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EFFECT OF INTRACANAL CRYOTHERAPY ON THE POST ENDODONTIC PAIN IN TEETH WITH SYMPTOMATIC APICAL PERIODONTITIS

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ABSTRACT

Objectives: *To compare the effect of cryotherapy, room temperature saline and no saline as final root canal irrigants on post-endodontic pain in patients with symptomatic apical periodontitis.*

Materials and Methods: *An observational study was done at the Endodontics Department of Rehman College of Dentistry, Peshawar from August 2023 to January 2024. Ninety patients were selected via purposive sampling technique and underwent root canal treatment. After root canal preparation, patients were equally divided into three groups using the lottery method: Cryotherapy group, room temperature saline group and no saline group. Pain on percussion was recorded pre-operatively and 24hours post-operatively for every patient using the visual analogue scale. Wilcoxon Signed ranks test was used to assess the significant difference between mean pre-endodontic and post-endodontic pain levels. Post hoc analysis was used to compare the significant difference (p value<0.05) between each group.*

Results: *At 24 hour post-operatively, the mean post-endodontic pain scores on visual analogue scale were 2.50±1.253 for cryotherapy group, 2.70±2.261 for room temperature saline group and 3.63±1.938 for no saline group. The result shows that the post-endodontic pain reduces significantly in all the three groups(p<0.05). However, cryotherapy as the final irrigant was found to be significantly more effective in reducing the post-endodontic pain than no saline as the final irrigant (p value 0.029). No significant difference was found in between the cryotherapy group and the room temperature saline groups (p value 0.964).*

Conclusion: *Cryotherapy as the final root canal irrigant is the most effective method of reducing post-endodontic pain as compared to when no saline was used as the final irrigant. Room temperature saline is also as useful as cryotherapy in reducing post-endodontic pain. The findings of the study will be helpful for the dentists to minimize post-endodontic pain.*

Key words: *Cryotherapy, Post-endodontic Pain, Symptomatic Apical Periodontitis*

INTRODUCTION

Post-endodontic pain (PEP) is described as the painful sensation following root canal treatment (RCT)[1]. The aim of RCT is to chemo-mechanically clean the root canals and to promote periapical healing. Even after completely cleaning the root a range of 3% to 65% of the patients experienced PEP[2]. Apical periodontitis (AP) is the inflammation of the peri-apical tissues and is the major cause of PEP[1].

Irritants from an inflamed pulp or bacterial toxins form a necrotic pulp spread into the periapical tissues causing inflammation around the roots of the involved tooth[1]. This situation causes severe pain to the patient. Various other causes like mechanical or chemical irritation to the periapical tissues also

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play their role[1].

Various strategies have been mentioned in the literature to prevent PEP. It includes pre-medication[3] use of anesthesia[4] root canal preparation technique[5] intra canal medication[6] and occlusal relief[7]. Each of the above-mentioned strategies has its own limitations. Medications prescribed for dental pain relief usually fall into the category of NSAIDs. Gastrointestinal upset is one of the most common adverse effects related to NSAIDs[8]. Similarly, intra canal medication and occlusal reduction doesn't show very promising results in reducing PEP[9].

The word cryotherapy is acquired from the Greek word "cryos" meaning very cold[10]. In dentistry, cryotherapy (CR) is commonly used for pain management after tooth extraction.11 Recently, CR has been used by many researchers for the management of PEP[12,13]. According to Vera et al, if the root external surface temperature is reduced by 10oC, it has an anti-inflammatory effect[14]. CR reduces the blood flow, metabolic activity, and neural response from the tissues[15].

A study by A.A.Alharthi et al[16] compared mean PEP among the three groups including CR, room temperature saline (RS) and no saline (NS). A significant difference (p value<0.05) was found between the CR and NS groups and in between the RS and NS groups However, the difference was not significant between the CR and RS groups (p value 0.966). AF Bashir[17] also showed that the difference between the CR and the RS in reducing the PEP was not significant (p value>0.5). However, a study by Veral et al[18] showed that the mean PEP in CR group was significantly reduced (0.46±1.5) after 24 hours as compared to RS group (2.02±1.5) with p value <0.05. A study by S Junaid19 also showed that CR as compared to RS significantly reduces PEP (p value<0.05).

Pain control following RCT is the foremost step. Analgesics are being overused for PEP control. In addition to the adverse effects, analgesics alone do not completely control the PEP. Therefore, the dentist and researchers are in search of other methods. Use of CR seems to be an effective, safe, and cheaper method for PEP control. However, whether CR has an advantage over RS or NS in reducing PEP is still not clear from the literature. The findings of our study will guide whether is there any use of CR in minimizing PEP. This will facilitate dentists to minimize the PEP. Therefore, the aim of the study is to compare the effect of cryotherapy, room temperature saline and no saline as final root canal irrigants on the post-endodontic pain in patients with symptomatic apical periodontitis.

MATERIALS AND METHODS

After getting the ethical approval from an ethical and research committee of the institute an observational study was done at the Endodontics department of Rehman College of Dentistry, Peshawar from August 2023-January 2024. Patients aged 18-60 years fulfilling the inclusion and exclusion criteria were selected via purposive sampling. A single trained endodontist who was not part of the study was assigned to record the patient's clinical sign of pain to percussion (symptomatic apical periodontitis SAP). A 10cm line (0-10) drawn on the page was given to every patient to mark their pain intensity. Patients who marked their pain to percussion from 4 to 10 on the scale in one of their mandibular premolars were selected. Medically compromised patients, pregnant females, patients with the pain score to percussion from 0 to 3, taking medications, not willing to undergo treatment, allergic to local anesthesia, non-restorable teeth, root resorption, open apices, and previously root canal treated teeth were not included. An informed consent was taken from every patient. A sample of 90 mandibular premolars in 90 patients were selected with a 95% confidence level and 80% power of test using openepi.com.

Another trained operator who was part of the study completed the RCT in a single visit. Local anesthesia containing 2% lidocaine with 1:100,000 epinephrine (Medicaine) using 27 G needle in an aspirating syringe was administered as an IANB to every participant. Under rubber dam access was created. Upon the pulpal exposure coronal pulp was removed with an endodontic excavator. Size 10No. K file was used for scouting the root canal and for establishing the length with an apex locator (Air-pex by Eighteeth). Protaper Gold rotary files and 3% sodium hypochlorite were used for canal preparation. After completing the canal preparation patients were equally divided into three groups using the lottery method, the cryotherapy (CR), the room temperature saline (RS) and the no saline group (NS). Each group

contains 30 patients.

In the CR group, 20mL of saline at 2-4 degree Celsius was used as the final irrigant. In the RS group, 20ml saline at room temperature was used. In the NS, no final irrigation with saline was done. The final irrigation was performed by using a 31G closed end and side vented irrigation needles. Canals were dried by using paper points and obturated with GP points and tooth restored with composite. Patients were recalled after 24 hours to record their tenderness pain score on the VAS.

Data was collected using SPSS v 26.0. Frequency and percentage were calculated for gender. Mean±SD was calculated for age and pain levels. The Levene test was used to assess the symmetric distribution of the data. Nonparametric tests were used to assess the difference between pre-endodontic and post-endodontic mean pain levels. Nonparametric tests were also used to determine the statistical difference in mean PEP levels among groups. Post-hoc analysis was used to calculate the differences between groups. The level of significance was set as <0.05.

RESULT

Gender distribution and age in all the three groups are given in Table 1. According to the levene test p value was <0.05, showed that the data was not distributed symmetrically, therefore nonparametric tests were used. Pre-endodontic and PEP pain levels of all the three groups were given in Table 2. The Wilcoxon Signed ranks test was used to assess the significant difference between mean pre-endodontic and post-endodontic pain levels (Table 2). PEP was significantly reduced in all the groups (p value<0.05). The Kruskal-Wallis test was used to assess the difference in mean post-endodontic pain levels among the three groups. There was a significant difference in mean post-endodontic pain levels among the three groups (p-value 0.040). Post hoc analysis (Table 3) showed that there was a significant difference between the CR, and the NS mean post-endodontic pain levels (p-value 0.029). However, the difference between CR and RS and, between RTS and NS was not statistically significant (p value>0.05).

DISCUSSION

This study was conducted to find out the effect of CR, RS and NS as final irrigants on PEP in patients presented with SAP. The result of our study showed that PEP reduces significantly (p<0.05) in all the three groups. CR was found to be significantly more effective in reducing the PEP than the NS group (p value 0.029). However, the difference between CR and RS groups was insignificant (p value 0.964).

A.A. Alharti et al[16] also shows that the use of CR is much more effective in reducing PEP than the normal classical protocol of irrigation (no saline) in which sodium hypochlorite is used as a final irrigant (p<0.05). But the difference in mean PEP in between the CR and the RS (p value>0.05) was insignificant. Use of saline at either CR or room temperature as the

Table 1: Mean age and gender distribution of participants

Demographic variables	Cryotherapy	Room temperature	Control
Age	37.73±11.27	36.00±11.55	35.87±11.24
Gender			
Male	46.7%	56.7%	36.7%
Female	53.3%	43.3%	63.3%

Table 3: P-value calculated by post hoc analysis (Dunnett T3). Comparison between two each group

Groups	Post-endodontic (p value)	Significant Difference
Cryotherapy Vs Room temperature	0.964	No
Cryotherapy Vs No saline	0.029	Yes
Room temperature Vs No saline	0.248	No

Table 2: Pre-endodontic and post endodontic pain levels

Groups	Pre-endodontic pain			Post-endodontic pain			P value*
	(Mean±SD)	Median	Range	(Mean±SD)	Median	Range	
Cryotherapy	6.50±1.526	6.00	5	2.50±1.253	2.00	5	<0.05
Room temperature	6.47±1.676	7.00	5	2.70±2.261	2.00	7	
No saline	6.57±1.382	7.00	5	3.63±1.938	3.50	6	

* Wilcoxon Signed ranks test

final irrigant removes the remnants of sodium hypochlorite that could cause post-endodontic pain[16]. AF Bashir[17] also shows that both the CR and RS reduces PEP but without any significant difference ($p<0.05$). However, these results are not in accordance with the studies by S Junaid[19] Vera et al[18] and Keskin et al[20]. In these studies, CR is found to be significantly more effective than the RS ($p<0.05$). CR has an antimicrobial effect, thus inhibiting the microorganisms that could lead to periapical infection and PEP[21]. Vital inflamed teeth with healthy apical periodontium were selected in studies by Keskin et al[18] and S Junaid[19]. However, Jain et al[22] and A.A.Alharti et al recommended that the direct effect of cryotherapy in reducing PEP can only be assess in teeth with SAP.

Microbial, chemical, and/or mechanical injury to the peri-apical tissues are the most common causes of PEP[1]. Adequate shaping and cleaning of the root canal system could result in the elimination of the microbial cause. To control the confounding factors like chemical irritation to the periapical tissues, treatment was done in a same visit, thus avoiding the use of an intra canal inter-appointment medicament. Root canal sealers also may cause chemical irritation. To avoid this root canal sealer was not applied to the apical third of the gutta-percha points. The use of electronic apex locator and the periapical radiograph minimizes the mechanical injury to the periapical tissues.

Pharmacological and non-pharmacological techniques are commonly used for the management of PEP[3]. NSAIDS that are commonly prescribed for PEP management are not completely effective in reducing pain and are also associated with few drawbacks[8].

Cryotherapy is an innovative technique used for minimizing PEP. In vitro study by Vera et al[14] shows that the use of cold temperature saline reduces the temperature of the root surface by 10oC. Lowering the root surface temperature results in reducing the inflammatory mediators and pain producing chemicals and decreases tissue edema[11]. An in-vitro study has shown a reduced number of E. Faecalis after irrigating the root canal system by NaOCL followed by CR as compared to NaOCL alone[12].

It was an observational study with a small sample size. Pain was recorded subjectively, and the pulpal status of the teeth involved was not considered. In future a randomized controlled trial with a large sample size will be more helpful. Further research regarding the dose and duration of cold therapy is recommended. The role of cryotherapy in the success of root canal therapy needs to be established yet

CONCLUSION

Use of cryotherapy and saline at room temperature as final irrigants are equally effective in reducing the post-endodontic pain in patients diagnosed with symptomatic apical periodontitis. This will be helpful in minimizing post-endodontic pain in patients with symptomatic apical periodontitis.

REFERENCES

1. Meirinhos J, Martins JN, Pereira B, Baruwa A, Gouveia J, Quaresma SA, Monroe A, Ginjeira A. Prevalence of apical periodontitis and its association with previous root canal treatment, root canal filling length and type of coronal restoration–a cross-sectional study. International endodontic journal. 2020 Apr;53(4):573-84.
2. Bamini L, Sherwood A, Arias A, Subramani SK, Bhargavi P. Influence of tooth factors and procedural errors on the incidence and severity of post-endodontic pain: A prospective clinical study. Dentistry Journal. 2020 Jul 7;8(3):73.
3. Tanwir A, Shahbaz A, Akhtar H, Wahid U, Abbasi MS, Naseer A. Effectiveness of single dose premedication of piroxicam and prednisolone on post endodontic pain in one visit root canal treatment: a randomized clinical trial. European Endodontic Journal. 2022;7(3):187.
4. Erdogan O, Casey SM, Ruparel NB, Sigurdsson A. Bupivacaine for Root Canal Treatment–Practitioner Behaviors and Patient Perspectives: Survey Studies. Local and Regional Anesthesia. 2022 Feb 3:11-21.
5. de-Figueiredo FE, Lima LF, Lima GS, Oliveira LS, Ribeiro MA, Brito-Junior M, Correa MB, Sousa-Neto M, Faria e Silva AL. Correction: Apical periodontitis healing and postoperative pain following endodontic treatment with a reciprocating single-file, single-cone approach: A randomized controlled pragmatic clinical trial. Plos one. 2020 Mar 11;15(3):e0230511.
6. Angın AE, Özkan HD, Saral İP, Aydın B. The incidence and intensity of postoperative pain and Flare-up following the use of three different intracanal medicaments in teeth with posttreatment apical periodontitis: a randomized clinical trial. Clinical Oral Investigations. 2024 Jul;28(7):1-0.
7. Shamszadeh S, Shirvani A, Asgary S. Does occlusal reduction reduce post-endodontic pain? A systematic review and meta-analysis. Journal of oral rehabilitation. 2020 Apr;47(4):528-35.
8. Alhammadi N, Asiri AH, Alshahrani FM, Alqahtani AY, Al Qout MM, Alnami RA, Alasiri AS, Al-Zomia AS. Gastrointestinal complications associated with non-steroidal anti-inflammatory drug use among adults: a ret-

rospective, single-center study. Cureus. 2022 Jun;14(6).

9. Ordinola-Zapata R, Noblett WC, Perez-Ron A, Ye Z, Vera J. Present status and future directions of intracanal medicaments. International endodontic journal. 2022 May;55:613-36.
10. Cifu DX, Lew HL. Braddom's Rehabilitation Care: A Clinical Handbook E-Book. Elsevier Health Sciences; 2017 Jun 8.
11. Zheng X, Luo S, Huang C, Wang Z, Lin X. Comparison of kinesiology tape and cryotherapy on postoperative reaction following third molar extraction: a randomized clinical trial. Quintessence International. 2022 Oct 1;53(9).
12. Ajeesh K, Jayasree S, James EP, Pooja KP, Jauhara F. Comparative evaluation of the effectiveness of intracanal and intraoral cryotherapy on postendodontic pain in patients with symptomatic apical periodontitis: A randomized clinical trial. Journal of Conservative Dentistry and Endodontics. 2023 Sep 1;26(5):555-9.
13. Gupta A, Aggarwal V, Gurawa A, Mehta N, Abraham D, Singh A, Jala S, Chauhan N. Effect of intracanal cryotherapy on postendodontic pain: a systematic review and meta-analysis of randomized controlled trials. Journal of dental anesthesia and pain medicine. 2021 Feb;21(1):15.
14. Vera J, Ochoa-Rivera J, Vazquez-Carcaño M, Romero M, Arias A, Sleiman P. Effect of intracanal cryotherapy on reducing root surface temperature. Journal of endodontics. 2015 Nov 1;41(11):1884-7.
15. Fayyad DM, Abdelsalam N, Hashem N. Cryotherapy: a new paradigm of treatment in endodontics. Journal of endodontics. 2020 Jul 1;46(7):936-42.
16. Alharthi AA, Aljoudi MH, Almaliki MN, Almalki MA, Sunbul MA. Effect of intra-canal cryotherapy on post-endodontic pain in single-visit RCT: A randomized controlled trial. The Saudi dental journal. 2019 Jul 1;31(3):330-5.
17. Bashir AF, Jatala UW, ud din Ahmad M, Khan MT, Khan SR, Butt AA. Determining Efficacy of Intracanal Cryotherapy on Post Endodontic Pain in Irreversible Pulpitis: Cryotherapy on Post Endodontic Pain. Pakistan Journal of Health Sciences. 2024 Jun 30:68-72.
18. Vera J, Ochoa J, Romero M, Vazquez-Carcano M, Ramos-Gregorio CO, Aguilar RR, Cruz A, Sleiman P, Arias A. Intracanal cryotherapy reduces postoperative pain in teeth with symptomatic apical periodontitis: a randomized multicenter clinical trial. Journal of endodontics. 2018 Jan 1;44(1):4-8.
19. Junaid S, Khan HH, Bhangar F, Shah JA, Hussain SM, Yousaf A. Frequency of pain in Teeth with irreversible pulpitis after single visit root canal treatment using cryotherapy: intracanal cryotherapy. Pakistan Armed Forces Medical Journal. 2022;72(6):2099-102.
20. Keskin C, Özdemir Ö, Uzun İ, Güler B. Effect of intracanal cryotherapy on pain after single-visit root canal treatment. Australian endodontic journal. 2017 Aug;43(2):83-8.
21. Mohammadi Z, Shalavi S, Jafarzadeh H. CE Credit. Cryotherapy in Endodontics: A Critical Review. Journal of the California Dental Association. 2022 Dec 1;50(12):727-32.
22. Jain A, Davis D, Bahuguna R, Agrawal A, Singh S, Ramachandran R, Varghese A. Role of cryotherapy in reducing postoperative pain in patients with irreversible pulpitis; an in-vivo study. Int J Den Med Sci. 2018;2(1):43-9.