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Original Article

Intracanal Cryotherapy in Post-operative Pain Management

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Abstract

Introduction: Postoperative pain is a frequent occurrence after root canal treatment. Various nonsteroidal anti-inflammatory drugs and corticosteroids have been used over the years for effective pain management. Although these drugs are generally considered safe, several side effects have been observed. cryotherapy has recently been employed in dentistry to help with pain and inflammation. Therefore, this study aimed to compare and evaluate the effect of cryotherapy and analgesics in reducing pain after endodontic treatment.

Method: A total of 30 patients who met with the inclusion criteria were randomly divided into 2 groups(n=15). Cold saline was used as final irrigant for Group 1 patients. For Group 2 patients saline at room temperature was used and analgesics were prescribed. Visual Analogue Scale forms were given to patients to record post operative pain after 6 hours, 24 hours and 72 hours.

Results: A statistically significant results were obtained when Visual Analogue Scale scores were analysed using Mann-Whitney test, Friedman test and Wilcoxon sign test. The least post endodontic pain was in group 1 after 24 hours.

Conclusion: Intracanal cryotherapy showed similar results to analgesics. Within the limitations of this study, it was concluded that cryotherapy can be used as an alternative for analgesics for post operative pain management.

Key words: Analgesics, Corticosteroids, Cryotherapy, Non-steroidal anti-inflammatory drugs, Post operative pain, Visual Analogue Scale.

INTRODUCTION

Management of interappointment pain is one of the most important aspects of endodontic practice, with a reported range of 3–58%.[1] The major cause of interappointment pain is the extrusion of debris, periradicular inflammation, changes in periapical pressure, mechanical, chemical, and microbial factors leading to physical irritation of periapical apparatus and psychological factors.[2,3]

To control pain and to reverse inflammation use of analgesics, NSAIDs and corticosteroids have been suggested. Despite being relatively safe medications, they may cause gastrointestinal, renal, hepatic, and respiratory problems. To avoid these complications recently, cryotherapy has been proposed.[4-6]

Cryotherapy also known as cold therapy means reducing tissue temperature as an alternative to traditional treatment methods. Cryotherapy is being used in medicine to reduce musculoskeletal pain, to treat skin condition and cancer, post-operative care for abdominal and gynecological operations, hip or knee replacement surgery, and also, whole-body cryotherapy to help with pain and inflammation. Therefore, cryotherapy might be an alternative method for managing interappointment pain.[7]

Delivery of cold saline for 5 min as a final irrigant in root canal treatment is termed intracanal cryotherapy. In 2015, *in vitro* study published by Vera *et al.* showed that intracanal cryotherapy reduced external root surface temperature

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and has an anti-inflammatory effect on the periradicular tissues.[8,9]

Many studies investigated the use of cryotherapy in different clinical scenarios. To best our knowledge, only few studies evaluated the efficacy of intracanal cryotherapy in managing interappointment pain.

Therefore, the aim of this study was to compare and evaluate the role of cryotherapy and conventional method in reducing interappointment pain after biomechanical preparation.

MATERIALS AND METHODS

This study was conducted in the department of conservative dentistry and endodontics, Sharavathi Dental College and Hospital, Shivamogga. The protocol for the study was approved by local ethical committee. Patients who visited the outpatient department with the chief complaint of pain were examined clinically and radiographically. Proper palpation and percussion tests were performed.

All patients were informed of the aims and design of the study and written consent was obtained before their enrollment.

A questionnaire was distributed to patients to note down Visual Analog Scale (VAS) score for pre-treatment pain in which 0 being the total absence of pain and 10 being the most unbearable pain [Figure 1].

VAS score:
- 0: No pain
- 1–3: Mild pain
- 4–6: Moderate pain
- 7–9: Severe pain
- 10: Worst pain.

Inclusion Criteria
- Teeth with sharp pain (>7 on a VAS chart)
- Pain on percussion
- Diagnosis of symptomatic irreversible pulpitis, pulp necrosis, and symptomatic apical periodontitis.

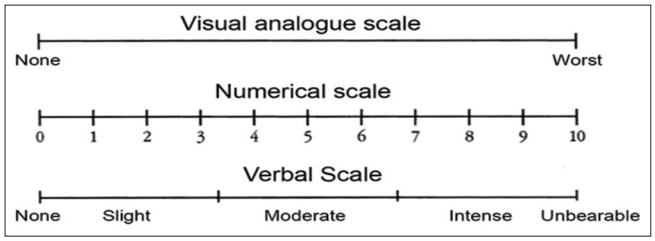


Figure 1: Visual Analog Scale

Exclusion Criteria
- Medically compromised patients
- Allergic patients
- Pregnant women
- Radiographically periapical radiolucency larger than 8 mm
- External or internal root resorption
- Teeth with open apices
- Vertical root fracture, calcification, or perforation
- Root canal retreatment
- Patients already under anti-inflammatory medication.

Sample Size Calculation
A power analysis was established by G*power, version 3.0.1 (Franz Faul Universitat, Kiel, Germany). A sample size of 24 (12 per group) would yield 80% power to detect significant differences, assuming the effect size of 0.25 and significance level of 0.05.

Considering 20% attrition rate, total sample size is 30 (15 per group).

Grouping
A total of 30 patients who met the inclusion criteria were included in the study. Patients were randomly assigned into two groups.

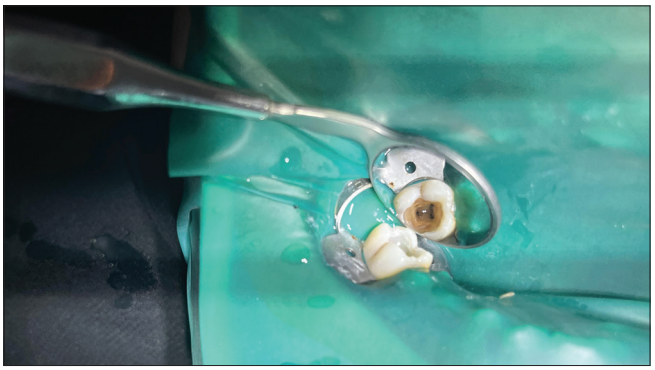


Figure 2: Rubber dam isolation and access cavity preparation

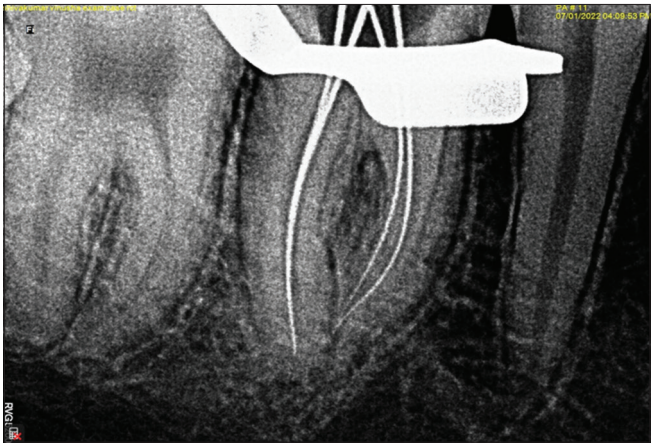


Figure 3: Working length determination

- Group 1 (n = 15): Intracanal cryotherapy group where cold saline was used as the final irrigant
- Group 2 (n = 15): Control group where the final irrigant was saline at room temperature and patients were prescribed analgesics.

Treatment Procedure

Patients were anesthetized with 2% lignocaine with adrenaline 1: 80,000 (Indoco Remedies Ltd, India). Rubber dam isolation was done followed by access cavity preparation using sterile round bur [Figure 2]. Pulp extirpation was done. The working length was first determined with a Root ZX apex locator (J Morita Corp, Kyoto, Japan) using 10k and 15k files and confirmed radiographically [Figure 3]. Eighteeth E-connect

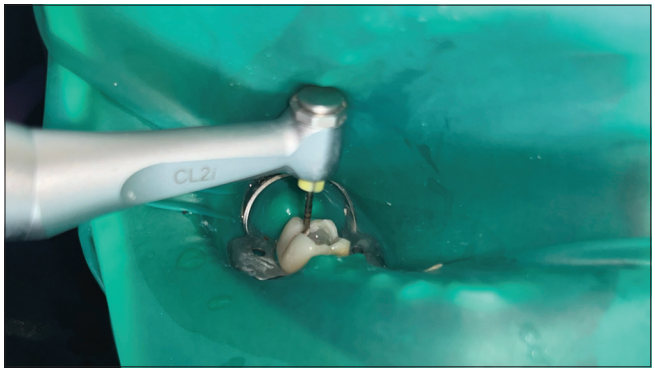


Figure 4: Biomechanical preparation

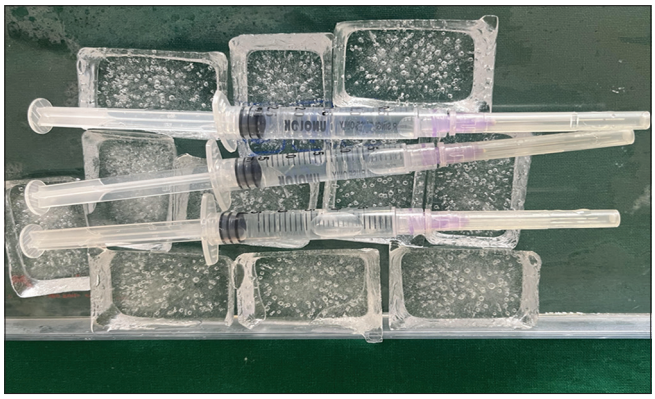


Figure 5: Syringes stored in ice container

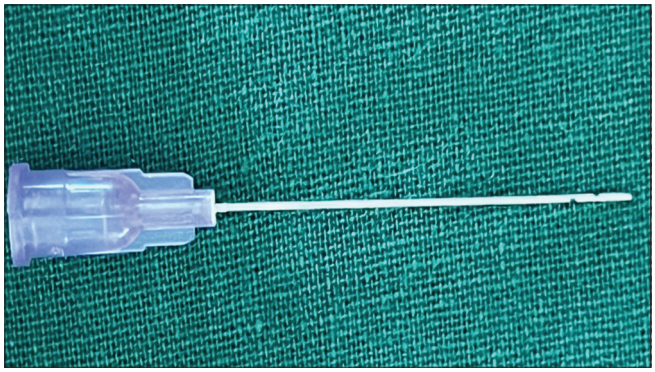


Figure 6: Side-vented need

Figure 7: Irrigation using a side-vented needle

Figure 8: A final irrigation with normal saline

Figure 9: Normal saline at room temperature

Endomotor (Changzhou Eighteeth Medical Technology Co., Ltd.) set to instructions provided by the manufacturer was used to prepare the canals. Neoendo rotary files were used for biomechanical preparation [Figure 4]. The files were used sequentially. The cervical third of the root canal was flared using orifice opener. Between instrumentations, 3 mL of 2.5% sodium hypochlorite solution was irrigated followed by saline irrigation.

GROUP 1 (n = 15): Syringes of cold saline were stored in the refrigerator which is monitored by a digital thermometer. The syringes were taken out of the refrigerator just immediately before using [Figure 5]. Patients in group 1 received a final irrigation with 20 mL cold sterile saline solution (25°C) for 5 min using side-vented needle [Figures 6 and 7].

GROUP 2 (n = 15): Patients assigned to group 2 received final irrigation with saline at room temperature for 5 min using side-vented needle and patients were prescribed analgesics. The recommended medication for pain was ibuprofen (600 mg/8–12 h) [Figures 8 and 9].

A temporary filling was then placed. The patients were given a questionnaire to record the presence and level of post-operative pain after 6 h, 24 h, and 72 h. Patients were instructed to return the questionnaire at the second appointment.

RESULTS

A total 30 patients actively participated in the study and completed the VAS questionnaire. Chi-square test was

Table 1: Comparison of the VAS scores between the scores at different time intervals using Mann–Whitney test

Time interval	Groups	Minimum	Maximum	Median	IQR	*P*-value
Baseline	Group 1	7.0	9.0	8.0	1.0	0.756
	Group 2	7.0	9.0	8.0	2.0	
6 h	Group 1	1.0	4.0	3.0	1.0	0.546
	Group 2	1.0	4.0	3.0	1.0	
24 h	Group 1	0.0	2.0	1.0	2.0	0.514
	Group 2	0.0	4.0	1.0	2.0	
72 h	Group 1	0.0	1.0	0.0	1.0	0.218
	Group 2	0.0	3.0	1.0	1.0	

Table 2: Comparison of the VAS scores within the group between different time intervals using Friedman test

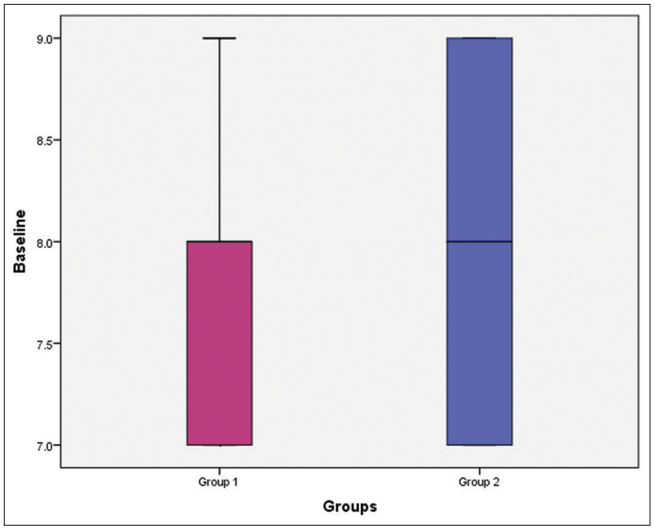
Groups	Time interval	Minimum	Maximum	Median	IQR	*P*-value
Group 1	Baseline	7.0	9.0	8.0	1.0	0.001*
	6 h	1.0	4.0	3.0	1.0	
	24 h	0.0	2.0	1.0	2.0	
	72 h	0.0	1.0	0.0	1.0	
Group 2	Baseline	7.0	9.0	8.0	2.0	0.001*
	6 h	1.0	4.0	3.0	1.0	
	24 h	0.0	4.0	1.0	2.0	
	72 h	0.0	3.0	1.0	1.0	

*Significant, VAS: Visual Analog Scale

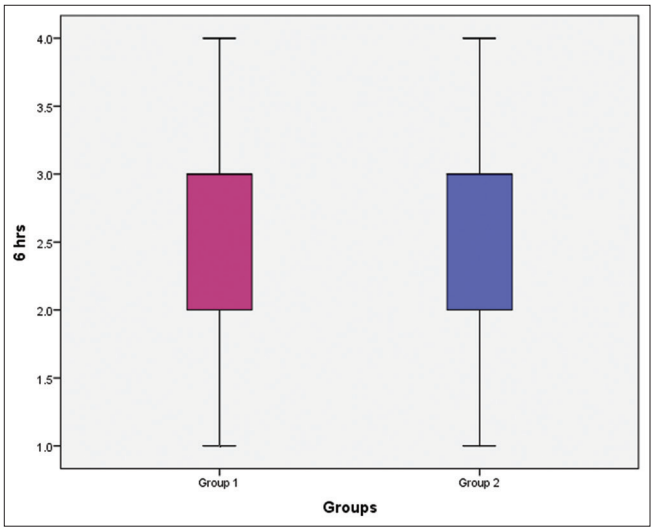
Table 3: Comparison of the VAS scores between different time intervals using Wilcoxon sign test

Time intervals	Group 1		Group 2	
	Z-value	*P*-value	Z-value	*P*-value
Baseline versus 6 h	−3.47	0.001*	−3.46	0.001*
Baseline versus 24 h	−3.53	0.0001*	−3.44	0.001*
Baseline versus 72 h	−3.5	0.0001*	−3.44	0.001*
6 h versus 24 h	−3.37	0.001*	−3.17	0.002*
6 h versus 72 h	−3.45	0.001*	−3.37	0.001*
24 h versus 72 h	−2.53	0.011*	−2.53	0.011*

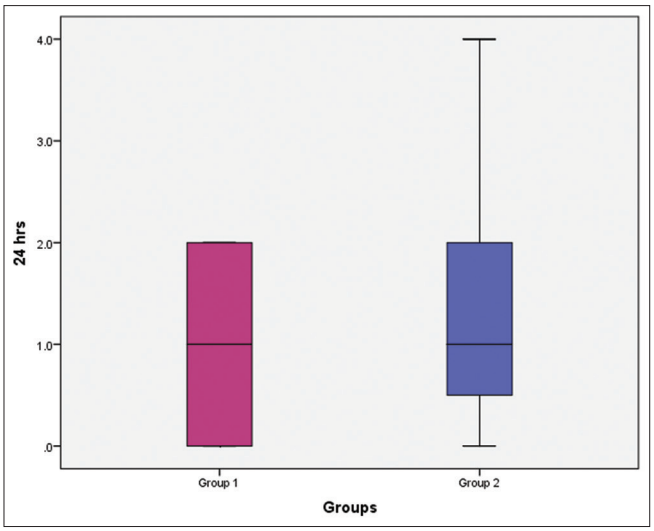
**P*-value set significant at 0.05/4=0.0125, VAS: Visual Analog Scale



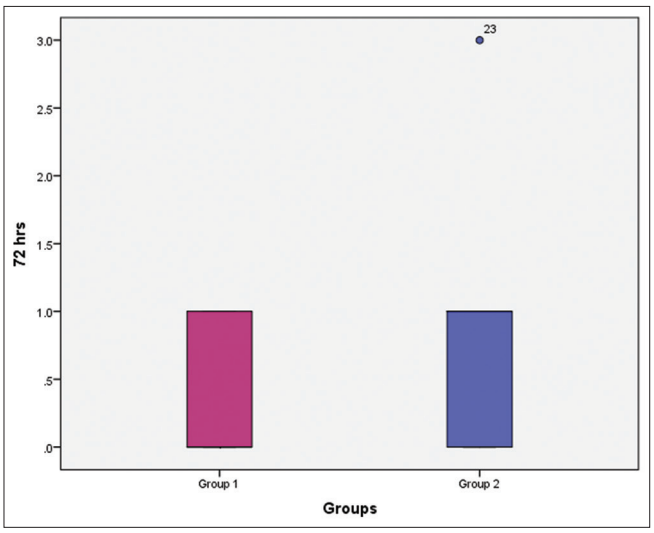
Graph 1: Minimum and maximum preoperative pain level scores of groups 1 and 2 (Baseline)



Graph 2: Minimum and maximum postoperative pain level scores of groups 1 and 2 at 6 hours



Graph 3: Minimum and maximum postoperative pain level scores of groups 1 and 2 at 24 hours



Graph 4: Minimum and maximum postoperative pain level scores of groups 1 and 2 at 72 hours

applied for qualitative variables to find the association. Mann–Whitney test (based on data distribution) was applied to compare the VAS scores between the groups at different time intervals [Table 1]. The results obtained between the groups at different time intervals were statistically significant.

Graphs show minimum and maximum scores of both groups at different time intervals [Graphs 2-4]. Baseline graph shows major difference between groups 1 and 2 since patients were randomly grouped [Graph 1]. Patients in Group 1 had less pain after 24 h [Graph 3]. In general, the interappointment pain decreased with time in all groups.

Friedman test [based on data distribution, Table 2] was applied to compare the VAS scores at different time intervals with *post hoc* Wilcoxon sign test [based on data distribution, Table 3] for comparison between subsequent time intervals. The level of significance is set at 5%. Results were found to be significant.

Patients in the cryotherapy group experienced less interappointment pain than patients in control group.

DISCUSSION

This study was conducted to evaluate the role of cryotherapy in reducing interappointment pain after biomechanical preparation. According to the clinical follow-up, the post-endodontic pain (6 h, 24 h, and 72 h) decreased with time in all groups.

The effect of cryotherapy on pain reduction has been proved already in medical field. Management of interappointment pain is a crucial aspect of root canal treatment which also affects patient–dentist relationship.[10] Cryotherapy also known as cold therapy means reducing tissue temperature as a treatment method.[11] It works by vasoconstriction, slowing down nerve conduction, decreasing cellular metabolism and by decreasing the release of chemical mediators.[12,13]

Analgesics are most commonly used to control interappointment and post-operative pain. Even though these medications are safe, they may cause systemic side effects.[6] This innovative approach of using cold saline as the last irrigant was proven to be effective in many studies. Cryotherapy might be an excellent alternative for the use of analgesics.

According to *in vitro* study conducted by Vera *et al.* 2015, the use of saline at 2.5°C for 5 min reduced root surface temperature by more than 10°C. This drop in tissue temperature causes reduced cellular metabolism which in turn causes cells to use less oxygen and reduces blood flow, thus leading to limitation of the damage. Cold saline-induced vasoconstriction with an antiedema effect reduces inflammation.[8,14]

Leukocytes play a major role in inflammatory response. Studies have shown that cryotherapy reduces the number of leukocytes. Hence, very few cells reach the affected tissues reducing inflammatory response.[15]

According to the literature, cryotherapy inhibits neural receptors in the skin and subcutaneous tissues. It decreases the conduction velocity of nerve signals. Key receptors to environmental cold include TRPM8 and TREK-1 which play a major role in hyperalgesia. Cryotherapy lowers the activation threshold of these tissue nociceptors and the

conduction velocity of pain signals, therefore, decreasing post-operative pain.[6,16]

CONCLUSION

Within the limitations of the study, it was concluded that irrigation with cold saline was an excellent choice for controlling post-endodontic pain considering its no side effects, good patient compliance, and cost effectiveness.

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