non-probability sampling was used.

The included patients were of either gender, aged between 18 and 70 years, presenting with irreversible pulpitis (Lingering sensation of pain on electric pulp testing with severity on VAS > 4) in a posterior tooth (maxillary or mandibular premolar or molar). Patients with periapical periodontitis, discharging sinus, periapical radiolucency, history of tooth trauma, or pregnancy were excluded.

Patients provided written informed consent. Baseline demographics, including age, gender, and BMI, were recorded. Medical histories such as diabetes mellitus, hypertension, and smoking status were also recorded.

A total of 168 patients were divided into two equal groups (84 patients per group). Group A was assigned 2% CHX, and Group B was assigned to 5.25% NaOCl as the irrigation solutions. The examination tooth was numbed with a local anesthetic. Rubber dam isolation was achieved after preparing the access cavity in rotated, tilted, heavily restored, and mal-aligned teeth. Once the canal was located and negotiated, the pulp was

removed using barbed broaches. Radiography was used to determine the appropriate working length. To prepare the canals, the manufacturer's recommendations for the ProTaper (Dentsply) universal files were followed, and irrigants from both sets were used simultaneously (crown-down technique). After each File canal was irrigated with 2ml of the irrigant using 30-gauge Max-i-probe syringes with side-vented needles. During irrigation, special care was taken to avoid pushing anything out. The canal walls were carefully avoided to prevent the needle from getting stuck. Pressure from the finger was used to extrude the irrigation fluid. The syringe was gently pushed to irrigate out. The distance from the irrigating needle to the root apex was marked with a stopper. The irrigation process required the needle to move up and down in the canal. Finally, the canals were dried with a paper point, and the entrance cavity was sealed with temporary restoration. No intracanal medication was used to mask the effectiveness of the irrigation. Postop pain was assessed after 48 hours using a Visual Analog Scale (VAS) ranging from 0 to 10, with 0 indicating no pain and 10 indicating worst pain. Pain was considered positive if the VAS score> 3. Swelling and bleeding were also recorded. Swelling was assessed using a six-point scale, ranging from zero (no swelling) to five (extreme severe swelling with trismus). A score greater than two was considered indicative of positive swelling. Postoperative bleeding was considered present if gauze was required to control bleeding after the procedure.

SPSS 23 software was used to analyze the data. The mean and standard deviation were used for age, BMI, and pain score. Frequencies and percentages were used for categorical variables such as gender, diabetes, hypertension, post-operative pain, swelling, bleeding, and smoking. Post-operative pain in both groups was compared using the chi-square test, with p-values ≤ 0.05 considered significant. Effect modifiers such as age, BMI, gender, diabetes, hypertension, swelling, bleeding, and smoking were addressed through stratification. Post-stratification chi-square/Fisher's exact test was conducted, with p-values ≤ 0.05 considered significant.

Results

This study included 168 patients, with 84 allocated to each group. The mean age of patients in Group A (Sodium hypochlorite) was 42.99 ± 15.96 years. The mean body mass index in this group was 23.49 ± 2.67 kg/m². Their mean postoperative pain score was 2.00 ± 1.58. There were 44 males (52.4%) and 40 females (47.6%) in this group.

In group B (Chlorhexidine), the mean patient age was 40.21 ± 14.62 years. Their mean body mass index was 22.41 ± 2.75 kg/m². The mean pain score in this group was 1.46 ± 1.34. There were 41 males (48.8%) and 43 females (51.2%) in this group.

Regarding the comorbidities, smoking was comparable between the groups. In Group A, 18 patients (21.4%) were smokers, while in Group B, 21 patients (25.0%) were smokers. Diabetes was present in 22 patients (26.2%) in the sodium hypochlorite group and 18 patients (21.4%) in the chlorhexidine group. Hypertension was reported by 20 patients (23.8%) in Group A and 22 patients (26.2%) in Group B (Table 1).

Postoperative bleeding was observed in 7 cases (8.3%) in Group A and 5 cases (6.0%) in Group B. Swelling occurred in 9 patients (10.7%) in sodium hypochlorite group and in 4 patients (4.8%) in chlorhexidine group (Table 2).

Postoperative pain showed a significant difference between the two groups. Postoperative pain was reported by 26 patients (31.0%) in the sodium hypochlorite group and by 13 participants (15.5%) in the chlorhexidine group (P = 0.01) (Table 3). Table 4 presents the stratification of various demographics and comorbidities with postoperative pain in both groups.

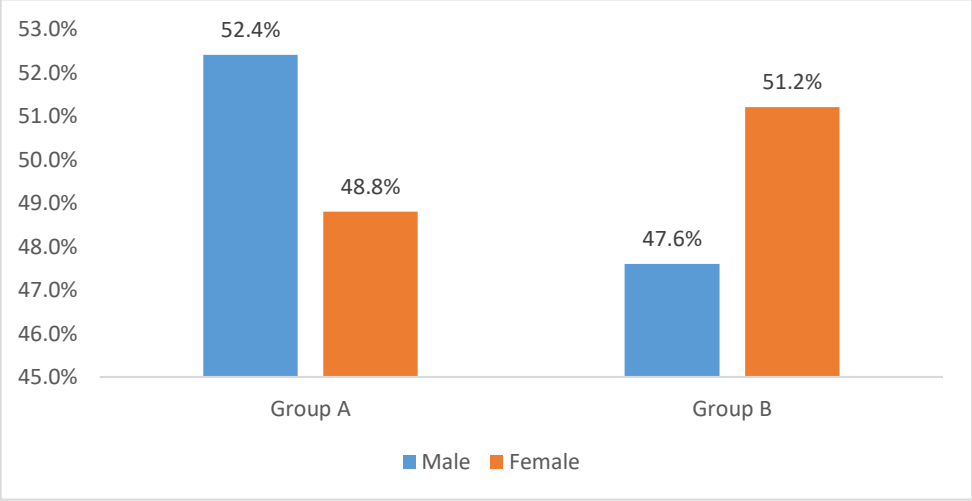

Figure 1: Gender distribution

Table 1: Comorbidities in patients in both groups

		Groups			
		Group A (Sodium Hypochlorite)		Group B (Chlorhexidine)	
		n	%	n	%
Gender	Male	44	52.4%	41	48.8%
	Female	40	47.6%	43	51.2%
Smoking	Yes	18	21.4%	21	25.0%
	No	66	78.6%	63	75.0%
Diabetes	Yes	22	26.2%	18	21.4%
	No	62	73.8%	66	78.6%
Hypertension	Yes	20	23.8%	22	26.2%

	No	64	76.2%	62	73.8%

Table 2: Incidence of bleeding and swelling in both groups

		Groups			
		Group A (Sodium Hypochlorite)		Group B (Chlorhexidine)	
		n	%	n	%
Bleeding	Yes	7	8.3%	5	6.0%
	No	77	91.7%	79	94.0%
Swelling	Yes	9	10.7%	4	4.8%
	No	75	89.3%	80	95.2%

Table 3: Comparison of postoperative pain between both groups

		Groups				P value
		Group A (Sodium Hypochlorite)		Group B (Chlorhexidine)		
		n	%	n	%	
Postoperative pain	Yes	26	31.0%	13	15.5%	0.01
	No	58	69.0%	71	84.5%	

Table 4: Stratification of demographics and comorbidities with postoperative pain in both groups

				Groups				P value
				Group A (Sodium Hypochlorite)		Group B (Chlorhexidine)		
				n	%	n	%	
Gender	Male	Postoperative pain	Yes	13	29.5%	7	17.1%	0.17
			No	31	70.5%	34	82.9%	
	Female	Postoperative pain	Yes	13	32.5%	6	14.0%	0.04
			No	27	67.5%	37	86.0%	
Smoking	Yes	Postoperative pain	Yes	9	50.0%	5	23.8%	0.08
			No	9	50.0%	16	76.2%	
	No	Postoperative pain	Yes	17	25.8%	8	12.7%	0.06
			No	49	74.2%	55	87.3%	
Diabetes	Yes	Postoperative pain	Yes	4	18.2%	2	11.1%	0.53
			No	18	81.8%	16	88.9%	
	No	Postoperative pain	Yes	22	35.5%	11	16.7%	0.01
			No	40	64.5%	55	83.3%	
Hypertension	Yes	Postoperative pain	Yes	5	25.0%	1	4.5%	0.05
			No	15	75.0%	21	95.5%	
	No	Postoperative pain	Yes	21	32.8%	12	19.4%	0.08
			No	43	67.2%	50	80.6%	
Bleeding	Yes	Postoperative pain	Yes	5	71.4%	2	40.0%	0.27
			No	2	28.6%	3	60.0%	
	No	Postoperative pain	Yes	21	27.3%	11	13.9%	0.03
			No	56	72.7%	68	86.1%	
Swelling	Yes	Postoperative pain	Yes	9	100.0%	4	100.0%	N/A
			No	0	0.0%	0	0.0%	
	No	Postoperative pain	Yes	17	22.7%	9	11.2%	0.05
			No	58	77.3%	71	88.8%	
Age groups (Years)	18 to 35	Postoperative pain	Yes	7	22.6%	8	19.0%	0.71
			No	24	77.4%	34	81.0%	
	36 to 50	Postoperative pain	Yes	13	50.0%	3	14.3%	0.01
			No	13	50.0%	18	85.7%	
	> 50	Postoperative pain	Yes	6	22.2%	2	9.5%	0.24
			No	21	77.8%	19	90.5%	
BMI (Kg/m^2)	18.5 to 24.9	Postoperative pain	Yes	16	30.2%	9	14.3%	0.03
			No	37	69.8%	54	85.7%	
	> 24.9	Postoperative pain	Yes	10	32.3%	4	19.0%	0.29
			No	21	67.7%	17	81.0%	

Discussion

Endodontic treatment aims to eliminate infection from the root canal system to improve periapical health. A notable challenge in clinical practice is the occurrence of postoperative pain, which impacts patient comfort and perception of care. The choice of irrigant is a critical factor in canal disinfection, with sodium hypochlorite (NaOCl) and chlorhexidine (CHX) being the most widely studied solutions. The existing literature presents a complex picture of their influence on postoperative symptoms. Some studies report comparable outcomes with

both irrigants. Amjad et al. found no statistically significant difference in pain 24 hours post-treatment between 2.5% NaOCl and 2% CHX gluconate, with adequate pain control in 83.3% and 76.7% of cases, respectively. (11) Similarly, Sarmento et al. reported that across multiple clinical trials, there was no apparent influence of the NaOCl or CHX on postoperative pain in teeth with pulp necrosis. However, one included trial reported an increase in pain with NaOCl at the six-hour mark. (8)

Bashetty et al. in their study demonstrated that the use of 5.25% NaOCl resulted in significantly higher pain scores at the sixth postoperative hour compared to 2% CHX, by 24 hours, no difference was observed. (7) This transient effect may be attributed to the immediate cytotoxic potential of higher NaOCl concentrations if extruded periapically. An earlier study by Qazi et al. reported that normal saline, while not antimicrobial, resulted in less postoperative pain than 2.6% NaOCl.(12) The antimicrobial properties of CHX are well-documented, but its inability to dissolve organic tissue remains a drawback compared to NaOCl. Studies on endotoxin reduction found that while both 2.5% NaOCl and 2% CHX gel reduced lipopolysaccharide (LPS) levels, neither eliminated it, with NaOCl showing a statistically greater percentage reduction. (13) This suggests that pain etiology is multifactorial, involving not just microbial load but also the patient's inflammatory response to the irritants.

Factors such as vital or necrotic pulp, instrumentation technique, irrigant concentration, and the definition and measurement timeframe for pain all contribute to varied outcomes. Studies focusing on necrotic teeth with established apical periodontitis may reflect different biological challenges compared to those including teeth with irreversible pulpitis. (8) Postoperative pain is not dictated by irrigant choice alone but is instead a result of a complex interaction between chemical irritation, microbial reduction efficacy, mechanical debridement, and individual patient factors.

The present study contributes by evaluating postoperative pain in a cohort of 168 patients. The frequency of local postoperative complications, such as bleeding and swelling, was low overall, with a non-significant trend toward greater swelling in the NaOCl group.

The present study found a statistically significant difference in postoperative pain incidence. Pain was reported by 31.0% of patients in the sodium hypochlorite group and by 15.5% in the chlorhexidine group ($p = 0.01$). This result aligns with the observations of Bashetty et al., who noted greater early pain with NaOCl.(7) The findings of this study contrast with those of Amjad et al., who reported equal efficacy of both irrigation chemicals. This difference may be explained by differences in NaOCl concentration. The present results suggest that chlorhexidine may offer an advantage in decreasing postoperative pain. This could be due to its lower tissue toxicity compared to NaOCl and its substantive antimicrobial action, which may provide prolonged microbial control without the initial chemical irritation associated with hypochlorite solutions.

The present study contributed to the existing evidence by showing that chlorhexidine is associated with a lower incidence of postoperative pain than sodium hypochlorite in routine clinical practice, suggesting its role as a primary irrigant in cases where postoperative pain is a significant concern.

Conclusion

In conclusion, the frequency of pain was lower in root canal treatment with chlorhexidine as the root canal irrigant compared with sodium hypochlorite.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRB)

Consent for publication
Approved

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Conflict of interest

The authors declared no conflict of interest.

Author Contribution

TN (Postgraduate Resident)
Data Collection, Data Analysis, Study Design and Manuscript drafting.
IUK (Professor)
Critical Input, Conception of Study and Final approval
AAK (Associate Professor)
Literature search and critical guidance
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Literature search

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Peters OA, Peters CI, Basrani B. Cleaning and shaping of the root canal system. In: Berman LH, Hargreaves KM, editors. Cohen's Pathways of the Pulp. 12th ed. Elsevier; 2020. p. 236-303. https://doi.org/10.1016/B978-0-323-06489-7.00009-6
2. Di Spirito F, Pisano M, Caggiano M, Bhasin P, Lo Giudice R, Abdellatif D. Root canal cleaning after different irrigation techniques: an ex vivo analysis. Medicina. 2022;58(2):193. https://doi.org/10.3390/medicina58020193
3. Qutieshat A, Al Harthy N, Al Busaidi S, Al Sadoon A, Al Sayahien D, Sedqi M, et al. Antimicrobial irrigation solutions in root canal treatment: a glance at the past, the present, and the future. Open Dent J. 2023;17(1):e187421062306010. https://doi.org/10.2174/18742106-v17-230621-2023-5
4. Darcey J, Jawad S, Taylor C, Roudsari RV, Hunter M. Modern endodontic principles part 4: irrigation. Dent Update. 2016;43(1):20-33. https://doi.org/10.12968/denu.2016.43.1.20
5. Rahimi S, Janani M, Lotfi M, Shahi S, Aghbali A, Vahid Pakdel M, et al. A review of antibacterial agents in endodontic treatment. Iran Endod J. 2014;9(3):161-168.
6. Almeida G, Marques E, De Martin AS, da Silveira Bueno CE, Nowakowski A, Cunha RS. Influence of irrigating solution on postoperative pain following single-visit endodontic treatment: randomized clinical trial. J Can Dent Assoc. 2012;78:c84.
7. Bashetty K, Hegde J. Comparison of 2% chlorhexidine and 5.25% sodium hypochlorite irrigating solutions on postoperative pain: a randomized clinical trial. Indian J Dent Res. 2010;21(4):523-527. https://doi.org/10.4103/0970-9290.74225
8. Borgo Sarmento E, Guimarães L, Tavares S, Thuller KABR, Antunes L, Antunes L, et al. The influence of sodium hypochlorite and chlorhexidine on postoperative pain in necrotic teeth: a systematic review. Eur Endod J. 2020;5(3):177-185. https://doi.org/10.14744/eej.2020.94830

9. Neelakantan P, Herrera DR, Pecorari VGA, Gomes BPFA. Endotoxin levels after chemomechanical preparation of root canals with sodium hypochlorite or chlorhexidine: a systematic review of clinical trials and meta-analysis. Int Endod J. 2019;52(1):19-27. https://doi.org/10.1111/iej.12963
10. Saba K, Maxood A, Abdullah S, Riaz A, Uddin S. Comparison of frequency of pain in root canal treatment using sodium hypochlorite and chlorhexidine as root canal irrigants. J Pak Med Assoc. 2018;68(9):1334-1338.
11. Amjad S, Afreen Z, Afreen A, Shuja E, Rasheed H, Rashid S. Comparison of pain observed with sodium hypochlorite and chlorhexidine-based root canal irrigant 24 hours post appointment. J Rawalpindi Med Coll. 2022;26(4):594-599. https://doi.org/10.37939/jrmc.v26i4.1932
12. Qazi SS, Manzoor MA, Qureshi R, Khan HH. Comparison of postoperative pain: normal saline vs sodium hypochlorite as irrigants. Pak Oral Dent J. 2005;25(2):177-182.
13. Gomes BPFA, Martinho FC, Vianna ME. Comparison of 2.5% sodium hypochlorite and 2% chlorhexidine gel on oral bacterial lipopolysaccharide reduction from primarily infected root canals. J Endod. 2009;35(10):1350-1353. https://doi.org/10.1016/j.joen.2009.06.011