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RESEARCH ARTICLE
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COMPARISION OF DIFFERENT INTRACANAL MEDICAMENTS IN DECREASING POST OPERATIVE PAIN AFTER ROOT CANAL TREATMENT

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Abstract

Objective: To compare the efficacy of different intracanal medicaments in reducing postoperative pain at different time intervals in necrotic teeth with apical periodontitis.

Study Design: Observational cross sectional

Place and duration of study: 128 Military Dental Unit (MDU), Dera Nawab Sahib from September 2023 to June 2024.

Methodology: Two hundred and four (204) gender matched patients of symptomatic apical periodontitis (SAP) and asymptomatic apical periodontitis (AAP) were selected after applying inclusion and exclusion criteria. They were divided into four groups based on treatment modality used. Mean ± SD pain score (0 -10) was measured pre and post operatively. Independent sample t test and ANOVA were employed to gauge any significant difference between these treatment modalities. $P<0.05$ was taken as statistically significant.

Results: Out of total 204 patients included in our study, 103 (50.5%) were male and 101(49.5%) were female. Mean age of study population was 36.71±7.99 years. Majority of the patients (67.1%) belonged to age group 20-40 years. There was statistically significant difference observed at all levels of management ($p<0.05$). Calcium hydroxide had the best results in terms of decreasing pain, followed by triple antibiotics paste (TAP) and Ledermix.

Conclusion: Calcium hydroxide mixture had best results in decreasing post-operative pain, followed by TAP and Ledermix.

Key Words: endodontic infections, intracanal medicaments, pain score.

INTRODUCTION

Endodontic infections are polymicrobial, mediated by various microbes including fungi and bacteria.[1] The purpose of endodontic treatment is to remove bacteria, by products and pulpal remnants with copious use of chemical irrigants and intra canal dressings to disinfect the root canal adequately. Pain before, during and after root canal therapy is of serious concern for both patients and dentists.[2] Root Canal treatment (RCT) is the treatment of choice in symptomatic or asymptomatic irreversible pulpitis and necrotic teeth which aim to eliminate inflamed and infected pulpal tissue thus promoting healing and progression of periapical pathology.[3] Elimination of microorganisms from infected root canals is a complicated task which includes numerous measures such as use of various instrumentation techniques, irrigation regimens and intracanal medicament.[4] Main purpose of intracanal medication is prevention of secondary infection and bacterial recolonization. Chemo-mechanical preperation alone cannot eliminate the microorganisms in dentinal tubules. Intracanal medication should have prolonged outcome and reduce irritation to periapical tissues. Hence both intracanal medication and chemomechanical preparation are beneficial for maximum bacterial reduction, which cannot be completed in single appointment due to the probability of bacteria surviving inside the dentinal tubules in inter-appointment time.[5] Total microbial eradication is challenging considering the complex anatomy of root canal system. However, the purpose is to reduce the microbial role in root canal to allow for complete microbial healing. Intracanal medicament is temporary placement of intra canal medicament with good biocompatibility in the root canal of teeth undergoing endodontic treatment to inhibit coronal invasion and proliferation of bacteria having good antimicrobial properties. It halts the bacterial growth and suppress bacterial proliferation and does not cause any tooth discolouration.[6] In primary root canal infection, success is dependent on type of pathogen and duration of infection. In persistent infection the efficacy can be compromised by development of microbial resistance and biofilm formation.[1]

Pulpal therapy and root canal treatment cause more severe and frequent post-operative pain as compared to other dental procedures. Success lies on good biomechanical preparation, cleaning, disinfection and obturation.[7] Many medications are used as intracanal medicaments e.g. ledermix, calcium hydroxide, farmocresol, chlorhexidine, glutaraldehyde, propolis, triple antibiotic paste (TAP) and odontopaste. Calcium hydroxide is the most established intracanal medicament. It functions by altering the cell wall resulting in reduced antigenicity and establishes highly alkaline environment which allows disinfection. It also promotes peri-radicular healing.[1] Ledermix is an antibiotic /corticosteroid combination effectively used as intracanal medicament. It has shown reduced incidence of post-operative pain. It diffuses through the dentinal tubules to periodontal and periapical tissue.[8] Triple antibiotic paste (TAP) is a common intracanal medication combination of ciprofloxacin, metronidazole and minocycline. It disinfects and sterilizes the root canal system, cleaning the microbial colonization and facilitating tissue regeneration. It gives polymicrobial cover which is effective against broad spectrum of bacteria.[9]

Rationale of this study is to note the specific response of the different intracanal medicaments in the local population and identify the best suited intracanal medicament which provides pain relief in necrotic teeth with asymptomatic and symptomatic apical periodontitis. The aim of the study was to compare the efficacy of different intracanal medicaments in reducing postoperative pain at different time intervals in necrotic teeth with apical periodontitis.

MATERIAL AND METHODS

This was an observational cross sectional study conducted at 128 Military Dental Unit (MDU), Dera Nawab Sahib from September 2023 to June 2024. Informed written consent was taken from all the participants of the study. Semi-structured questionnaire was used to collect the data.

Consecutive randomized sampling technique was employed and sample size was calculated by WHO sample size calculator at 95% confidence interval with 5% margin of error taking presumptive prevalence of 10% which came out to be slightly over 200.

Inclusion criteria were the patients having necrotic teeth giving negative response to vitality test which were divided in two groups; 1) symptomatic apical periodontitis (SAP) and 2) Asymptomatic Apical

Periodontitis (AAP). Exclusion criteria were the patients who had endo periodontal lesion, non-restorable teeth, teeth having chronic periodontitis, teeth with internal/external resorption, teeth with calcified canals, teeth with open apices, pregnant patients and the patients with serious medical illness including those not willing to give consent.

SAP was defined as inflammation of apical periodontium, producing clinical symptoms involving a painful response to biting and percussion or palpation. AAP was defined as inflammation of apical periodontium, not producing any clinical signs or symptoms. However, long term inflammation can eventually destroy the tissue surrounding the teeth. This usually develops gradually and leads to chronic periapical periodontitis.

All the patients were grouped into four categories based on treatment offered; which included 1) calcium hydroxide mixture (10 ml mixture containing 74 mg $Ca(OH)_2$ and dexamethasone 4 mg/ml), 2) Ledermix (medicinal active substances [1 g paste containing triamcinolone acetonide 10.0 mg, demeclocycline calcium 30.21 mg] and medicinal inactive substance [triamcinolone, calcium chloride, zinc oxide, and purified water]), 3) Triple antibiotics (TAP) consisting of three antibiotics namely metronidazole, ciprofloxacin and minocycline in a definite proportion of 1:1:1 and 4) placebo group.

Post-operative pain was gauged by pain perception index expressed as pain score from zero (0) to ten (10) in ascending order of severity. Pain scores were calculated postoperatively at different time intervals i.e. pre-operatively, 4 hours, 24 hours, 48 hours and 72 hours post operatively. Data were entered in software "statistical package for social sciences" (SPSS) version 21 for statistical analysis. Frequency and percentage were used as statistical tools for categorical variables whereas mean and standard deviation (SD) were used for numerical variables. Independent sample t test and one way analysis of variance (ANOVA) were used to find any significant difference between means of pain scores post operatively. P value <0.05 was taken as statistically significant.

Results:

Out of total 204 patients included in our study, 103 (50.5%) were male and 101(49.5%) were female. Mean age of study population was 36.71±7.99 years. The presentation of AAP was 51.5% while SAP was 48.5%. Majority of the patients (67.1%) belonged to age group 20-40 years. (Figure-1)

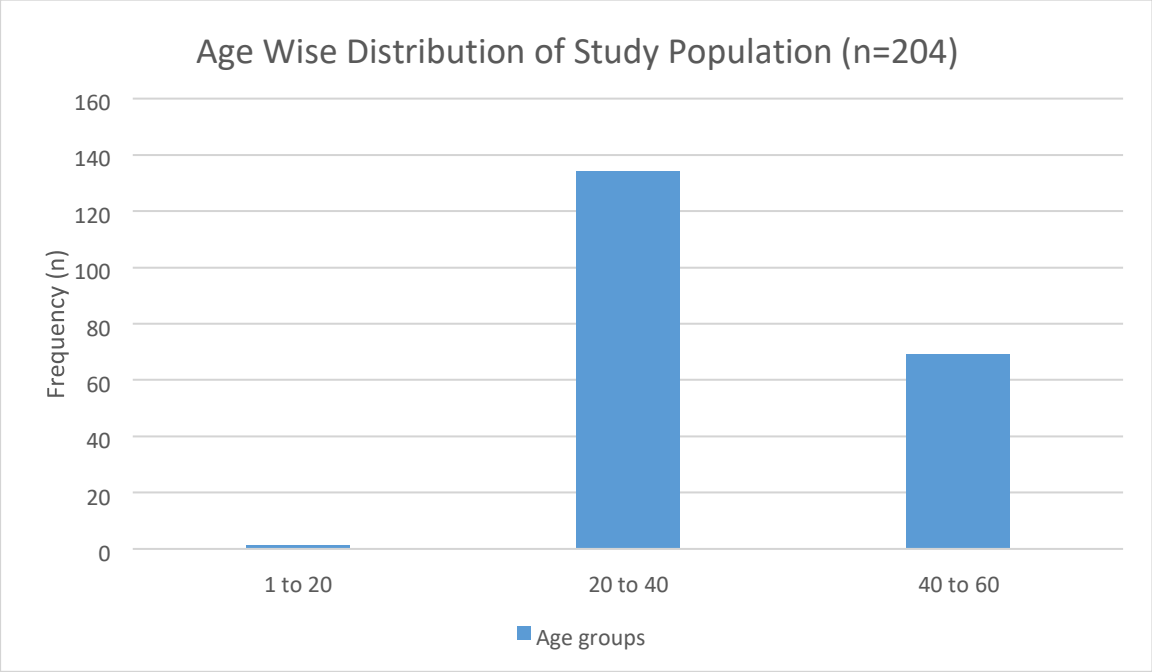

Figure-1: Age wise presentation of study population (n=204)

Most frequent treatment [n (%)] offered were TAP [59 (28.5%)] followed by Calcium hydroxide mixture [54 (26.5%)], Ledermix [50 (24.5%)] and Placebo [41(21.5%)] respectively.

Pain scores were calculated postoperatively at different time intervals i.e. 4 hours, 24 hours, 48 hours and 72 hours post operatively. These are summarized in Table-I.

Table-I: Mean pain scores in study population at different time intervals pre and post-operative (n=204).

Duration	Pain score (Mean±SD)
Pre-Operative	8.93±0.89
4 hours post-operatively	8.33±1.00
24 hours post-operatively	6.65±1.25
48 hours post -operatively	4.15±1.22
72 hours post operatively	1.86±1.15

The pain scores decreased significantly after treatment. After treatment through different modalities the responses of patients with respect to pain score were recorded as shown in TableII. There was statistically significant difference observed at all levels of management in timeline ($p<0.001$). Calcium hydroxide had the best results in decreasing pain scores, followed by TAP and Ledermix.

Table-II: Effects of different treatments on pre and post-operative pain in study population (n=204)

Pain score (0 – 10)	Treatment Modality				p-value
	Triple antibiotic (TAP)	Calcium Hydroxide Mixture	Ledermix	Placebo	
Preoperative Pain score (Mean±SD)	9.15 ± 0.85	8.98 ± 0.86	9.58 ± 0.91	8.95 ± 0.89	0.008
4 hours post-operative Pain score (Mean±SD)	8.56 ± 0.84	7.74 ± 0.96	8.92 ± 1.03	8.07 ± 0.72	<0.001
24 hours post-operative Pain score (Mean±SD)	7.03 ± 0.95	5.72 ± 1.20	7.20 ± 1.31	6.66 ± 0.97	<0.001
48 hours post-operative Pain score (Mean±SD)	4.31 ± 1.12	3.31 ± 0.95	4.78 ± 1.17	4.24 ± 1.18	<0.001
72 hours post-operative Pain score (Mean±SD	1.97 ± 1.29	1.26 ± 0.78	2.10 ± 1.22	2.20 ± 1.03	<0.001

DISCUSSION:

Endodontic treatment is a treatment or preventive measure to restore the condition of a diseased tooth so that it can be biologically accepted by the surrounding tissue. Irreversible pulpitis is the strongest

indication for endodontic treatment, followed by pulp necrosis, fractured teeth, intentional or prosthodontic reasons and failure of root canal treatment. Ngangi et al in their study showed pulp necrosis was the most common disease in dentistry.[10]

Despite conflicting claims, no medicament appears to be ideal, and significant variability exists in clinical dental practice regarding their use. With a wide choice of intracanal medicaments now available, selection should be made according to the special needs of the case in question. Intracanal medicament is effective in reducing the incidence of post treatment pain. Use of intracanal medicament differs from case to case and person to person depending on their clinical experience.[11]

The ideal intracanal medicaments should have the following characteristics: (1) strong antimicrobial abilities, (2) permeability and flowability, (3) formation of a physicalchemical barrier within the root canal, (4) excellent biocompatibility reducing inflammation in periapical tissues without causing additional irritation to the apical tissue (5) not interfering with the repair, induction of healing and hard tissue formation in periapical tissues and (6) easy removal. Currently, available drugs in clinical practice have not yet met all these requirements.[12]

Calcium hydroxide Mixture (CHM) is the commonly used intracanal medication for the treatment of apical periodontitis because of its antibacterial effect; it is used alone or together with 2% chlorhexidine to increase its efficacy against bacteria resistant to E. faecalis, it is the most frequently reported microorganism in cases of apical periodontitis.[13]

In our study it was observed that calcium hydroxide had the best outcome when seen in perspective of pain and gauged in terms of pain score. The mean pain scores decreased from 8.98 ± 0.86 to 1.26 ± 0.78 with best impact at 24 hours post operatively (pain score 5.72 ± 1.20). While TAP had second best significant impact in which mean pain scores decreased from 9.15 ± 0.85 to 1.97 ± 1.29 with best impact at 24 hours (mean pain score 7.03 ± 0.95). CH had best performance in decreasing pain scores post operatively which maybe attributable to the alkaline environment created in the apical area neutralizes periapical inflammation. However, recent studies have revealed a mechanism that causes a decrease in antimicrobial activity of CH due to buffering by dentin and a decreased penetration of CH in the dentinal tubules.[14]

While comparing the results of our study with studies conducted in different dental treatment centres of the world, we found different perspectives. There are some studies that prefer Ledermix over Calcium hydroxide and TAP. While there are also studies available that prefer TAP on other treatment modalities. Yet, most of these studies have concluded that there is a better outcome from any medicament (intervention) and the calcium hydroxide groups.

Genet et al concluded a study on post op pain reduction and found that usually there is a reduction in endo pain to a tolerable level in 3 days. Ledermix showed a hundred percent relief of symptoms.[15]

In another study by Khan et al revealed information regarding the relative effectiveness of different intra-canal medicaments in alleviating post-operative pain. The most significant reduction of pain was seen in the TAP group. Although no significant 4 hours post op between the TAP and Control group, in the next four days, the pain scores in the TAP group were significantly lower than all the other groups. The microbial flora responsible for pulp space infection is polymicrobial, and the lower pain scores in the TAP group indicate the better antimicrobial activity of this medicament.[16] Both medications significantly reduced mean pain over the follow-up period. Although the difference between the calcium hydroxide and triple antibiotic paste intracanal medications was not statistically significant ($p>0.05$), the triple antibiotic paste exhibited decreased post-operative pain.[17]

Following endodontic therapy, corticosteroids alleviate pain right away. Corticosteroids have long been used in dentistry in several ways. Intra-canal dexamethasone and ketorolac were shown to be more helpful in lowering postoperative pain than ibuprofen and placebo [new] 20 Although higher doses of corticosteroids help in providing better anti-inflammatory effects in the periradicular region, the chances of it resulting in systemic side effects may also increase when it is administered through other routes.[18]

On comparing CH with no ICM, CH does not seem to affect postoperative pain prevention within the first 24 hours [10], yet it could be of benefit afterward in reducing pain risk by about 12% within the following 2 days and 87% afterward. Results, however, should be interpreted with caution due to the

overall low-to-moderate quality evidence. Considering the potential microbiologic etiology of post-endodontic pain [31], CH has been postulated to have painpreventive properties which can be attributed due to its antibacterial, anti-inflammatory, and tissue-altering properties.[19, 20]
At present, different treatment modalities are effective in reducing post-operative pain and complications. Calcium hydroxide mixture can be effectively used in treating post-operative pain. Its antimicrobial properties and alkaline nature makes it the best suited treatment modality. Moreover, it is easily available, cost effective and does not need complicated procedures for its formulation. Dexamethasone has anti-inflammatory properties which further makes it work faster in reducing post-operative pain. Although, Standard of care root canal therapy causes significant reduction in post-operative pain, corticosteroids like dexamethasone may be used as medicaments or endodontic irrigants to the process of root canal treatment more pleasant for the patient.[21,22]

Limitations of Study:
The current study has certain limitations. Firstly, in the present study, cotton pellets were used as endodontic spacers and to wipe off excess medicaments from the access cavity walls. This step might leave residual cotton fibres on the access cavity walls, and can interrupt the seal of the temporary restoration as well as acting as a potential substrate for surviving bacteria. Secondly, the procedures were performed without the aid of an endodontic microscope. Microscopes have been shown to improve endodontic outcomes by helping in the detection and removal of necrotic debris and the management of canal variations and calcifications.

Conclusion:
Calcium hydroxide mixture effectively reduces post-operative pain in patients undergoing endodontic treatment. Calcium hydroxide mixture provided best treatment outcome for decreasing post-operative pain. TAP was second best treatment option and provided better pain relief. However, treatment needs to be individualized according to disease severity and resources available.

Conflict of Interest:
None

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