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Original Article

Determining Efficacy of Intracanal Cryotherapy on Post Endodontic Pain in Irreversible Pulpitis

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ABSTRACT

Endodontic cryotherapy is a procedure that reduces pain and inflammation by applying cold to tissues, aiming to decrease post-endodontic pain. **Objectives:** To compare the effectiveness of cryo-treated endodontic irrigant in reducing post-endodontic pain in mandibular molars with irreversible pulpitis. **Methods:** This comparative analytical study was conducted from December 2023 to February 2024 in the Department of Operative Dentistry at Lahore Medical and Dental College. It included patients of both genders, aged 18 to 60, with symptomatic irreversible pulpitis in mandibular molars and pre-endodontic pain of VAS 7-10 for 10 days or less. Patients were divided into two groups: Group A (normal saline) and Group B (cryotherapy). Patients were instructed on using the Visual Analogue Scale (VAS) to assess pain. Group B received final irrigation with 20 ml normal saline at 2.5°C for 5 minutes, while Group A received 20 ml normal saline at room temperature. Pain scores were recorded preoperatively and at 24 and 48 hours' post-treatment via telephone interviews. Data were analyzed using SPSS version 25 and a repeated measures ANOVA test assessed VAS scores across time points. A p-value <0.05 was considered significant. **Results:** 45 (46%) were male and 53 (54%) were female patients, with mean age of patients being 35.71 ± 10.71years. At 24 hours postoperatively, the mean VAS score was 1.51 ± 1.2 for the normal saline group and 0.98 ± 0.9 for the cryo-treated saline group. By 48 hours postoperatively, the mean VAS score further decreased to 0.27 ± 0.5 for the normal saline group and 0.12 ± 0.4 for the cryo-treated saline group. The mean differences in VAS scores at 24 hours showed significant difference in mean pain score (P-value<0.05) but at 48 hours between the two groups showed no significant difference (p = 0.104). **Conclusions:** Both saline groups significantly decreased pain, the type of saline, normal or cryo-treated, did not significantly impact overall pain scores differently between the groups.

INTRODUCTION

Dental pain, particularly odontogenic pain, is the primary motivator for patients seeking dental treatment. Ironically, unresolved dental pain can lead patients to abandon their dental care. Therefore, dental practitioners prioritize treatment options that effectively alleviate pain [1, 2]. Literature has addressed a range of techniques and strategies for managing postoperative pain following endodontic operations [3]. Prescription drugs, intra-canal treatments and occlusal modifications are among these methods. However, each has its drawbacks. For instance, the use of Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) has been linked to adverse effects on the stomach and liver. Additionally, there are conflicting findings in the literature regarding the efficacy of intra-canal therapies like calcium hydroxide, laser application and analgesic solutions in reducing postoperative endodontic discomfort [4, 5]. Cryotherapy, a recent therapeutic innovation, capitalizes on the application of low temperatures to stimulate healing and offer various therapeutic advantages [6, 7]. Its core mechanism triggers three primary tissue responses: vasoconstriction, inhibition of neural receptors and a reduction in metabolic activity. By limiting the release of

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pain-inducing chemical mediators and slowing the propagation of neural pain signals, cryotherapy effectively reduces postoperative pain. Cryotherapy additionally enhances the delivery of oxygen to injured tissues by drastically diminishing cellular metabolism, with potential reductions of up to 50% [8]. Cryotherapy is used in dentistry to treat a variety of disorders. In the field of endodontics, cryotherapy may be used in several settings. It can be used to lessen postoperative discomfort and inflammation after root canal procedures and after periradicular surgery [9]. Furthermore, with the use of bioceramic materials in conjunction with cryotherapy, cryotherapy has proven to be an efficient supplementary strategy for attaining hemostasis in crucial pulp cryotherapy in more recent times [10]. Cryotherapy is unique in that it is an easy, affordable, and safe alternative for managing endodontic pain. The rationale of conducting this study is to emphasis to include cryotherapy techniques in daily clinical endodontic practice, the potential benefits being significant [8]. This study underscores the effectiveness of cryotherapy, particularly when managing post endodontic pain. Todorova MV et al., in an in vitro study revealed that utilizing a saline solution at 5 mL for 5 minutes was insufficient for a cryotherapy affect [11]. At a capacity of 20 mL, the temperature difference between the initial and lowest recorded values was reached the quickest, at 10°C. This temperature drop may likely produce a localized anti-inflammatory impact in the peri-radicular area [6].

This study was to ascertain efficiency of decrease in post endodontic pain by using room temperature normal saline and cryo-treated saline, in irreversible pulpitis mandibular molars with no apical periodontitis.

METHODS

This comparative analytical study was conducted from December 2023 till February 2024, in the department of Operative Dentistry in Lahore Medical and Dental College. Approval was obtained from ethical committee (IRB) of the college, FD/5301/23. Patients included were of both genders, from 18 to 60 years of age, presenting with symptomatic irreversible pulpitis in mandibular molars, with pre-endodontic pain of VAS, from 7-10, for 10 days or less. It was also noted that there was no consumption of any analgesics or antibiotics, at least 7 days prior to the visit. To determine pulp sensitivity, an electric pulp tester was used to diagnose. Participants in the study were excluded whose teeth were determined to be necrotic, exhibit inadequate coronal tooth structure, required re-endodontic treatment, had severe periodontal disease, or had systemic conditions like diabetes or autoimmune illnesses. Using WHO calculator, sample size of 101 patients was determined with confidence level of 95%, power of test 90 and a population proportion of 80% and 61.14% for groups A and B, respectively, 51 were allotted to each group [8]. Individuals meeting the criteria were informed on the treatment and study design. After gaining consent of the patient, proformas were used to record patient information, such as age and gender. Regarding randomization, the foremost case was assigned to group A, second for group B, the next case for group A and so on, without disclosing to the participant the treatment group they were allotted. Group A was normal saline group and Group B was cryotherapy group. Patients were blinded to groups, but clinicians could not be, as temperature difference was felt through the 5cc plastic irrigation syringe. Both groups underwent pre-established procedures. Before treatment, patients were provided instructions on use of Visual Analogue Scale (VAS) to assess the pain. The VAS values 0 denoting no pain, 1-3 denoting mild pain, 4-6 denoting moderate pain and 7-10 denoting severe pain were explained to the patients. After determining the preoperative pain score, we used an inferior alveolar nerve block to deliver local anesthesia consisting of 2% lidocaine and 1: 100,000 epinephrine. After that, a rubber barrier was installed, and burs were used to get to the endodontic site. After access, working lengths were established using radiograph. Root canals were instrumented with a protaper hand files using copious 2.5% sodium hypochlorite irrigant. After complete instrumentation, root canals were flushed with 17% EDTA for 1 min. In cryotherapy group, final irrigation was done in root canals using 20 ml normal saline, for 5 minutes at 2.5°C temperature. Cryotreated saline was stored in a controlled refrigerator till use. Whereas in the normal saline group, 20 mL of normal saline at room temperature was used. In both groups, canals were dried using paper points and immediately obturated with single cone technique using gutta-percha cones and sealapex sealer. Coronal access cavities were temporized using glass ionomer cement. Participants were telephoned to inquire about their analgesic consumption and to document their VAS scores for 24-hour and 48-hour marks. If an analgesic was consumed, the patient was excluded from the study. This was to ensure that no decrease in VAS score occurred due to analgesic effect, on follow up VAS scores, but only due to the treatment provided to the patient. Data were inserted and analysed using SPSS version 25.0. Qualitative data for gender was displayed as frequency and percentages. Age and VAS scores means and standard deviations were used to display the quantitative data. Repeated measure ANOVA test was used to assess pain using the VAS at follow up and mean VAS scores in both saline groups at preoperative pain, 24 hours after surgery and 48 hours after treatment was compared by independent sample t test. P-value <0.05 was considered as significant.

RESULTS

Of the 102 participants enrolled, four were excluded from the results due to one drop out and three patients requiring analgesics within 24 hours, resulting in a total of 98 participants. 49(50%)were treated using normal saline and 49 were treated using cryotreated saline. Out of these 98 participants, 45 (46%) were males and 53 (54%) were

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females. Amongst males, those treated with normal saline were 19 (42%) and 26 (58%) were treated with cryotreated saline. Whereas 30 (57%) female patients were treated using normal saline and 23 (43%) were cryotreated. Mean age was 35.71 ± 10.71 years. Patients with age range from 18-40 years old were 67 (68%) and those of 41-60 age categories were 31(32%) as shown in table 1.

Table 1: Baseline Characteristics of Patients

Variables		Frequency (%)/ (Mean ± SD)
Gender	Male	45 (46%)
	Female	53 (54%)
Male Treatment	Normal Saline	19 (42%)
	Cryotreated Saline	26 (58%)
Female Treatment	Normal Saline	30 (57%)
	Cryotreated Saline	23 (43%)
Age Categories	18-40 Years	67
	41-60 Years	31
Mean Age (Years)	35.71 ± 10.71	

Table 2 showed mean and standard deviation of VAS scores for each group. Initial preoperative VAS scores were comparable between groups. Further examination of within subject's effects using ANOVA revealed significant reductions in VAS scores over time within each group ($p < 0.001$). An independent sample t-test comparing the mean differences in VAS scores at 24 hours showed significant difference in mean pain score but at 48 hours between the two groups showed no significant difference ($p = 0.104$). In conclusion, while time significantly influenced VAS scores, the type of saline used, did not significantly impact overall pain scores differently between the two groups.

Table 2: Comparison of Visual Analogue Scale (VAS) Scores Between Normal Saline and Cryotreated Saline Groups at Different Time Points

Groups	Visual Analogue Scale (VAS) Scores (Mean ± SD)			
	Pre-Operative	24 Hours	48 Hours	p-Value
Group A Normal Saline	8.47 ± 1.3	1.51 ± 1.2	0.27 ± 0.5	<0.001[a]
Group B Cryotreated Saline	8.73 ± 1.2	0.98 ± 0.9	0.12 ± 0.4	<0.001[a]
p-Value	0.306[b]	0.01[b]	0.104[b]	-

[a] = ANOVA
[b] = Independent sample t-test

DISCUSSION

A novel, cost effective method of treating patients seeking emergency care for endodontic pain may be able to lessen their postoperative pain, according to the results of our experimental clinical research. Most cryotherapy users assert that it has many advantages, such as decreased microbial activity, inflammation and postoperative pain [10]. Other research endeavors on the application of cold saline in endodontics have produced varying conclusions concerning its therapeutic consequences [12]. Compared to conventional techniques, a number of studies have indicated that cold saline irrigation during root canal therapy can successfully lower postoperative pain levels [13, 14]. This is due to vasoconstriction brought on by the cold causes a reduction in nerve transmission and pain perception [2]. By lowering the activation threshold of the tissue nociceptors and the velocity at which pain signals are conducted, cryotherapy produces a local anesthetic effect. According to Mohammadi *et al.*, cold saline irrigation has antimicrobial qualities because it inhibits the growth of bacteria and lowers the number of bacteria present in the root canal system [12]. This reduces the possibility of reinfection and may help with disinfection. Cryotherapy's ability to decrease post-endodontic pain in teeth presenting with irreversible pulpitis with or without apical periodontitis was compared in some randomized multicenter clinical trials. Bazaid DS stated that, only individuals with apical periodontitis responded to cryotherapy and among patients with irreversible pulpitis alone, there was no discernible variation in the prevalence of postoperative discomfort amongst the cryotherapy and control groups [15]. Alharthi AA *et al.*, in their randomized controlled study had similar results to ours in which they stated that in previously asymptomatic instances without periapical pathosis, room-temperature saline as the last irrigation produced outcomes that were comparable to intracanal cryotherapy [16]. Jamdar SF also stated that they had no significant differences in decrease of post op pain between groups [13]. All these studies are in accordance to our research as the inclusion criteria was limited to cases of irreversible pulpitis and we found the type of saline, normal or cryotreated, did not significantly impact overall pain scores differently between both the saline groups. Sadaf *et al.*, assessed impact of intracanal cryotherapy on postoperative pain following endodontics in both pulpal and periradicular pathosis through a systematic review [17]. The results demonstrated intracanal cryotherapy considerably decreased post-operative pain six hours and twenty-four hours following the treatment as compared to controls. After the operation, however, there was no discernible change in discomfort 48, 72, or 7 days later. In our study, temperature of saline normal room or cryotreated did not significantly affect total pain scores differently across the two saline groups, though there was significant decrease in VAS scores over 24 and 48 ours postoperatively. In their meta-analysis, Monteiro LP *et al.*, found that there was less postoperative pain six and twenty-four hours following cryotreated irrigation [18]. Patients who received intracanal cryotherapy showed a decrease in postoperative pain levels on the seventh day when compared to the room temperature group, albeit this difference did not reach statistical significance. Our research produced conflicting findings to this but was in accordance to Gupta A *et al.*, and according to Gupta *et al.*, systematic analysis, intracanal cryotherapy did not

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significantly reduce post endodontic pain, which is in line with our investigation's results [10]. Using EndoVac has been demonstrated to decrease the probability of periapical inflammatory reactions by minimizing apical extrusion [7]. All patients in this research had root canal therapy using traditional needle irrigation needle that was inserted 2 mm short of working length. It has been demonstrated that negative apical pressure devices produce less postoperative pain and considerably less irrigant extrusion than conventional needle irrigation [19]. Therefore, as advised by earlier research, the needle was not placed more than 2 mm from the working length in order to provide a safe irrigation routine. There was significant decrease in VAS score in our study, in spite of using traditional needle irrigation. Although an ideal protocol for volume and length of time for intracanal cryotherapy is yet to be established, majority of the studies employed 20 mL of cold saline for five minutes at 2.5°C [15, 20]. For locations with minor fat or muscle, such the fingers, 3-5 minutes of cold treatment is thought to be sufficient, as opposed to 20 minutes, which is advised for regions with deep tissues, like the hips [21]. Nevertheless, extending these findings to root canal treatment may be, at most, speculative. Thus, it should be a top priority to conduct additional research to determine the ideal dosage and duration. Another limitation of the study includes that double blinding could not be done as temperature difference of cryotreated saline could be felt through the plastic irrigation syringes. The results of our analysis demonstrated that the randomization process and the large sample size employed in the study had enabled the normal temperature saline and cryotreated saline to have similar distributions of variables.

CONCLUSIONS

In summary, cryotherapy and normal saline resulted in a reduction in the occurrence of postoperative pain, in patients diagnosed with irreversible pulpitis.

Authors Contribution

Conceptualization: AFB
Methodology: UWJ
Formal analysis: MUDA, MTK
Writing, review and editing: AFB, SRK, AAB

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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