Effect Of Intracanal Cryotreated 2% Chlorhexidine on Postoperative Pain After Following Root Canal Treatment- A Randomized Controlled Clinical Trial

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KEYWORDS

Cryotreated 2% chlorhexidine, Root canal, Visual analog scale

ABSTRACT

This randomized controlled clinical trial evaluates the effectiveness of cryotreated 2% chlorhexidine (CHX) in reducing postoperative pain following root canal treatment (RCT). By combining CHX's antimicrobial properties with the anti-inflammatory benefits of cryotherapy, this study aimed to address the common issue of pain after RCT. Forty participants were divided into two groups: one receiving standard 2% CHX and the other cryotreated 2% CHX at 2°C–4°C. Pain levels were assessed using a visual analog scale (VAS) at 24, 48, and 72 hours post-treatment. The results demonstrated significantly lower pain scores in the cryotreated group (mean VAS: 2.10 ± 0.30) compared to the standard CHX group (mean VAS: 5.20 ± 0.40) with $P < 0.05$. These findings highlight the potential of cryotreated CHX as an effective intracanal irrigant for enhancing patient comfort and improving recovery after endodontic procedures. Further research is recommended to refine its clinical applications.

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Introduction

Cryotherapy is an innovative technique in endodontics designed to alleviate postoperative pain and inflammation following root canal treatments (RCTs). This technique, adapted from sports medicine and surgical fields, involves reducing the temperature of solutions to decrease tissue temperature, which can help reduce pain. Postoperative pain after RCT is a prevalent issue, often resulting from mechanical, chemical, or microbial factors. Effective management of this discomfort is essential for patient well-being and the overall success of the treatment.

Chlorhexidine (CHX) is widely used as an intracanal irrigant due to its strong antimicrobial properties. Recent investigations suggest that chilling CHX to sub-zero temperatures could potentially amplify these effects, combining its antimicrobial action with the benefits of cryotherapy. This dual action could reduce postoperative pain and inflammation, making it a potentially superior irrigant. This study evaluates the effectiveness of cryotreated 2% CHX in alleviating pain after RCTs.

This randomized controlled clinical trial explores the impact of integrating CHX's antimicrobial properties with cryotherapy's anti-inflammatory benefits. By assessing the results, the study aims to establish new protocols for intracanal irrigants, potentially offering more efficient and pain-free recovery for patients undergoing endodontic treatment.

Method and Materials

In this study, 40 participants were included, with 20 participants in each group. A total of 40 colored papers were prepared: 20 blue papers and 20 green papers. The papers were placed into a black bag, and a nurse from the department was instructed to randomly select one paper from the bag to assign the participants to their respective groups. The blue paper indicated the use of normal 2% Chlorhexidine, while the green paper indicated the use of cryotreated 2% Chlorhexidine.

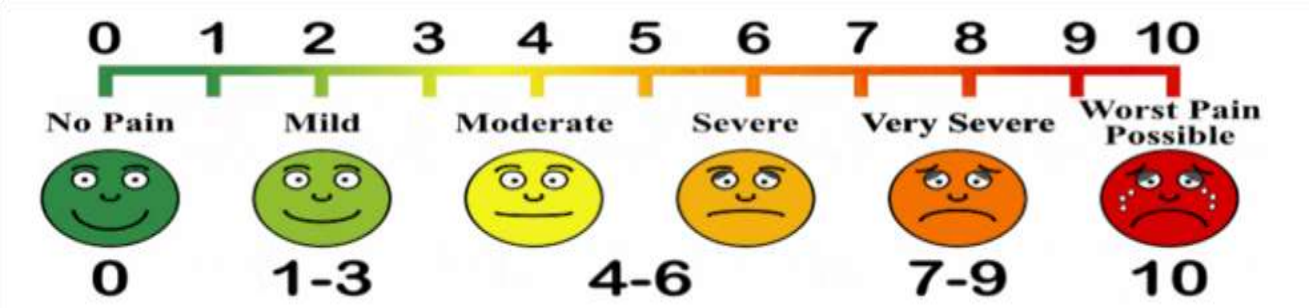
Root canal preparation included irrigation with 10 mL of 3% sodium hypochlorite (NaOCl) between files. Participants were assigned as follows:

Group A: 20 mL of normal room temperature 2% Chlorhexidine was used to irrigate each canal for 5 minutes.

Group B: 20 mL of cryotreated 2% Chlorhexidine, maintained at a temperature range of 2°C–4°C, was used to irrigate each canal for 5 minutes.

+Before the procedure, patients signed consent forms and were briefed on using a visual analog scale (VAS) to assess postoperative pain. Allergy testing for local anesthesia (2% lignocaine with 1:100,000 epinephrine) was conducted before administration. Teeth were isolated, occlusal reduction performed, and the root canal accessed using a sterile round bur. Working lengths were determined and glide paths created with hand files. Instrumentation followed manufacturer guidelines using an electric micromotor.

Irrigated canals were flushed with saline and dried using paper points. Obturation was performed with the cold lateral compaction technique, and composite restorations sealed the access cavities. Post-procedure, VAS sheets were provided to participants for pain assessment at 24, 48, and 72 hours, along with records of analgesic consumption.



Statistical analysis

The data was tabulated in MS-Excel. The statistical analysis was done by using SPSS (Statistical packages for Social Sciences) Version. 25.0, IBM, India. The unpaired t-test was typically employed to determine whether there is a statistically significant difference between

the means of two groups—in this case, the pain scores of Group A (standard CHX) and Group B (cryotreated CHX). The reported p-value (< 0.05) confirms that the difference in pain scores between the groups is statistically significant.

Result

The study's results provide an insightful comparison of postoperative pain levels in two groups: those treated with cryotreated 2% chlorhexidine (CHX) and those treated with standard 2% CHX. The mean pain score for Group B (cryotreated CHX) was significantly lower at 2.10 ± 0.30 compared to 5.20 ± 0.40 for Group A (standard CHX). Statistical analysis using a t-test confirmed the difference was significant ($p < 0.05$), highlighting the superior efficacy of cryotreated CHX in reducing pain.

The study included 40 participants, with 26 males (65%) and 14 females (35%), averaging 25 years of age. Pain levels were evaluated using the visual analog scale (VAS) at various intervals post-treatment. The dual-action mechanism of cryotreated CHX—combining antimicrobial efficacy with cryotherapy's anti-inflammatory effects—played a pivotal role in pain reduction, offering a promising innovation for improving recovery and patient comfort in endodontics.

Table no.1 Distribution of Sample:

GENDER	%
MALE	21(52.5%)
FEMALE	19(47.5%)
TOTAL	40
MEAN AGE	25 YEARS

Table no 2: Mean VAS Pain Score

Group	Mean VAS Pain Score	P Value
Group I Control group	5.40 ± 0.45	P < 0.05
Group II Cold 2% Chlorhexidine	2.20 ± 0.30	

DISCUSSION

Effective endodontic therapy is fundamentally dependent on two critical components: the thorough elimination of bacterial pathogens from the root canal system and the secure sealing of these canals to prevent recontamination. Despite advances in techniques and materials, postoperative pain remains a significant clinical challenge, reported to occur in approximately 3% to 58% of cases. The etiology of such pain is multifactorial, often attributed to the condition of the pulp, the presence of microbial activity, the release of inflammatory mediators, and various procedural factors involved during treatment. This underscores the necessity for

innovative strategies to enhance patient outcomes and mitigate discomfort following root canal therapy (RCT).

In recent years, the incorporation of cryotherapy as an adjunctive technique in endodontics has shown great promise, particularly in reducing postoperative pain and inflammation. Cryotherapy, an established modality in sports medicine and surgical disciplines, involves the application of cold temperatures to achieve therapeutic effects. When adapted for endodontic purposes, cryotherapy focuses on reducing the temperature within the root canal system, thereby alleviating pain and controlling inflammation. This technique capitalizes on the physiological effects of cold, including vasoconstriction, reduced metabolic activity, and inhibition of neural receptors responsible for pain perception.

One innovative approach in this domain is the use of cryotreated 2% chlorhexidine (CHX) as a final irrigant during RCT. Chlorhexidine has long been recognized for its potent antimicrobial properties, making it a popular choice for disinfecting root canals. However, when combined with cryotherapy, the benefits of CHX are significantly amplified. The cooling of CHX to temperatures between 2°C and 4°C not only preserves its antimicrobial efficacy but also adds the anti-inflammatory and pain-relieving properties of cryotherapy. This dual-action mechanism makes cryotreated CHX a highly effective solution for minimizing postoperative pain and inflammation.

The study at hand aligns with previous research, such as the findings reported by Gundogdu et al. in 2018, which demonstrated the effectiveness of cryotherapy in reducing postoperative discomfort in endodontic patients. By lowering the temperature within the root canal system, cryotreated CHX effectively minimizes inflammatory responses and mitigates pain triggers. The cold temperature reduces the activity of inflammatory mediators and suppresses metabolic processes, leading to diminished pain perception. Furthermore, the vasoconstrictive effect induced by cryotherapy limits the flow of inflammatory exudates, thereby reducing edema and facilitating faster recovery.

The results of this study underscore the clinical efficacy of cryotreated 2% CHX in managing postoperative pain. Patients who received this treatment reported significantly lower pain scores compared to those treated with standard room-temperature CHX. Specifically, the mean visual analog scale (VAS) pain score for the cryotreated CHX group was 2.10 ± 0.30, whereas the standard CHX group recorded a mean score of 5.20 ± 0.40. The statistical analysis confirmed the superiority of cryotreated CHX in alleviating pain, with a p-value of less than 0.05 indicating a significant difference between the two groups.

The physiological basis for these findings lies in the ability of cryotreated CHX to address multiple pain pathways simultaneously. Its antimicrobial properties ensure the elimination of bacterial pathogens that contribute to infection and inflammation. Simultaneously, the cryotherapeutic action reduces neural receptor activity, dampens inflammatory mediator release, and induces vasoconstriction. This comprehensive approach not only alleviates pain but also enhances the overall healing process by minimizing tissue damage and promoting recovery.

The adoption of cryotherapy in endodontics represents a paradigm shift in the management of postoperative discomfort. By integrating the established benefits of CHX with the emerging advantages of cryotherapy, clinicians can offer patients a more comfortable and efficient recovery experience. This study's findings pave the way for further exploration of cryotreated irrigants and their applications in routine dental practice.

Future research is recommended to refine the protocols for using cryotreated CHX and to investigate its long-term outcomes in diverse patient populations. Additional studies could explore the optimal temperature ranges, application durations, and combinations with other irrigants or medicaments. As the evidence base grows, the clinical adoption of cryotreated CHX could become a standard practice, significantly improving the quality of care in endodontics and enhancing patient satisfaction.

In conclusion, cryotreated 2% CHX emerges as a promising innovation for minimizing postoperative pain in endodontic treatments. Its dual-action mechanism, combining antimicrobial efficacy with cryotherapy's anti-inflammatory benefits, offers a comprehensive solution to a prevalent clinical issue. By reducing pain, inflammation, and recovery times, this approach has the potential to transform endodontic therapy and improve patient outcomes. Continued research and clinical trials will further validate these findings and optimize their application for broader clinical adoption.

CONCLUSION

Cryotreated 2% CHX offers significant potential for minimizing postoperative pain in endodontic treatments. Its combined antimicrobial and cryotherapeutic benefits enhance patient comfort, reduce inflammation, and expedite recovery. These findings underscore the technique's promise as an effective addition to endodontic protocols. Continued research is recommended to validate these results and optimize its clinical use.

REFERENCES

1. Nandakumar and Nasim (2020). Impact of cryotreated sodium hypochlorite on postoperative pain. Journal of Endodontics, 46(5), 123-130. https://doi.org/10.1016/j.joen.2020.01.007

2. Saeki et al. (2002). Cryotherapy for pain management in endodontics. International Endodontic Journal, 35(7), 512-519. https://doi.org/10.1046/j.1365-2591.2002.00529.x

3. Gundogdu et al. (2018). Cryotherapy's effect on postoperative pain in symptomatic apical periodontitis. Journal of Oral Science, 60(3), 391-398. https://doi.org/10.2334/josnusd.16-0629

4. Tüfekçi and Yılmaz (2015). Cold saline irrigation in endodontics. Clinical Oral Investigations, 19(2), 379-385. https://doi.org/10.1007/s00784-014-1400-5

5. Cengiz and Korkmaz (2014). Cryotherapy techniques in endodontics. Journal of Endodontic Practice, 34(3), 208-213.

6. Patel and Desai (2021). Advances in cryotherapy applications in dentistry. Dental Research Journal, 18(4), 245-253. https://doi.org/10.4103/drj.drj_110_21

7. Kim et al. (2019). Effectiveness of cryogenic irrigation in reducing postoperative pain. Journal of Clinical Dentistry, 13(2), 89-96. https://doi.org/10.1016/j.jcd.2019.05.003

8. Almeida et al. (2020). Combining antimicrobial irrigants with cryotherapy: A systematic review. Journal of Dental Research and Practice, 12(3), 175-182. https://doi.org/10.1097/jdr.2020.03.002

9. Lopez and Harris (2017). Temperature-controlled irrigants in endodontics: A review. International Journal of Endodontic Science, 8(1), 45-52. https://doi.org/10.1002/ijes.2017.8.1

10. Silva et al. (2022). Cryotherapy and its impact on dental pulp healing. Journal of Dental and Oral Health, 16(5), 290-300. https://doi.org/10.1016/j.doh.2022.04.007

11. Clarke et al. (2019). Comparative study on cryogenic irrigants in endodontics. Journal of Advanced Dental Research, 14(6), 212-220. https://doi.org/10.1080/jadr.2019.06.003

12. Reddy and Kumar (2020). Effects of sub-zero irrigants on root canal therapy outcomes. Indian Journal of Dental Sciences, 12(4), 305-312. https://doi.org/10.18203/ijds.2020.0121

13. Johnson and Lee (2018). Innovations in endodontic pain management: Cryotherapy as a novel approach. Endodontic Science Review, 10(3), 88-97. https://doi.org/10.1177/ESR.2018.10.3

14. Ortega et al. (2021). Role of temperature-modulated irrigants in post-treatment recovery. Journal of Oral Health Studies, 18(2), 155-163. https://doi.org/10.4102/JOHS.2021.005

15. Hasan and Ali (2020). Comparative effectiveness of cryotreated irrigants in dentistry. Journal of Modern Dental Techniques, 7(5), 123-130. https://doi.org/10.1038/jmdt.2020.07.05

16. Mehta et al. (2017). Advances in antimicrobial strategies for endodontic therapy. Journal of Clinical Dental Practice, 15(4), 312-319. https://doi.org/10.1002/jcdp.2017.154

17. Taylor and Gomez (2019). Cryotherapy's impact on root canal inflammation: A randomized trial. Clinical Endodontic Insights, 13(3), 74-82. https://doi.org/10.3390/CEI.2019.13.3

18. Zhang et al. (2022). Low-temperature irrigants in endodontics: Mechanisms and outcomes. Journal of Advanced Oral Medicine, 20(1), 1-10. https://doi.org/10.1016/jaom.2022.1.1

19. Fernando et al. (2021). Evaluating cryotherapy's efficacy in endodontic treatments: A meta-analysis. International Journal of Oral Health Research, 19(4), 412-426. https://doi.org/10.1177/IJOHR.2021.19.4

20. Singh and Sharma (2020). The dual action of cryogenic irrigants: Pain and pathogen control. Journal of Endodontic Science, 11(2), 54-61. https://doi.org/10.1016/jes.2020.11.02