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Original Research

Efficacy of Intracanal Cryotherapy in Reducing Post Operative Pain in Patients with Symptomatic Apical Periodontitis*: An In-Vivo Study*

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ABSTRACT:
In the endodontic clinical practice, one of the most damaging and unnerving experience for both patient and clinician is the precipitation of pain, during or after the treatment. To control the postoperative pain several strategies have been developed including the use of analgesics, long-standing anesthesia, and different techniques in root canal preparation. Cryotherapy is also one of the methods to reduce post-operative pain. Cold through various methods may decrease the conduction velocity of nerve signals, hemorrhage, edema, and local inflammation and is therefore effective in the reduction of musculoskeletal pain. Patients presenting with a diagnosis of symptomatic apical periodontitis with pulpal necrosis and a preoperative visual analog scale (VAS) score higher than 7 were randomly allocated in the control and experimental group after the completion of shaping and cleaning procedures. The experimental group received final irrigation with a 20 mL sterile cold (2.5◦C) saline solution delivered to the working length with a sterile, cold (2.5◦C) side vented needle for 5 minutes. The same protocol was used in the control group with room temperature saline solution. Patients were instructed to record the presence, duration and level of postoperative pain, and analgesic medication intake. Postoperative pain after 6, 24, and 72 hours recorded in a VAS scale and the need for analgesic medication intake between the 2 groups were assessed. Patients in the control group presented a significantly higher incidence of postoperative pain, intensity, and need for medication intake ($P < .05$). Cryotherapy reduced the incidence of postoperative pain and the need for medication intake in patients presenting with a diagnosis of necrotic pulp and symptomatic apical periodontitis.

Key words: Endodontic pain, cryotherapy, symptomatic apical periodontitis.

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INTRODUCTION

Pain management during and after root canal treatment is one of the most important aspects of endodontic practice. (1) It is reported with a high incidence rate ranging between 3 and 58%.(2) Hargreaves and Hutter (3) stated that this painful situation can be predicted, especially in teeth with preoperative pain, pulp necrosis, and symptomatic apical periodontitis. Symptoms associated with symptomatic irreversible pulpitis, pulp necrosis, and symptomatic apical periodontitis can be related to different factors including changes in periapical pressure, microbial factors, chemical mediators of pain, and psychological factors, which ultimately lead

patients to seek emergency dental care.(4,5,6) Several strategies have been developed for pain management including prescribing prophylactic analgesics and corticosteroids, administering long-lasting anesthesia, root canal preparation using the crowndown technique and occlusal reduction.(7,8,9,10) Side effects such as gastrointestinal intolerance and renal, hepatic, and respiratory disorders such as asthma have been reported. Even non-steroidal analgesics with an enteric coating have been related to colon pathologies, such as intestinal inflammatory disease, enteropathy with protein loss, iron deficiency anemia, and ulcers. To avoid these secondary effects, treatments such as manual lymphatic drainage, lasers, and cryotherapy have been suggested. (11,12)

Cryotherapy is a long-standing technique that has been frequently applied in sports injuries, decreasing edema, inflammation, and recovery time with short-term applications in orthopaedic, abdominal, gynecological, and hernia operations. (13) In dentistry, cryotherapy has been used after intraoral surgical procedures such as periodontal surgery, extractions, and implant placement. (14) In order to reduce inflammation of the periapical tissues, resulting in a certain degree of pain relief. One way to apply cryotherapy to the inflamed periradicular tissues is by intracanal irrigation with a cold substance after flaring the root canal system. (15) Therefore, the purpose of this study was to evaluate the effect of cold saline irrigation as a final irrigant following biomechanical preparation of root canals on postoperative pain in patients with Symptomatic Apical Periodontitis with pulpal necrosis.

METHODOLOGY

The present study was carried out in the Postgraduate clinic, Department of Conservative Dentistry and Endodontics, Dr. Harvansh Singh Judge Institute of Dental Sciences and Hospital, Panjab University, Chandigarh. It was an experimental study and ethical approval was obtained from the Institutional Ethics Committee, Panjab University, Chandigarh. 40 patients visiting the OPD (Out Patient Department) of Conservative Dentistry and Endodontics in Dr. HSJIDS, PU, Chandigarh with Symptomatic Apical Periodontitis with pulpal necrosis were selected. The patients were randomly allocated in two groups according to the temperature of the final irrigation solution (saline). Group 1: control group (n=20) where the final irrigant was saline at room temperature. Group 2: cryotherapy group (n=20) where 2.5℃ saline was used as the final irrigant. Verbal information regarding the study design, associated procedures, and written bilingual patient information sheets were provided to the patients. Any queries related to the treatment were explained to the patient's complete satisfaction. Written informed consent was procured from the participants who met the inclusion criteria.

The pulpal sensibility was assessed before treatment using EndoIce, and proper palpation and percussion tests were performed. Only patients with permanent mandibular molars having a diagnosis of necrotic pulp and symptomatic apical periodontitis were included in the study. The patient was required to fill out a preoperative questionnaire that included a visual analog scale (VAS) score (0–10, with 0 being the total absence of pain and 10 the most unbearable pain) to register the level of pretreatment pain. Only those patients registering 8, 9, or 10 were included in the study. Patients with the age group between 18-45 years were included in the study. Cases with the following criteria were excluded from the study: Patients with other pulpal diagnoses, Medically compromised patients, Pregnant females, Patients on / taken analgesics, antibiotics or any other medication within last 4 weeks, Presences of any defect in the root – caries, restoration, root resorption, craze lines, fracture or extreme root curvature.

Before starting treatment patients preoperative pain was recorded using visual analogue scale (VAS). The preoperative apical diagnosis was determined according to the radiograph and percussion test. The treatment was performed over 2 appointments. In the first appointment local anesthesia (lidocaine 2% with adrenaline 1:80000) was given to the patient, and rubber dam was placed. For each tooth, proper access cavity preparation was done followed by pulp extirpation and working length determination then canals were enlarged with the hand files to size 25 and final cleaning and shaping of the canals were done with rotary protaper files upto the working length. The canals were irrigated with 5.25% NaOCl then final irrigation was done with either 2.5℃ saline(experimental group) using side vented needle (Figure1) or saline at room temperature(control group) for 2 min. Canals were then dried, filled with Calcium hydroxide paste, and sealed temporarily. The patients were asked to record their postoperative pain after 6, 24, and 72 hours using the (VAS) scale. Data were collected, tabulated, and statistically analyzed. A refrigerator has been used to obtain 2.5℃ saline and a digital thermometer (Figure2) was used to control the temperature. Patients were instructed to return the questionnaire at the second appointment. The second session occurred approximately 7 days later. The tooth was isolated, the temporary filling was removed, and calcium hydroxide was removed by using the last hand instrument used to flare at the WL during the first appointment. The root canals were dried and finally obturated. The post obturation was done at the same appointment. The recommended medication for pain was ibuprofen (400mg/8–12 h). Patients were instructed to return the questionnaire at the second appointment.

Figure1

Figure 2

STATISTICAL ANALYSIS

To compare the two groups, we made a sample size (20) in each group to obtain a power of 0.8 (large) and level of significance is 0.05.

RESULTS

Table 1 shows the distribution of patients in both the control and experimental group. A total of 40 patients were included in the study. Group 1(control) and Group 2(experimental) had 20 patients respectively with an intensity of severe pain preoperatively (VAS score 8-10). Table 2. In both the groups, there was a reduction in post-operative pain at 6 hours, 24 hours, and 72 hours in the experimental group, compared to the control group. At 6 hours group 1(control) showed 5/20 patients with severe pain (VAS score 8-10), 15/20 patients with moderate pain (VAS score 5-7) whereas in Group 2(experimental) 1/20 patient showed severe pain(VAS score 8-10), 4/20 patients with moderate pain (VAS score 5-7) and 15/20 patients having no pain(VAS score 1-4). Table 3 At 24 hours post-operatively, 2 patients complained of pain intensity 5-7(VAS score) and 18 patients of 1-4, in the experimental group. Whereas in the control group, 20 patients complained of pain intensity 5-7(VAS score).Table 4 At 72 hours post-operatively, in the experimental group only 2/20 patients showed moderate pain with a VAS score of 5-7 whereas in the control group all the 20/20 patients showed moderate pain. Table 5 From the results it can be concluded that Using the chi-square test there was a statistically significant relationship (p-value < 0.05) among pain and groups at 6, 24, and 72 hours.

Also, there is a statistically significant interaction between the group and time on Pain. Using the Greenhouse-Geisser method, the p-value for the interaction effect is less than .05, which means that there is a statistically significant Time * Group interaction effect. Table 6,7.

TABLE1: GROUPS			
		Frequency	Percentage
Valid	Control	20	50.0
	Experiment	20	50.0
	Total	40	100.0

TABLE 2: Crosstab			
Count			
		PRE OPERATIVE VAS SCORE(8-10)	Total
		Severe Pain	
GROUPS	Control	20	20
	Experiment	20	20
Total		40	40

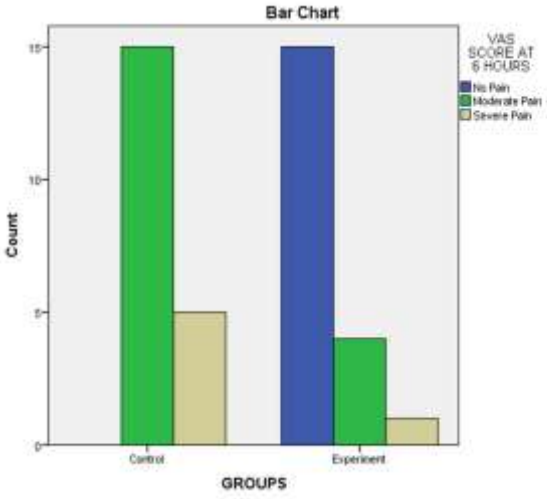
TABLE 3: Crosstab						
Count						
		VAS SCORE AT 6 HOURS			Total	Chi square, p –value
		No Pain (1-4)	Moderate Pain (5-7)	Severe Pain (8-10)		
GROUPS	Control	0	15	5	20	24.035, 0.003
	Experiment	15	4	1	20	
Total		15	19	6	40	

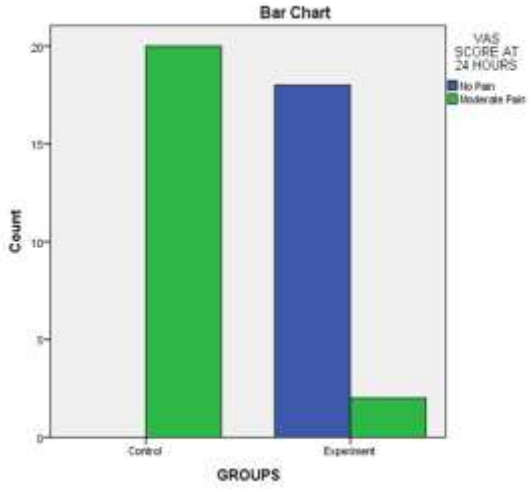
TABLE 4: Crosstab					
Count					
		VAS SCORE AT 24 HOURS		Total	Chi square, p –value
		No Pain (1-4)	Moderate Pain (5-7)		
GROUPS	Control	0	20	20	32.727, 0.002
	Experiment	18	2	20	
Total		18	22	40	

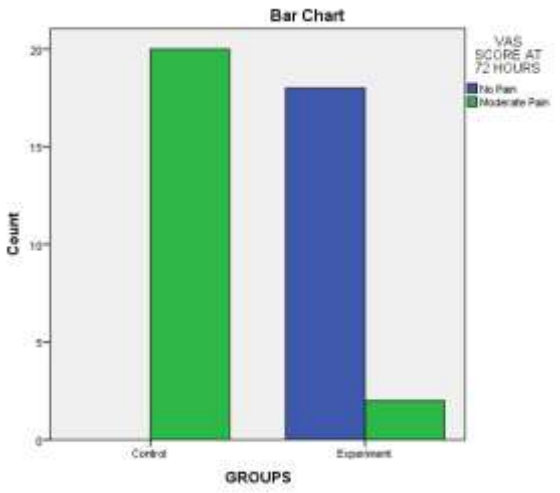
TABLE 5: Crosstab					
Count					
		VAS SCORE AT 72 HOURS		Total	Chi square, p- value
		No Pain (1-4)	Moderate Pain (5-7)		
GROUPS	Control	0	20	20	32.727, 0.002
	Experiment	18	2	20	
Total		18	22	40	

TABLE6: Tests of Within-Subjects Effects					
	Measure: MEASURE_1				
Source	Type III Sum of Squares	df	Mean Square	F	p-value
Hours	58.069	3	19.356	280.650	.0002
Hours * GROUPS	6.319	3	2.106	30.539	.0002
Error(Hours)	7.862	114	.069		

TABLE 7: Tests of Between-Subjects Effects					
Measure: MEASURE_1 Transformed Variable: Average					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	620.156	1	620.156	4143.462	.0001
GROUPS	18.906	1	18.906	126.319	.0002
Error	5.688	38	.150		







DISCUSSION

This study was conducted to determine whether an innovative approach can reduce the postoperative pain experienced by patients seeking emergency treatment because of preoperative pain, pulp necrosis, and symptomatic apical periodontitis. (16) During the endodontic treatment, pain can be precipitated at any stage due to various factors. They could be mechanical, chemical, or microbiological. (17) Once these factors pass through the root into the periapical region, inflammation is initiated, resulting in pain. This condition could be complicated further, resulting in a flare-up. The necrotic debris present within the root canal, the microorganisms, and/ their byproducts, and various chemicals and medicament used during endodontic treatment could be pushed into the periapical region during the treatment. Even the higher mechanical pressure used during the endodontic treatment could lead to or accelerate the movement of these products into the periapical region, precipitating the pain. (18)

In spite of all the precautions observed during biomechanical preparation, pain can be precipitated. In such a situation, the treatment option is decompression of the peiradicular area, followed by the resolution of inflammation. Towards this end, various strategies have been employed. (19)Cryotherapy is one of the latest modalities in these sequences. The benefits of cryotherapy have been reported in the medical literature. Cold causes vasoconstriction with an antiedema effect and, hence, a consequent reduction of inflammation. At the same time, leukocytes play a central role in a soft tissue lesion's inflammatory response.(20,21) Cryotherapy has been shown to be useful in diminishing the number of leukocytes adhering to the endothelial wall of capillaries, leading to fewer of these cells migrating to the affected tissues, reducing endothelial dysfunction and the inflammatory response.(22) In addition, it affects peripheral nerve endings by diminishing the threshold needed to activate the tissue nociceptors and the speed of painful nerve impulses. Cryotherapy induces a local anesthetic effect by lowering the activation threshold of the tissue nociceptors and the conduction velocity of pain signals. An optimal dosage for cryotherapy has not been determined; it varies depending on the nature of the tissue. When minimal fat and muscle are present (eg, when applied to a finger), 3 to 5 minutes of cryotherapy has been recommended. This time is minimal compared with the approximate 20 minutes recommended for areas with more deeply affected tissue like the hip. (23, 24) Cold transmission to the periodontal ligament may also be different in apical and coronal portions of the root because of differences in dentin properties (width and mineralization) at both levels. Cervical dentin has more dentinal tubules, which are also larger, both making it more difficult to transmit therapeutic effectors to the adjacent tissues. On the other hand, apical dentin being more mineralized and denser with fewer tubules would facilitate more efficient cold transmission.(25) The use of cryotherapy is controversial in patients having certain systemic diseases or cardiac conditions like arrhythmia, angina pectoris, and hypertension because vasoconstriction raises blood pressure. (26)

In this study, Cryotherapy was found to diminish the incidence of postoperative pain in patients with symptomatic apical periodontitis. This can be explained by the effect of cold saline in reducing edema and inflammation. It worked as an anti-inflammatory in the periapical area. It has been found that intracanal cryotherapy reduces root surface temperature. Lowering the body temperature decreases peripheral nerve conduction, and especially, when it reaches about 7°C, there is complete deactivation of myelinated A-delta fibers, whereas deactivation of non-myelinated C-fibre occurs at a lower temperature.(27) In our study, 2.5ºC saline was used for cryotherapy, which proves the effectiveness of lower temperatures in reducing pain.

CONCLUSION

- Pain management during endodontic procedures and the postoperative stages is one of the most important goals of clinicians.
- This study evaluated the effects of intracanal cryotherapy on postoperative pain in teeth with symptomatic apical periodontitis.
- The results of this study revealed that irrigation of root canals with a cold sterile saline solution held at 2.5°C for 2 min reduced postoperative pain when compared with the pain levels of patients in a control group.

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