

Comparison of the Efficacy of the Dexamethasone Infiltration Injection and Cold Saline Irrigation on Postoperative Pain in Patients with Symptomatic Irreversible Pulpitis: A Prospective Clinical Study

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ABSTRACT

Objective: Root canal treatment and pulp therapy produce more acute and repeated postoperative discomfort, according to previous research studies. For pain control, several treatments have been approved, including the use of cold saline and dexamethasone before, during, and after an endodontic procedure. This study aimed to compare the clinical efficacy of dexamethasone infiltration injection and cold saline irrigation on postoperative pain in patients with symptomatic irreversible pulpitis.

Materials and Methods: A total of 100 patients who presented to a private dental clinic in Khyber Pakhtunkhwa have placed in two separate groups i.e., Group A, the dexamethasone infiltration group (n=50) and Group B, the cold saline group (n=50). The root canal treatment was performed in two sittings. The first appointment consisted of cleaning and shaping the canals with the postoperative use of dexamethasone infiltration injection in one group and cold saline in the other. After 24 hours, patients were recalled and their pain was reported using a visual analogue scale (VAS).

Results: For Group A, 15 (30%) patients felt no post-operative pain, 17 (34%) faced mild pain, 13 (26%) reported moderate pain and 5 (10%) faced severe pain. Whereas in Group B, 12 (24%) out of 50 patients felt no pain, 21 (42%) had mild pain, 13 (26%) reported moderate pain and 4 (8%) complained of severe pain. However, no statically significant difference was found in the level of pain between the irrigants used ($p=0.915$).

Conclusion: Slight difference exists in postoperative pain-controlling efficacy between 2 groups. But that is not significant according to the results. Cold saline irrigation being a new technique is highly effective as compared to Dexamethasone injection. Therefore, its use is recommended in controlling post-operative pain.

Keywords: Dexamethasone, Infiltration, Irrigation, Pulpitis

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INTRODUCTION

One of the most significant parts of endodontic practice is pain control during and after root canal treatment.¹ Attempts to educate patients about post-operative pain (PEP) and prescribe drugs to alleviate it can boost patient trust in their practitioners, raise patients' pain thresholds, and improve their mindset toward future dental procedures. When compared to other dental operational procedures, root canal treatment (RCT) and pulp therapy produce more acute and repeated postoperative discomfort, according to past research studies.² The root canals are cleaned of microorganisms by cleaning and shaping, followed by three-dimensional obturation to achieve a protective seal, hence providing a suitable atmosphere for peri-radicular healing.³ Despite executing root canal treatments with extreme caution, some patients have pain or flare-ups as a result of the procedure.^{2,3} Microorganism remnants are the most common cause of post-endodontic discomfort.³ The prevalence of PEP has been estimated to be between 3 - 58% in many studies.⁴ Many researchers have proposed hypothetical theories for why oedema and/or pain occur after endodontic therapy. Injuries to the peri-radicular tissue might be chemical, mechanical, or microbiological.⁵

Some of the treatments explored for PEP management include premedication with preventive analgesics and corticosteroids before endodontic treatment, occlusal reduction, and the provision of long-lasting anaesthesia.⁶ For several years Dexamethasone has been used in endodontics.⁷ Dexamethasone inhibits the production of prostaglandins and leukotrienes, lowering polymorphonuclear leukocyte chemotaxis. It also inhibits endothelial cell synthesis of oxygen and nitric oxide free radicals. It can also reduce proinflammatory cytokines (interleukin-1, -2, -6, and -7, as well as tumour necrosis factor) that are implicated in the inflammatory and immunological responses.⁷ For pain control, several treatments have been approved, including the use of dexamethasone before, during, and after an operation; this pharmaceutical substance can be taken orally or injected intraligamentary, periapical, intracanal, or intramuscularly.⁸

Another method to control PEP is the use of cold saline. Physiologic and clinical data show that administering cold saline via various means reduces nerve signal conduction velocity, bleeding, oedema, and local

inflammation, making it beneficial in the treatment of musculoskeletal pain, muscular spasms, and connective tissue distension.⁹ In a recent *in-vitro* study, a continuous intracanal supply of cold saline solution at 2.5°C with negative pressure irrigation causes the decrease in external root surface temperature by more than 10°C for 5 minutes which, according to the studies mentioned, would be sufficient to produce a local anti-inflammatory effect in peri-radicular tissues.¹⁰ However, there is no research on whether the use of cold saline lessens postoperative pain better than dexamethasone. The purpose of the study was to compare the clinical efficacy of dexamethasone infiltration injection and cold saline irrigation on postoperative pain in patients with symptomatic irreversible pulpitis.

MATERIALS AND METHODS

This prospective, comparative clinical study was conducted in a private tertiary care setup in the province of Khyber Pakhtunkhwa. Since the principal investigator is a consultant endodontist & restorative dentist, and an independent researcher, ethical approval for the present study was obtained from the head of the tertiary care setup. Written informed consent was obtained from all subjects before the study. The study was spanned over 6 months and was performed by two consultant endodontists who were competent in their work, techniques and materials. Inclusion criteria for the study were; participants from both genders (male and female), between the age group of 18 to 35 years, with good general health, patients who were willing to participate in the study, patients with a maxillary or mandibular molar tooth that had been identified as having symptomatic irreversible pulpitis (severe) and patients who have taken painkillers or anti-inflammatory drugs for less than past eight hours. Exclusion criteria for the said study were; patients with medical conditions like hypertension and diabetes mellitus, pregnant patients, patients taking systemic steroids or having dexamethasone allergy, patients with undeveloped apices or root resorption and patients presented with acute apical abscess, necrosed pulp or retreatment cases.

Using a non-probability consecutive sample technique, 100 patients were selected for the study. They were then randomly split into two equal groups (n=50) using a scientific random number table. All volunteers who met

the inclusion criteria completed informed permission forms after hearing verbal and written explanations of the study's design.

Demographic details including age, gender, preoperative pain intensity along with medical and dental history were recorded for each patient. Thereafter, a detailed clinical examination was performed and periapical radiographs were taken for each study participant. The diagnosis was made in consideration of the main complaint and the clinical investigation. The primary diagnostic sign was preoperative pain which was recorded before the procedure using Visual Analogue Scale (VAS). The operator graded the level of pain from 0 to 9 with 0 meaning No pain at all, 1-3 denoted minor pain, 4-6 representing moderate pain and a pain score of 7-9 denoted severe pain. All the patients had severe preoperative pain with scores ranging from 7 to 9.

The root canal procedure started with the injection of 1.8 mL of 2% lidocaine containing 1/100000 epinephrine for local anaesthesia (buccal infiltration for maxillary molars and inferior alveolar nerve block for mandibular molars).

The endodontic access cavities were prepared with sterile burs after a rubber dam was put in place. A glide path was created using a #10 K file (Dentsply Maillefer, Ballaigues, Switzerland) after the pulp tissue was removed with a broach. Using a Root ZX Mini Apex Locator (J. MORITA USA, INC.), the working lengths were calculated and radiographically verified. Cleaning & shaping was performed in each case using Protaper

Next (Dentsply Maillefer, Ballaigues, Switzerland). Sodium hypochlorite (5.25%) was used throughout the procedure for irrigation and debridement purposes. After completion of root canal preparation in each case, patients in Group A received Dexamethasone 0.2ml injections using a supra-periosteal infiltration injection technique with a 3cc syringe. In Group B, the root canals were then irrigated with 0.9% cold saline (2.5%) with a syringe having 30G side vented needle for 5 minutes and then dried using paper points. After 24 hours patients were recalled for the second appointment and the same VAS was used to measure the intensity of the pain.

The data was analyzed using SPSS® version 25.0. Means and standard deviations of post-operative pain for dexamethasone injection and cold saline were calculated. Post-stratification among irrigants, gender and postoperative pain at 24 hours was carried out using cross-tabulation between these variables. To find out the efficacy of irrigants, Independent samples t-test was performed by comparing means of postoperative pain between 2 groups keeping a *p*-value ≤ 0.05 which was considered statistically significant. All the data was presented in the form of tables.

RESULTS

A total number of 100 patients were included in this study, out of which 42(42%) were females and 58(58%) were males. The patients were divided into two groups equally to compare the postoperative pain faced by the patients, Dexamethasone was used in group A

Table 1: Crosstabulation between Irrigants, Post-operative Pain and gender after 24 hours

Gender			Post-Operative Pain				Total
			No Pain	Mild Pain	Moderate Pain	Severe Pain	
Female	Irrigant	Dexamethasone Injection	4	5	5	1	15
		Cold Saline	5	10	10	2	27
	Total		9	15	15	3	42
Male	Irrigant	Dexamethasone Injection	11	12	8	4	35
		Cold Saline	7	11	3	2	23
	Total		18	23	11	6	58
Total	Irrigant	Dexamethasone Injection	15	17	13	5	50
		Cold Saline	12	21	13	4	50
	Total		27	38	26	9	100

Table 2: Means and Std. Deviations of post-operative pain for both groups

Post-Operative Pain	Irrigant	N	Mean	Std. Dev
	Dexamethasone Injection	50	1.16	0.976
	Cold Saline	50	1.18	0.896

Table 3: Comparative means of postoperative pain between 2 groups using Independent Sample t-test

		t-test for Equality of Means		
		t	df	Sig. (2-tailed)
Post-Operative Pain	Equal variances assumed	-0.107	98	0.915*
	Equal variances not assumed	-0.107	97.293	0.915

**p*-value is 0.915

containing 50 patients and Cold Saline was used in group B containing 50 patients as well. In Group A, 15(30%) patients felt no post-operative pain, 17(34%) faced mild pain, 13(26%) complained of moderate pain and 5(10%) faced severe pain. Whereas in Group B, 12 (24%) out of 50 patients felt no pain, 21 (42%) had mild pain, 13(26%) had moderate pain and 4(8%) complained of severe pain (Table 1). Independent sample *t*-test was performed to compare means of postoperative pain between the two groups. However, no statically significant difference was found in the level of pain between the irrigants used ($p=0.915$) as given in Tables 2 & 3.

DISCUSSION

One of the most crucial objectives for clinicians is to manage pain during endodontic procedures and in the postoperative period.¹¹ Even with painkillers, the pain connected to symptomatic irreversible pulpitis is frequently excruciating and challenging to manage.¹² Depending on the severity of pain, various painkillers have been prescribed for post-endodontic pain ranging from anti-inflammatory drugs to opioids and steroids as well.¹³ Recently cryotherapy has been used in which cold saline is used as an intracanal irrigant.^{9,10}

The results of this study were quite diverse. Male to Female ratio was 1.380:1. 30%(15) of patients in Group A showed no postoperative pain at all. While in group B, 24%(12) had no pain after 24 hours. These results are nearly similar and are very desirable regarding cold saline irrigation. Moreover, 27% of the total patients fall into this category which means both groups responded very well to their respective irrigants. In a study conducted by Mehrvarzfar P et al, 40% of patients reported no pain after 24 hours of using dexamethasone

injection which is almost near to the result of the current study.^{14,15} In another study by Bazaid et al, 35% of patients experienced no pain at all after 24 hours of using cold saline irrigation which is slightly different from the findings of the present study.¹⁶ Although the statistics of these 2 studies differ very slightly from the current study, this is insignificant because of the variation that exists in sample size only.

In Group A, 34%(17) of patients had only mild pain after 24 hours while in Group B, 42%(21) of patients faced mild pain. This category constitutes the maximum number of patients (38%) and yet again there is little difference between the results of the 2 groups which means cold saline as a new modality, performed effectively in controlling postoperative pain in comparison to dexamethasone. According to a study by Jorge-Araújo et al, 30% of patients had only mild pain after 24 hours of using dexamethasone injection which is almost the same as the stats of the current study.¹⁷ In another study by Bazaid DS et al, 39% of patients had mild pain at 24 hours using cold saline irrigation which is also similar to the result of the present study.¹⁶ It is also implied that the occurrence of a mild degree of post-operative pain is very common between 12 to 24 hours as evidenced by many studies.

In both Groups A and B, 26%(13) of the patients felt moderate pain at 24 hours, which constitutes 26% of the total sample. Finally in Group A, 10%(5) of the patients felt severe pain at 24 hours while in Group B, only 8%(4) of patients felt severe pain which is better than dexamethasone. This category comprises only 9% of the total sample which means both the groups performed well in controlling post-operative pain. According to a study by Mehrvarzfar P et al, none of the

patients had moderate or severe pain using dexamethasone injection after 24 hours, unlike the present study.¹⁵ Concrete studies suggest that dexamethasone is the most effective from 12 to 48 hours and is a potent pain-reducing agent and very little data suggests that it can cause severe pain.^{8,13} On the other hand, in a study by Keskin C et al, 24.7% of patients felt moderate pain after 24 hours which is almost similar to the present study while none of the patients, unlike the present study, experienced severe pain using intracanal cold saline irrigation.¹⁸ The results vary because of the sample size variation between the two studies. These findings may also differ because of any change in methodology between studies.

Comparative means of postoperative pain between 2 groups was calculated using an independent sample *t*-test which showed the result was statistically insignificant ($p = 0.915$). It means that there is no significant difference in pain-controlling efficacy between dexamethasone and cold saline irrigation. And cold saline being a novel irrigant, cheap, nontoxic and easy to use, bear promising results in reducing postoperative pain in patients presenting with irreversible pulpitis.^{16,18}

There are a few limitations related to this study. The sample size could have been larger to have more predictable and precise data. There should have been a control group in this study for better comparison. The postoperative pain could also have been checked after 36 and 48 hours for more accurate data to be compared. The responses from patients are sometimes very subjective and variable which creates biases in the study. In the future, more studies are required to use cold saline irrigation on larger populations with longer follow-up times and to compare it with other medicaments to have a better idea about its potency.

CONCLUSION

It is concluded from the findings of the present study that although dexamethasone performs slightly better than cold saline irrigation in controlling postoperative pain after root canal treatment the difference is insignificant and the cold saline irrigation technique is very efficient in patients presenting with symptomatic irreversible pulpitis. Cold saline irrigation unlike other medicaments & materials is quite cheap, readily available and easy to use. Therefore, its use is evidence-based, encouraged and recommended for clinical use as

well.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

The ethical approval is provided by the Institutional Review Board at the Institute of Continuing Education, Peshawar, Pakistan (RefNo. 3502/ICE/2023).

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