

Frequency of Pain in Teeth with Irreversible Pulpitis after a Single Visit of Root Canal Treatment Using Cryotherapy

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ABSTRACT

Objective: To determine the frequency of pain in teeth with irreversible pulpitis after a single visit of root canal treatment using intra-canal cryotherapy.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Operative Dentistry, Armed Force Institute of Dentistry, Rawalpindi Pakistan from Jun to Dec 2017.

Methodology: A total of 140 patients of either gender, aged 20 to 65 years were equally divided into two groups Group-A, in which cryotherapy was used, and Group-B was the Control Group. After anaesthetizing the tooth and application of Rubber Dam, Root canal preparation was done with Protaper next series and copious irrigation of 5.25% Sodium Hypochlorite and 17% Ethylene Diamine Tetra Acetic Acid solution. In Group-A, the final irrigation was done with Normal saline at a temperature of 2.5°C. The Control-Group performed final irrigation with normal saline at room temperature. Obturation was done with cold lateral condensation, and permanent restoration was done with composite. Patients were contacted by telephone after 24 Hours and were asked about pain.

Results: The mean age was 39.26±12.61 years. There were 82(58.6%) male and 58(41.4%) female patients. After 24 hours, 56(80%) of the patients in Group-A had no pain, while in the Control-Group, 43(61.4%) were pain-free, with a *p*-value of 0.016.

Conclusion: There was a significant decrease in pain after using cryotherapy in single-visit root canal treatment.

Keywords: Cryotherapy, Irreversible pulpitis, Postoperative pain, Root canal treatment.

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INTRODUCTION

Orofacial pain is a serious health problem in many countries, sometimes unbearable, rendering an individual into a severe physical and mental illness.¹ Orofacial pain can be classified into odontogenic and non-odontogenic in origin. Most odontogenic pain symptoms are related to the pathology of pulp, and periapical tissues and endodontic treatment is generally indicated. Post-operative endodontic pain ranges from 3% to 58% due to mechanical, chemical and microbial injury to periradicular tissues.² Success of root canal treatment depends on good control of intracanal infection by mechanical instrumentation and chemical disinfection using irrigating solutions such as 5.25% NaOCl, chlorhexidine gel, 17% EDTA and normal saline (0.9%NaCl).³ Multiple strategies have been used for the management of post-endodontic pain. These include the use of analgesics, NSAIDs, corticosteroids, occlusal reduction, and cryotherapy of utmost importance and careful performance of endodontic procedures.⁴

Cryotherapy is a newly introduced technique that promotes healing and provides other therapeutic benefits by utilizing low temperatures applied locally or generally.⁵ Cryotherapy produces three basic tissue responses, vasoconstriction, inhibition of neural receptors and decreased metabolic activity, thus decreasing oedema, pain and inflammation. The combined effect of the decreased release of chemical mediators of pain and slower propagation of neural pain signals thus produces reductions in postoperative pain.⁶ In addition, better oxygen perfusion of injured tissue is attained by a decrease in cellular metabolism of nearly up to 50%.⁷ Cryotherapy has been used to manage pain and post-operative care in sports injuries, and surgical procedures are done in the oral cavity, abdomen, orthopaedic and gynaecology.⁸ In dentistry, cryotherapy is used to treat intraoral lesions, benign, malignant or premalignant, periodontal surgery, extractions, implant placement, and endodontics.⁹

Cryotherapy is a simple, cost-effective and non-toxic option for controlling post-operative pain. This study emphasized the effectiveness of cryotherapy for managing post-obturation pain, and the results will aid the general dental practitioner in incorporating this technique into routine practice.

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METHODOLOGY

This study was conducted at the Department of Operative Dentistry, Armed Force Institute of Dentistry, Rawalpindi Pakistan, from June to December 2017. After approval of the Institutional Ethics Review Committee (No 905/Trg-ABP1K2), The total Sample size of 140 patients was calculated by the WHO calculator keeping the power of test 85, confidence level 95%, significance level 0.05, population proportion of Group-A at 85.88% and Group-B at 68.23%.²

Inclusion Criteria: Patients of either gender aged 20 to 65 Years with symptomatic irreversible pulpitis reported to the Operative Department, were included in the study.

Exclusion Criteria: Patients on preoperative analgesics and antibiotics, teeth with calcified canals resorption and open apex, previously injured teeth, root canal-treated teeth, immunocompromised patients, and pregnant and lactating mothers were excluded from this study.

After explaining the procedure, written consent was taken from the willing patients. The thorough medical and dental history of each patient was recorded. The pulpal and periapical status of the tooth to be treated were evaluated with the help of periapical radiographs, periodontal probing, palpation, percussion, electric pulp tester and thermal tests. In addition, the patient's age, gender and tooth being treated were recorded. A convenient sampling technique was adopted, and patients were equally divided into two groups with the help of a random scientific table. Group-A was the Cryotherapy-Group, and Group-B was the Control -Group. Endodontic treatment was initiated under local anaesthesia and rubber dam isolation. An apex locator was initially used to obtain working length and then confirmed with a radiograph. The root canals were instrumented with a ProTaper Next system. Sodium hypochlorite (NaOCL) is 5.25% used for copious irrigation. #10K file was instrumented initially to confirm patency.17% EDTA of 5ml was used for flushing the root canal system after canal preparation. The root canals in Group-A were finally irrigated for five minutes with normal saline at a temperature of 2.5°C 2mm short of working length, using a 31G Navi- Tip needle. In the Control-Group, a 31G Navi-tip needle 2mm short of working length was used for normal saline at room temperature as a final five-minute rinse. In both groups, paper points were used to dry canals, and a cold lateral condensation technique was done for obturation with gutta-percha

cones and AH plus as a sealer. Direct composite restorations using dentinal adhesives and universal composite resin were used to close coronal access cavities. Patients were asked on the telephone about post-operative pain after 24 Hours.

Statistical Package for Social Sciences (SPSS) version 21.0 was used for the data analysis. Descriptive statistics were calculated for both qualitative and quantitative variables. Mean±SD were calculated for age. Frequency and percentages for gender and pain were calculated. Chi-square Test was performed for comparison of pain at 24h after treatment. The *p*-value of ≤0.05 was considered to be statistically significant.

RESULTS

There were 82(58.6%) male and 58(41.4%) female patients with a mean age of 39.26±12.61 years, Group-A mean age was 34.96±11.75, and Group B was 43.57 ±12.04 (Table-I). After 24 hours, 56(80%) of the patients in Group-A had no pain, while 43(61.4%) were pain-free in the Control Group. At the same time, only 14 (20%) are symptomatic in Group-A compared to 27 (38.6%) in Group-B, with a *p*-value of 0.016 (Table-II).

Table-I: Demographic Details of the Patients (n=140)

Gender	Group-A	Group-B
Male	38 (54.3%)	44 (62.9%)
Female	32 (45.7%)	26 (37.1%)
Mean Age	34.96 ± 11.75 years	43.57 ± 12.04 years

Table-II: Comparison of Pain after Treatment (24 hours) among both the Groups (n=140)

Pain	Group-A	Group-B	<i>p</i> -value
No Pain	56(80.0%)	43(61.4%)	0.016
Pain	14(20.0%)	27(38.6%)	

DISCUSSION

Cryotherapy is an effective and safe method to minimize post-endodontic pain with less or minimal untoward effects, particularly in elderly patients.¹⁰ Our results showed that root canals irrigated with a cold sterile saline solution of 2.5°C for 5 min in the group significantly mitigated post-endodontic pain (80%) when compared with the Control-Group (61.4%). The outcome of the study by Keskin *et al.* indicated that 2.5°C cold saline irrigation as the final irrigant could result in a significant reduction in postoperative pain levels in comparison to the Control Group. In the Cryotherapy Group, 85.88% of patients had no postoperative pain, 12.94% of patients reported mild pain, and 1.18% of patients reported moderate pain; in the control group, 68.23% of patients had no postoperative pain, 24.71% of patients reported mild pain, and 7.06% of patients reported moderate pain at 24 hours.²

The study by Alharthi *et al.* showed that Group-1, where intracanal cryotherapy was used, had the lowest post-endodontic pain (6h, 24h, and 48h). Nevertheless, there was no significant difference between Group-2, where normal saline was used.¹⁰ Vieyra and colleagues conducted a study on the reduction of post-endodontic pain after one-visit root canal treatment using three cryotherapy protocols with different temperatures, and the results showed statistically significant differences between the Control Group and one Cryotherapy Group in which 2.5°C intracanal cryotherapy was used throughout all periods for post-endodontic pain.¹¹

In a randomized prospective clinical trial, Gundogdu EC showed that intracanal cryotherapy applications resulted in lower postoperative pain levels and VAS pain scores on percussion versus those of the Control Group.¹² Similar results were shared by Jain *et al.* which stated that there was a significant reduction in post-operative pain at 6 hours, 24 hours and 48 hours in the Cryotherapy Group compared to the Control Group.¹³ Similar to our finding, Hespanhol *et al.* also found intracanal cryotherapy to help reduce pain in symptomatic irreversible pulpitis with apical periodontitis patients.¹⁴ Keskin *et al.* and Vera *et al.* in their study on irreversible pulpitis also found intracanal cryotherapy to reduce post-operative pain.^{2,7}

The decreased temperature of the external root surface might constrain inflammatory reactions, production of the release of pain-producing substances, and oedema occurring in the periapical region. Cryotherapy has been shown to decelerate peripheral nerve conduction.¹⁵ As the temperature decreases, the conduction velocity of nerve fibres decreases until it stops completely. However, Ernst *et al.* found that the nerve conduction of C fibres could not be decreased via the application of moderate cold.¹⁶

In contrast, our results in a randomized control trial by Vera *et al.* showed that patients in the Cryotherapy Group suffered less pain after 6, 24, and 72 hours.¹⁷ Another study showed room-temperature saline as the final irrigation comparable to intracanal cryotherapy.¹⁸

We recommend cryotherapy as a safe and well-tolerated strategy to minimize postoperative pain with few-to-no side effects, particularly in geriatric or allergic patients. However, more studies are needed to investigate the possible advantages of this procedure in patients with necrotic pulp and periradicular diseases. Furthermore, this study has some limitations, as pain is a subjective response which differs greatly for

different individuals. In addition, it is influenced by psychological, emotional, cultural and social behaviours, so the split-mouth technique would have more reliable results.

CONCLUSION

It is concluded that there was a significant decrease in pain after using cryotherapy in single-visit root canal treatment.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

SJ & HHK: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

FB & JAS: Conception, drafting the manuscript, approval of the final version to be published.

MH & AY: Study design, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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