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Original Research Article

Comparative evaluation of calcium hydroxide and amalgamated with NSAIDs as intracanal medicaments on preoperative and post operative pain in patients with symptomatic irreversible pulpitis: an in-vivo study

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ABSTRACT

Background: Pain of endodontic origin has been a major concern to the patient and clinicians for many years. Calcium hydroxide is the least effective medication in reducing postoperative pain despite having good antibacterial properties. NSAIDs have shown anti-inflammatory and antibacterial activity when incorporated into calcium hydroxide by improving the properties of calcium hydroxide as intracanal medicaments. This study aims to compare and evaluate the preoperative and postoperative pain following use of NSAIDs with Calcium hydroxide Intracanal medicament.

Methods: Eighty participants were included in the study and preoperative pain scores were recorded using the Visual Analog Scale and were divided into four groups: group 1-calcium hydroxide, group 2-calcium hydroxide with paracetamol, group 3 - calcium hydroxide with ketorol, group 4-calcium hydroxide with ketorol sp. postoperative pain scores were recorded using the visual analog scale at 6,12,24,48 hours.

Results: Results revealed that calcium hydroxide with ketorol group showed least pain and calcium hydroxide group has shown more pain.

Conclusions: This clinical study has provided evidence of anti-inflammatory efficacy of NSAIDS when used in addition with Calcium hydroxide as intracanal medicament.

Keywords: Calcium hydroxide, NSAIDs, Postoperative pain, VAS

INTRODUCTION

Pain after root canal treatment is a common concern that can greatly affect a patient's quality of life. Identifying the factors contributing to this pain and focusing on those supported by high-quality research can lead to more effective pain management.¹ Contemporary endodontic approaches produce appropriate biological outcomes yet preventing during and post operative pain is as much desired goal.² Pulpal inflammation is the primary source of endodontic pain region, and commonly occurs when dental caries advances into the tooth.³ Microorganisms are a major etiologic factor in pulpal and periradicular

diseases. Therefore, there is a need for a medicament that can provide prolonged anti-bacterial action with minimal irritation to the apical periodontium especially when the treatment cannot be completed in a single visit.⁴ Calcium hydroxide is most commonly used as an intracanal medicament for disinfection of the root canals since its introduction by Herman in 1920. Its highly alkaline pH is responsible for its lethal effects on bacterial cells which occurs through to protein denaturation and damage to DNA and cytoplasmic membranes.⁵ NSAIDs are among the most commonly recommended analgesics in dentistry today. They act by inhibiting the cyclooxygenase enzymes and prevents prostaglandin molecules.⁶ Paracetamol is one

of the most commonly used medication for the relief of mild to moderate pain. After decades of use, its efficacy and excellent safety profile have established it as the standard analgesic recommended as the first-line choice of pain relief for a wide range of patients and conditions.⁷

Ketorol DT is commonly used for the management of acute toothache due to its potent analgesic and anti-inflammatory properties. By reducing inflammation and blocking pain signals, Ketorolac provides significant relief from the intense pain often seen in acute dental conditions. Its rapid onset of action and effectiveness in managing both pain and inflammation make it especially useful in dental emergencies, offering short-term relief for patients before further treatment can be completed.⁸

Serratiopeptidase (serralysin/ serrapeptase/ Serratia-protease) is a proteolytic enzyme which is predominantly used for its anti-inflammatory action. It reduces the fluid accumulation in the tissues and facilitates the drainage of the fluid, thereby reducing edema and aids in tissue repair and reduces pain.⁹ So the aim of the present study is to compare and evaluate the preoperative and postoperative pain following use of NSAIDs with Calcium hydroxide Intracanal medicament.

METHODS

This Randomized clinical trial received approval from the ethical committee (MDC R-088476), Mamata Dental College, Khammam, Telangana. The study has been conducted from November 2024 to December 2024 in the Department of Conservative Dentistry and Endodontics, Mamata Dental College, Khammam Oral and written consent was obtained from all participants after explaining the study's objectives and methodology which are according to CONSORT guidelines .

Eligibility criteria

The study included Eighty adults aged 18–60 years with moderate to severe pain from symptomatic irreversible pulpitis diagnosed during an emergency visit. Eligible participants showed prolonged pain in response to a cold test with Endo-Frost spray and had not taken analgesics within the previous 6 hours.

Exclusion criteria included individuals with an American society of anesthesiologists physical status above 1, those allergic to NSAIDs, teeth unresponsive to the cold test and cases of toothache caused by periapical disease.

Randomization and blinding

Participants who met the inclusion criteria were randomly assigned to four groups: group 1–calcium hydroxide, group 2–calcium hydroxide with paracetamol, group 3–calcium hydroxide with keterol, group 4–calcium hydroxide with keterol SP (Figure 1). The allocation was

done by the assistant in which they have dispensed the medicament on the glass slab.

Blinding was maintained throughout, ensuring that participants, the researcher and the statistician were unaware of the group assignments. The medicament given was recorded on the participants information sheets solely for reference during the prescription process.

Patient assessment

All the patients were anaesthetized using standard 2% lignocaine with 1:100000 epinephrine. The teeth were isolated with rubber dam and an access opening was done (Figure 2). Working length was determined with apex locator and then confirmed radiographically. BMP was done using rotary nickel titanium files. throughout the treatment the canals were flushed with 5.25% sodium hypochlorite alternating with 17% EDTA. Final irrigation was done with normal saline, canals were dried and medicament was placed with one of the following medications: group 1-calcium hydroxide, group 2-calcium hydroxide with paracetamol, group 3-calcium hydroxide with keterol, group 4-calcium hydroxide with keterol SP.

Intracanal medications were inserted into dried canals with the help of lentulo spirals (Figure 3). Cavities were sealed with cavit, at the end of appointment, visual analog pain scale was explained to the patient. Patients were told to evaluate pain experienced 6 hours after treatment and daily for additional 12, 24 and 48 hours according to the visual analog scale (Figure 4). Values were attributed according to postoperative pain characteristics. They were also requested to stop taking analgesics except if pain persisted or recurred.

Statistical analysis

The obtained data was analyzed using SPSS (IBMSPPS Statistics for Windows version 26). Intragroup comparison was done using Friedman's test, Two-way ANOVA test and Post hoc Bonferroni test. Intergroup comparison was done using Kruskal Wallis test. Pairwise comparison was done using Post hoc Tukey's and Mann Whitney test. P value ≤ 0.05 was considered significant.

RESULTS

Table 1 represents demographic data of the patients. Table 2 compares the VAS score at different time points within each group. In each group, the VAS score showed a gradual reduction over different time points which was statistically significant.

Table 3 compares the change in VAS score at each time point from the baseline score within each group. In each group except in the calcium hydroxide+keterol group, the difference in the baseline and 6 hours VAS scores was non-significant. Comparison of 12 hours VAS score, 24 hours VAS score and 48 hours VAS score with Baseline VAS

within each group showed a significant difference from that of the baseline score. 12, 24 and 48 hours VAS scores were significantly lower than that of the baseline score.

Table 1: Demographic data of the patients.

Parameter	Number	%
Sex		
Male	22	27.5
Female	58	72.5
Age (in years)		
18-39	36	45
40-60	44	55

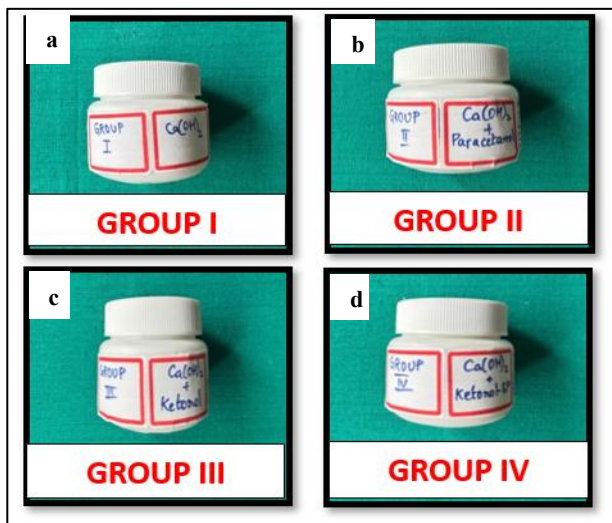


Figure 1 (a-d): Grouping: group 1-calcium hydroxide, group 2-calcium hydroxide with paracetamol, group 3-calcium hydroxide with ketorol, group 4-calcium hydroxide with ketorol SP.

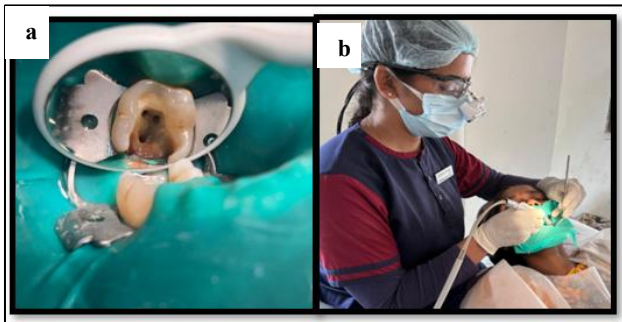


Figure 2 (a and b): Access opening of the tooth under isolation.

Table 4 compares the VAS score between four groups. At each interval except for 12 hours' time interval, the VAS score showed a non-significant difference between the four groups. At 12 hours' time interval, there was a significant difference in the VAS score of four groups.

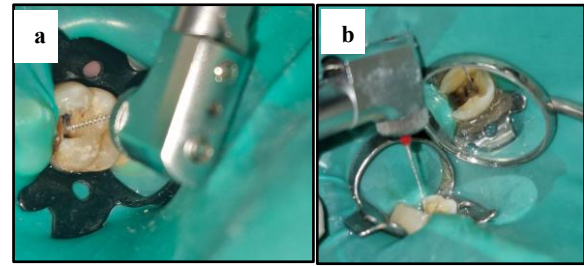


Figure 3 (a and b): Placement of intracanal medicament using a lentulospiral in the tooth.

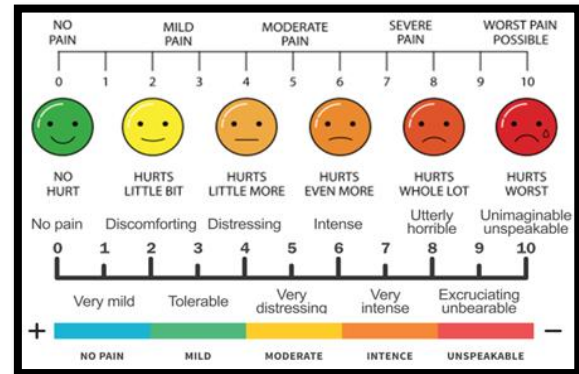


Figure 4: Visual analog scale for pain assessment.

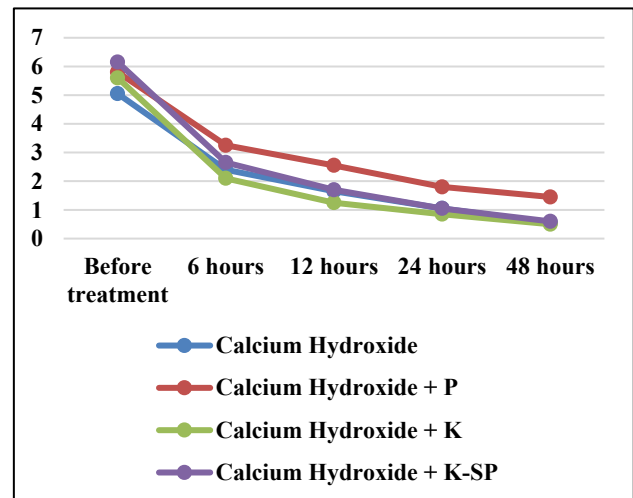


Figure 5: Comparison of change in VAS score at each time point from the baseline score within each group.

Table 5 presents the pairwise comparison of the VAS score between four groups. There was a non-significant difference in the VAS scores of four groups at baseline. After 6, 12, 24 and 48 hours, the VAS score of calcium hydroxide+ketorol group was significantly lower than that of calcium hydroxide+paracetamol group. Also, after 12 hours, VAS score of calcium hydroxide group was significantly lower than that of calcium hydroxide+paracetamol group. Rest of the pairwise comparisons did not achieve the statistical significance.

Table 2: Comparison of VAS score at different time points within each group Friedman's.

Group	Interval	Mean	SD	P value
Calcium hydroxide	Before treatment	5.05	2.11	<0.001*
	6 hours	2.40	2.19	
	12 hours	1.65	2.06	
	24 hours	1.05	1.54	
	48 hours	0.55	1.10	
Calcium hydroxide+paracetamol	Before treatment	5.80	2.29	<0.001*
	6 hours	3.25	1.94	
	12 hours	2.55	1.96	
	24 hours	1.80	1.80	
	48 hours	1.45	2.06	
Calcium hydroxide+Ketorol	Before treatment	5.60	1.96	<0.001*
	6 hours	2.10	1.97	
	12 hours	1.25	1.77	
	24 hours	0.85	1.66	
	48 hours	0.50	1.47	
Calcium hydroxide+Ketorol SP	Before treatment	6.15	2.78	<0.001*
	6 hours	2.65	1.66	
	12 hours	1.70	1.90	
	24 hours	1.05	1.57	
	48 hours	0.60	1.23	

Two-way ANOVA test; * indicates a significant difference at $p \leq 0.05$.**Table 3: Comparison of change in VAS score at each time point from the baseline score within each group.**

Baseline to	CH		CH+P		CH+K		CH+KSP	
	Difference	P value	Difference	P value	Difference	P value	Difference	P value
6 hours	2.65	0.214	2.55	0.093	3.5	0.037*	3.5	0.06
12 hours	3.4	<0.001*	3.25	<0.001*	4.35	<0.001*	4.45	<0.001*
24 hours	4	<0.001*	4	<0.001*	4.75	<0.001*	5.1	<0.001*
48 hours	4.5	<0.001*	4.35	<0.001*	5.1	<0.001*	5.55	<0.001*

Post hoc Bonferroni test; * indicates a significant difference at $p \leq 0.05$.**Table 4: Comparison of VAS score between four groups.**

Interval	Calcium hydroxide		Calcium hydroxide+P		Calcium hydroxide+K		Calcium hydroxide+K-SP		P value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Before treatment	5.05	2.11	5.8	2.29	5.6	1.96	6.15	2.78	0.566
6 hours	2.4	2.19	3.25	1.94	2.1	1.97	2.65	1.66	0.131
12 hours	1.65	2.06	2.55	1.96	1.25	1.77	1.7	1.9	0.045*
24 hours	1.05	1.54	1.8	1.8	0.85	1.66	1.05	1.57	0.068
48 hours	0.55	1.1	1.45	2.06	0.5	1.47	0.6	1.23	0.06

Kruskal Wallis test; * indicates a significant difference at $p \leq 0.05$.**Table 5: Pairwise comparison of VAS score between four groups.**

Interval	CH vs CH+P	CH vs CH+K	CH vs CH+KSP	CH+P vs CH+K	CH+P vs CH+KSP	CH+K vs CH+KSP
Before treatment	0.355	0.369	0.265	0.678	0.565	0.445
6 hours	0.096	0.678	0.429	0.033*	0.355	0.221
12 hours	0.035*	0.445	1	0.009*	0.102	0.478
24 hours	0.086	0.529	0.82	0.015*	0.081	0.779
48 hours	0.121	0.478	0.968	0.038*	0.127	0.478

Post hoc Mann Whitney test; * indicates a significant difference at $p \leq 0.05$.

DISCUSSION

Root canal infections are polymicrobial, comprising both aerobic and anaerobic microorganisms which are responsible for the production of enzymes and endotoxins, the inhibition of chemotaxis and phagocytosis.^{10,11} Post operative pain following root canal treatment is mostly associated with the residual microorganisms in the root canal system.²

Moreover, the severity of the pain depends on several factors, including the gender, tooth type, presence and size of periapical lesion, the number of treatment sessions, extrusion of infected debris, application of irrigation solution into the periapical tissue, volume of extruded debris and the technique of instrumentation.¹² Elimination of microorganisms is therefore crucial and placement of antimicrobial dressing after preparation is generally recommended. Antimicrobial dressing should have factors that enable the greatest possible and most long-lasting effect against a spectrum of bacterial species and should be biocompatible to periapical tissues.¹¹

Calcium hydroxide is widely used in dentistry because of its antimicrobial and biologic effects. Calcium hydroxide acts by stimulating tissue mineralization and its biologic and antiseptic effects rely on alkalinity and calcium ion release. The high pH of calcium hydroxide promotes microbial inhibition through an irreversible enzymatic reaction.¹³ The potential advantages that may be acquired using NSAIDs as intracanal medicament are anti-inflammatory action, local analgesia and possible antibacterial action so analgesics can be considered as choice for managing odontogenic pain in patients.¹⁴ Domenico et al conducted first research into the antibacterial efficacy of NSAIDs.¹⁴

NSAIDs are a category of analgesics that are widely used for dental pain because of their pronounced anti-inflammatory action that directly combat the main cause of POP.¹⁵ Since analgesics cross the placental barrier and may have adverse effects on the developing fetus, acetaminophen is considered as a safe analgesic. In pregnant patients, the prevalence of NSAIDs use has been reported to be as high as 34%. Acetaminophen (Paracetamol) is the most commonly used over-the-counter medication by 65-70% of pregnant women.¹⁶

Ketorolac is a potent NSAID and is as effective as morphine and meperidine for pain relief. It inhibits conduction in C-fibers, which are more resistant to local anesthesia than A-delta fibers and it has shown similar safety profile to traditional NSAIDs and COX-2 agents, but it presented significantly fewer adverse effects when compared to opioid analgesics.^{17,18} Other advantages of ketorolac over other NSAIDs include the lesser likelihood of alteration of bleeding time, acute renal failure in patients with pre-existing renal impairment and interaction with other drugs and single-dose administration.¹⁷ Enzyme based drugs have a great potential to be used. Serine

protease, the largest proteolytic family has been reported for several therapeutic applications. Serratiopeptidase, which is an extracellular metalloprotease has an anti-inflammatory, antiedemic and fibrinolytic activity and blocks the release of pain-inducing amines from inflamed tissues.¹⁹

According to the study done by Hegde et al Calcium hydroxide was effective in reducing post-treatment pain when it is used alone, but its effectiveness can be increased when used in combination with other medicaments which was in correlation with our study.²⁰ In the current study significant reduction in post operative pain was observed in ketorol group followed by calcium hydroxide, ketorol SP and paracetamol group which was in accordance with the study done by Sadeghein et al.²¹

The VAS is the most common scale to evaluate post-operative pain. VAS was a highly reliable tool for assessing acute pain in adults. VAS was also more informative and relatively sensitive to changes in pain, compared to other ordinal scales. Hence, we used VAS scale for pain assessment in our study.²²

CONCLUSION

This clinical study provided evidence of anti-inflammatory efficacy of NSAIDs when used in addition with Calcium hydroxide as intracanal medicament. This study concluded that ketorol in combination with calcium hydroxide in teeth with necrotic pulps was most effective in reducing post-operative pain followed by ketorol SP. Further studies are required to determine the most appropriate analgesic, along with its optimal dosage and timing in pain management.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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