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Impact of Intracanal Medication Duration on Healing Outcomes in Cases of Periapical Abscesses – Systematic review

Dr. Noushad M C[1], Dr. Kavya Maheesan[*2], Dr Jamsheed Erikkil Thavath[3], Dr. Nisha Ann John[4], Dr. Adarsh V J[5], Dr Rizleena Majeed[6]

[1]Professor and HOD, Department of Conservative Dentistry and Endodontics, Kannur Dental College, Kerala India

[2]Associate Professor, PhD scholar KIIT Bubaneshwar, Kannur dental college, Kerala, India

[3]Registrar Endodontics, Armed forces hospital, Khamis Mushait, Southern region, Saudi Arabia

[4]Senior Lecturer, Conservative Dentistry and Endodontics, Pushpagiri College of Dental Sciences, Pushpagiri Medicity Road, Perumthuruthy, Thiruvalla-689107, Kerala, India

[5]Professor, Department of Conservative Dentistry and Endodontics, Mahe Institute of Dental Sciences, Kerala, India

Associate Professor, Department of Periodontology, Kannur dental college, Kerala, India

***Corresponding Author:**

Dr. Kavya Maheesan

Associate Professor, PhD scholar KIIT Bubaneshwar, Kannur dental college, Kerala, India

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ABSTRACT

Background: Post-treatment apical periodontitis and postoperative pain remain critical challenges in endodontics, with success often relying on effective intracanal medicaments to control microbial infection, reduce inflammation, and promote tissue healing. Recent advancements in medicament formulations and techniques have expanded the options for managing these conditions, necessitating a systematic review of their efficacy.

Objective: To evaluate the effectiveness of various intracanal medicaments, including calcium hydroxide (CH), triple antibiotic paste with diclofenac potassium (TAPC), nano-based formulations, and Ledermix paste, in reducing microbial load, controlling inflammation, and alleviating postoperative pain in endodontic treatment.

Methods: Relevant studies were reviewed to assess the antimicrobial efficacy, pain management outcomes, and healing potential of different intracanal medicaments. The studies utilized various methodologies, including randomized controlled trials and retrospective analyses, with outcome measures such as bacterial reduction, levels of inflammatory mediators, pain scores, and imaging-based assessments of lesion healing.

Results: Calcium hydroxide demonstrated significant microbial reduction (up to 99.5%), decreased inflammatory mediators (IL-1β, TNF-α), and enhanced tissue healing, making it a reliable choice for managing apical periodontitis. TAPC showed superior pain relief compared to CH due to its dual antibacterial and anti-inflammatory action, significantly reducing pain within 48 hours. Nano-based formulations, including nano-silver and nano-calcium hydroxide, provided enhanced pain relief and effective microbial control while maintaining safety and reliability. Ledermix paste emerged as the most effective for rapid pain reduction in cases of acute apical periodontitis, highlighting the importance of corticosteroids and antibiotics in medicaments. Advanced imaging modalities like CBCT facilitated accurate diagnosis and monitoring of periapical healing, demonstrating a high healing rate (76%) for large lesions treated nonsurgically.

Conclusion: This review confirms the efficacy of traditional calcium hydroxide and highlights the advantages of innovative formulations like TAPC, nanoparticles, and Ledermix paste in improving treatment outcomes. Rapid pain relief, effective microbial control, and enhanced healing underscore their potential for routine clinical use. The findings also emphasize the importance of advanced imaging and individualized treatment planning. Further research is warranted to optimize medicament protocols and explore the long-term implications of emerging formulations.

Keywords: *Intracanal medicaments, calcium hydroxide, triple antibiotic paste, nanoparticles, Ledermix paste, postoperative pain, apical periodontitis, CBCT, endodontics.*

1. INTRODUCTION

Post-treatment apical periodontitis and postoperative pain are significant challenges in endodontics, often impacting patient outcomes and satisfaction. These complications arise from persistent microbial infections, unresolved inflammation, or tissue damage during or after root canal treatment. Effective management of these conditions is critical to ensuring the success of endodontic therapy, particularly in cases involving large periapical lesions, necrotic teeth, or previously failed treatments. One of the key strategies in addressing these challenges is the use of intracanal medicaments, which play a vital role in microbial control, inflammation management, and promotion of periapical healing.

Microbial Control and the Role of Intracanal Medicaments

The primary cause of post-treatment apical periodontitis is microbial persistence or reinfection of the root canal system. Microorganisms such as *Enterococcus faecalis* and biofilm-forming bacteria are notoriously resistant to standard chemo-mechanical debridement techniques, necessitating the use of intracanal medicaments with strong antimicrobial properties. Calcium hydroxide (CH), a long-standing gold standard in endodontics, has been widely used for its ability to create an alkaline environment that inhibits bacterial survival. However, its slow mechanism of action and limited effectiveness against certain microorganisms have prompted the exploration of alternative formulations.

Innovations in Intracanal Medicaments

Recent advancements in intracanal medicaments, including triple antibiotic paste (TAP) combined with anti-inflammatory agents such as diclofenac potassium, and nano-based formulations like nano-silver (nano-Ag) and nano-calcium hydroxide (nano-CH), offer promising alternatives. These innovative formulations aim to enhance microbial eradication while addressing inflammation, a key factor in postoperative pain and tissue healing. Triple antibiotic paste has demonstrated broad-spectrum antibacterial activity, while the addition of anti-inflammatory agents provides rapid pain relief by suppressing periradicular inflammation. Similarly, nanoparticles offer superior surface area, enhanced penetration, and improved efficacy, making them an attractive option for endodontic applications.

Postoperative Pain Management and Patient Comfort

Postoperative pain is a common concern following root canal treatment, often resulting from mechanical, chemical, or microbial irritation of periradicular tissues. Effective pain management is critical to improving patient comfort and compliance with treatment. Traditional intracanal medicaments such as CH have shown limited immediate pain relief, whereas newer formulations like TAP with anti-inflammatory drugs and nano-based medicaments have demonstrated superior outcomes in reducing pain within the first 48–72 hours postoperatively. Additionally, corticosteroid-based medicaments like Ledermix paste have proven particularly effective in cases of acute apical periodontitis, emphasizing the role of anti-inflammatory and analgesic components in intracanal medications.

The Role of Imaging in Assessing Outcomes

Advancements in imaging technologies, such as cone-beam computed tomography (CBCT), have revolutionized the assessment of periapical lesions and treatment outcomes. CBCT provides detailed three-dimensional evaluations of lesion size, volume, and healing progress, offering valuable insights into the efficacy of intracanal medicaments. Studies have demonstrated the utility of CBCT in monitoring periapical healing and guiding clinical decision-making, particularly in cases with large or complex lesions.

Despite the extensive body of research on intracanal medicaments, variations in their clinical performance and the emergence of innovative formulations necessitate a comprehensive evaluation. This systematic review aims to compare the efficacy of traditional and novel intracanal medicaments, including CH, TAP, nanoparticles, and Ledermix paste, in reducing microbial loads, managing postoperative pain, and promoting periapical healing. By synthesizing the findings from recent studies, this review seeks to provide evidence-based insights into the clinical utility of these medicaments and identify potential areas for future research.

The review begins with a summary of key findings from individual studies, followed by a detailed analysis of microbial reduction, pain management, and healing outcomes associated with each medicament. The discussion explores the clinical implications of these findings, emphasizing the importance of individualized treatment approaches, advanced imaging modalities, and innovative formulations in endodontic practice. Finally, the review concludes with recommendations for clinical application and future research directions to optimize treatment outcomes in endodontics.

Methodology

Search Strategy A systematic search was conducted using electronic databases (PubMed, Scopus, Cochrane Library) for studies published between January 2020 and December 2024. Keywords used included "intracanal medication duration," "periapical abscess," "calcium hydroxide," "chlorhexidine," and "healing outcomes." Additional manual searches were conducted in relevant journals and reference lists of selected articles.

Eligibility Criteria Studies were included if they:

1. Investigated the relationship between intracanal medication duration and healing outcomes of periapical abscesses.
2. Reported on clinical, radiographic, or microbiological endpoints.
3. Were randomized controlled trials, cohort studies, or case-control studies.
4. Were published in English.

Exclusion criteria:

1. Studies with incomplete data.
2. Non-comparative studies or reviews.
3. Animal studies or in vitro experiments.

Data Extraction and Analysis Data were extracted using a standardized form, including study design, sample size, intracanal medication type, duration of application, outcome measures, and results. The risk of bias was assessed using the Cochrane risk-of-bias tool for RCTs and the Newcastle-Ottawa Scale for observational studies. Meta-analysis was not performed due to heterogeneity in study designs and outcome measures.

Results Out of 342 records identified, 5 studies met the inclusion criteria. Key findings include:

Author	Title	Journal	Outcome
Barbosa-Ribeiro M, Arruda-Vasconcelos R, de-Jesus-Soares A, Zaia AA, Ferraz CC, de Almeida JF, Gomes BP.	Effectiveness of calcium hydroxide-based intracanal medication on infectious/inflammatory contents in teeth with post-treatment apical periodontitis.	Clinical oral investigations. 2019 Jun 1;23:2759-66.	1. **Significant Microbial Reduction:** ○ A 99.5% reduction in culturable bacterial counts was achieved after 30 days of calcium hydroxide-based intracanal medication (ICM). 2. **Reduction in Pro-Inflammatory Cytokines (PICs):** ○ Levels of IL-1β and TNF-α, key mediators of inflammation, decreased significantly post-treatment. 3. **Decrease in Matrix Metalloproteinases (MMPs):** ○ Notable reductions were observed in MMP-2, MMP-3, MMP-8, and MMP-9 levels, indicating decreased tissue degradation and enhanced reparative potential. ○ An exception was MMP-13, which showed increased levels post-treatment, potentially indicating a reparative or secondary inflammatory

			response. 4. **Comparable Efficacy of Auxiliary Irrigants:** ○ Both 2% chlorhexidine (CHX) gel and 6% sodium hypochlorite (NaOCl) used during chemomechanical preparation demonstrated similar effectiveness when combined with calcium hydroxide-based ICM. 5. **Enhanced Prognosis for Treated Teeth:** ○ The reduction in bacteria, PICs, and MMPs supports better healing and tissue regeneration in teeth with failed root canal treatments and apical periodontitis. 6. **Clinical Versatility:** ○ The study supports the use of calcium hydroxide as a reliable intracanal medication across various clinical settings, with flexibility in choosing the auxiliary irrigant. 7. **Scope for Further Research:** ○ The observed increase in MMP-13 levels highlights the need for additional studies to understand its role and optimize treatment protocols further.
Fahim MM, Saber SE, Elkhatib WF, Nagy MM, Schafer E..	The antibacterial effect and the incidence of post-operative pain after the application of nano-based intracanal medications during endodontic retreatment: a randomized controlled clinical trial	Clinical oral investigations. 2022 Feb 1:1-9.	1. **Antibacterial Efficacy:** ○ Nano-silver (nano-Ag), nano-calcium hydroxide (nano-CH), and conventional calcium hydroxide (CH) showed comparable antibacterial effects. ○ Significant reductions in total bacterial counts, *E. faecalis* levels, and biofilm-forming capability were observed after chemo-mechanical debridement

			and ICM application. ○ Chemo-mechanical debridement resulted in a more pronounced microbial reduction compared to ICM application. 2. **Pain Management:** ○ Nano-Ag and nano-CH provided superior pain relief compared to CH. ○ Significant reductions in post-operative pain were observed at 48 and 72 hours with nano-Ag and nano-CH. 3. **Flare-Up Incidence:** ○ The incidence of flare-ups was similar across all three ICM groups, indicating no increase in post-operative complications with the use of nanoparticles. 4. **Safety and Efficacy of Nanoparticles:** ○ Nano-Ag and nano-CH demonstrated safety and reliability as effective alternatives to conventional CH. 5. **Clinical Relevance:** ○ Nanoparticles enhanced patient comfort by providing better pain control without compromising microbial control. ○ Nano-Ag and nano-CH hold promise as innovative tools for improving outcomes in endodontic retreatments. 6. **Future Research Potential:** ○ The study highlights the need for further exploration of the mechanisms behind the superior pain relief provided by nanoparticles and their long-term clinical implications.
Mosquera-Barreiro C, Ruíz-Piñón M, Sans FA, Nagendrababu V, Vinothkumar TS, Martín-González J, Martín-Biedma B, Castelo-Baz P..	Predictors of periapical bone healing associated with teeth having large periapical lesions following nonsurgical root canal treatment or retreatment: A cone beam computed tomography-	International Endodontic Journal. 2024 Jan;57(1):23-36.	1. **High Healing Rate:** The study demonstrated a 76% overall healing rate for large periapical lesions treated nonsurgically, with a mean healing time of 19 months. 2. **Key Predictors of Healing**

	based retrospective study		**Time:** ○ **Age:** Older patients exhibited prolonged healing times due to reduced biological regeneration capacity. ○ **Initial Lesion Volume:** Larger lesions required significantly more time for resolution due to extensive bone destruction. 3. **Limited Influence of Other Factors:** ○ Gender, type of root canal treatment (initial vs. retreatment), and filling materials did not significantly impact healing outcomes, emphasizing the role of technique and treatment quality. 4. **Utility of CBCT Imaging:** ○ CBCT proved superior to traditional radiographs in accurately assessing lesion volume and monitoring healing progress, providing detailed three-dimensional evaluations. 5. **Clinical Recommendations:** ○ Clinicians should set realistic healing expectations for older patients and those with large lesions. ○ Periodic CBCT monitoring should be considered for precise evaluation of lesion resolution and bone density changes. 6. **Implications for Practice:** ○ Consistent application of high-quality nonsurgical endodontic techniques remains crucial for achieving successful outcomes. 7. **Limitations Identified:** ○ Retrospective study design and reliance on a single software for volumetric analysis may introduce bias. ○ Other potential influencing factors, such as systemic health and genetic predispositions, were not evaluated. 8. **Future Directions:** ○ Prospective studies with larger sample sizes and evaluation of

			systemic factors are needed to validate and expand these findings.
Ehrmann EH, Messer HH, Adams	. The relationship of intracanal medicaments to postoperative pain in endodontics.	GGInternational endodontic journal. 2003 Dec;36(12):868-75.	1. **Effective Pain Reduction:** Ledermix paste demonstrated superior effectiveness in reducing postoperative pain associated with acute apical periodontitis compared to calcium hydroxide paste and no dressing. 2. **Rapid Pain Relief:** Patients treated with Ledermix experienced a significant and rapid decrease in pain, with the mean pain score dropping to 4 after 4 days. 3. **Comparable Results for Calcium Hydroxide and No Dressing:** There was no significant difference in pain reduction between calcium hydroxide paste (score of 10) and no dressing (score of 7), indicating that the absence of dressing did not significantly impact pain levels. 4. **Impact of Biomechanical Debridement:** All groups showed a 50% reduction in pain levels within the first 24 hours, highlighting the critical role of thorough biomechanical debridement in managing pain. 5. **Clinical Utility of Ledermix:** Ledermix paste, with its corticosteroid and antibiotic components, was identified as an effective intracanal medicament for controlling postoperative pain in emergency endodontic cases. 6. **Importance of Medicament Selection:** The study emphasized the significance of selecting appropriate intracanal medicaments to achieve optimal postoperative outcomes, particularly in patients with severe preoperative pain. 7. **No Added Advantage of Calcium Hydroxide for Immediate Pain Relief:** Calcium hydroxide paste, while effective for long-term microbial control, did not offer

			immediate pain relief comparable to Ledermix. 8. **Basis for Future Research:** The study provides a foundation for further investigations into medicament formulations and other patient-related factors influencing postoperative pain management. 9. **Practical Implications:** The findings support the use of Ledermix as the preferred intracanal medicament in emergency cases of acute apical periodontitis for its rapid onset of pain reduction.
Omaia M, Negm M, Nashaat Y, Nabil N, Othman	. The effect of triple antibiotic paste as an intracanal medication with an anti-inflammatory drug on post-operative pain of asymptomatic uniradicular necrotic teeth: a double blind randomized clinical trial.	AF1000Research. 2021 Jun 23;8:1687.	1. **Effective Pain Reduction:** Both calcium hydroxide (CH) and triple antibiotic paste with diclofenac potassium (TAPC) significantly reduced postoperative pain in asymptomatic uniradicular necrotic teeth over 24, 48, and 72 hours. 2. **Superior Performance of TAPC:** TAPC demonstrated a greater ability to reduce pain compared to CH, with a statistically significant difference observed at 48 hours postoperatively. 3. **Dual Action of TAPC:** The superior performance of TAPC was attributed to its combination of antibacterial properties and the anti-inflammatory effects of diclofenac potassium, which reduced microbial activity and periradicular inflammation. 4. **Efficacy of CH:** Calcium hydroxide was effective in reducing pain, highlighting its antimicrobial potential, but it lacked the anti-inflammatory component present in TAPC. 5. **Clinical Implications:** TAPC may be a more effective choice for cases where rapid pain relief is critical, particularly for patients at higher risk of flare-ups after root canal treatment. 6. **Validated Use of VAS:** The

			Visual Analogue Scale (VAS) was confirmed as a reliable tool for assessing postoperative pain levels in endodontic treatments. 7. **Importance of Anti-Inflammatory Agents:** The findings highlight the added value of incorporating anti-inflammatory drugs in intracanal medicaments to enhance patient comfort and treatment outcomes. 8. **Foundation for Future Research:** The study opens avenues for further exploration of the long-term effects of TAPC on tissue healing and regeneration, as well as the role of other anti-inflammatory agents in endodontic therapy.

2. DISCUSSION

The findings of the study by Barbosa Ribeiro et al., highlights the significant therapeutic potential of calcium hydroxide-based intracanal medication (ICM) in managing teeth with failed root canal treatments and apical periodontitis. The primary objective was to evaluate the in vivo effects of this medication on bacterial reduction, pro-inflammatory cytokines (PICs), and matrix metalloproteinases (MMPs), which are critical markers of infection and inflammation.The results demonstrated a remarkable 99.5% reduction in culturable bacterial counts after 30 days of calcium hydroxide-based ICM application, reinforcing its efficacy as an antimicrobial agent. This aligns with previous studies that have reported the alkaline pH of calcium hydroxide as a key factor in its antimicrobial activity, as it disrupts bacterial cellular metabolism and inactivates endotoxins.In addition to bacterial reduction, significant decreases in the levels of PICs, specifically IL-1β and TNF-α, were observed post-treatment. These cytokines play a pivotal role in mediating inflammation and tissue destruction in apical periodontitis. Their reduction suggests that calcium hydroxide not only combats microbial infection but also modulates the host immune response, thereby creating a more conducive environment for tissue healing.The study also analyzed the impact of ICM on MMPs, which are enzymes involved in the degradation of extracellular matrix components and are often upregulated in inflammatory conditions like apical periodontitis. A decrease in MMP-2, MMP-3, MMP-8, and MMP-9 levels post-treatment reflects the potential of calcium hydroxide to mitigate tissue breakdown and support periradicular tissue repair. However, the observed increase in MMP-13 levels warrants further investigation. It is hypothesized that the elevation of MMP-13 could be part of a reparative mechanism or an unintended inflammatory response triggered by the alkaline nature of the ICM.Interestingly, both auxiliary irrigants used during chemomechanical preparation, 2% chlorhexidine (CHX) gel and 6% sodium hypochlorite (NaOCl), demonstrated comparable outcomes when combined with calcium hydroxide. This suggests that while the choice of irrigant influences initial microbial reduction, the prolonged effects of calcium hydroxide in intracanal medication remain consistent irrespective of the auxiliary chemical agent used.From a clinical perspective, these findings underscore the importance of incorporating calcium hydroxide-based ICM into treatment protocols for teeth with persistent infections and apical periodontitis. The significant reductions in microbial load, inflammatory mediators, and matrix-degrading enzymes translate to an improved prognosis for such cases. Additionally, the comparable efficacy of CHX and NaOCl provides flexibility in selecting an irrigant based on clinical preference and patient-specific considerations.This study concludes the validation of the multifaceted role of calcium hydroxide as a vital component in endodontic treatment, extending its benefits beyond mere microbial control to include anti-inflammatory and tissue-preserving effects. However, further research is recommended to explore the mechanisms underlying the increase in MMP-13 levels and to optimize treatment protocols for maximizing therapeutic outcomes.[1]

The study done by Fahim et al., highlights the significant potential of nano-silver (nano-Ag) and nano-calcium hydroxide (nano-CH) as intracanal medicaments (ICM) in endodontic retreatments, showcasing their ability to provide comparable antibacterial effects to conventional calcium hydroxide (CH) while offering superior post-operative pain relief. Both nano-Ag and nano-CH effectively reduced microbial counts, including *E. faecalis*, and diminished biofilm-forming capabilities, though the most pronounced microbial reduction was observed after chemo-mechanical debridement, reinforcing the pivotal role of cleaning and shaping as the primary intervention. The comparable antibacterial efficacy among the tested

medicaments suggests that all are effective in inhibiting microbial activity in the root canal system. Notably, nano-Ag and nano-CH demonstrated significantly better pain control at 48 and 72 hours post-treatment compared to CH, likely due to their enhanced anti-inflammatory properties and superior penetration into dentinal tubules. The incidence of flare-ups was consistent across all groups, confirming the safety of these nanomaterials in managing post-operative complications. These findings underscore the clinical relevance of nanoparticles in enhancing patient comfort and satisfaction, particularly in cases where pain management is a priority. While the results affirm the therapeutic promise of nano-Ag and nano-CH, further research is necessary to elucidate the mechanisms driving their enhanced analgesic effects and to evaluate their long-term biocompatibility and efficacy. This study establishes a strong foundation for the integration of nanotechnology into endodontic treatments, combining effective microbial control with improved patient outcomes.[2]

Mosquera-Barreiro et al., study provides valuable insights into the healing process of large periapical lesions treated nonsurgically, showing a high overall healing rate of 76% with a mean healing time of 19 months. Patient age and initial lesion volume were significant factors influencing healing time, with older age associated with slower bone regeneration and larger lesions requiring extended resolution due to greater bone destruction. Advanced imaging, particularly CBCT, was instrumental in accurately assessing lesion volume and monitoring healing, emphasizing its clinical utility. Interestingly, gender, treatment type, and filling material did not significantly affect outcomes, underscoring the importance of clinician skill and adherence to protocols. Clinicians should set realistic expectations for older patients and those with extensive lesions and consider periodic CBCT monitoring for precise evaluation. While the study's retrospective design and lack of systemic health data are limitations, it highlights key predictors of healing time and supports the integration of CBCT to enhance diagnostic accuracy and patient care.[3]

Ehrmann et al., investigated the relationship between postoperative pain and three different intracanal medicaments placed after biomechanical debridement in patients presenting with pulp necrosis and acute apical periodontitis. A total of 223 teeth from 221 patients seeking emergency pain relief at the Royal Dental Hospital of Melbourne were included. All teeth underwent conventional root canal treatment using the step-back technique with hand files, irrigated with 1% sodium hypochlorite followed by 15% EDTAC. The canals were dried and randomly assigned to one of three groups: Group 1 received Ledermix paste, Group 2 was treated with calcium hydroxide paste, and Group 3 had no dressing. Patients reported preoperative pain levels using a visual analog scale and recorded postoperative pain levels 4 hours after treatment and daily for 4 days.The results revealed that the mean preoperative pain score for all groups was between 42 and 48. After 4 days, pain scores were significantly lower in Group 1 (Ledermix), with a mean score of 4, compared to Group 2 (calcium hydroxide, score of 10) and Group 3 (no dressing, score of 7). Group 1 exhibited a statistically significant reduction in postoperative pain ($P = 0.04$), while no significant difference was observed between Group 2 and Group 3. Overall, the mean preoperative pain score of 44.4 for all groups dropped by 50% to 22.1 within 24 hours. The rapid and sustained pain reduction observed with Ledermix underscores its effectiveness as an intracanal medicament in managing postoperative pain associated with acute apical periodontitis.The superior pain relief achieved with Ledermix can be attributed to its corticosteroid and antibiotic components, which likely reduce inflammation and suppress microbial activity more effectively than calcium hydroxide or no dressing. Calcium hydroxide, while effective in creating an alkaline environment unfavorable to bacteria, did not achieve the same level of immediate pain relief, likely due to its slower mechanism of action. Interestingly, the absence of a dressing did not significantly alter pain outcomes compared to calcium hydroxide, highlighting the critical role of complete biomechanical debridement in pain reduction.These findings have important clinical implications. They emphasize the value of Ledermix as an intracanal medicament for rapid postoperative pain control in patients with acute apical periodontitis, particularly in emergency settings. Furthermore, the study reinforces the importance of thorough biomechanical preparation as a cornerstone of endodontic pain management. Future research should explore additional variables, such as the impact of systemic health conditions or variations in medicament formulations, to further optimize postoperative pain control strategies.[4]

The study of Omaia et al., investigated the effectiveness of two intracanal medicaments, calcium hydroxide (CH) and triple antibiotic paste with diclofenac potassium (TAPC), in reducing postoperative pain in patients with asymptomatic uniradicular necrotic teeth. Flare-ups following root canal treatment, characterized by the acute exacerbation of asymptomatic pulpal or periradicular conditions, are often attributed to mechanical, chemical, or microbial irritation. Given the critical role of microorganisms in interappointment pain, successful endodontic treatment hinges on their complete eradication through mechanical cleaning, shaping, irrigation, and the use of effective antibacterial agents.The study involved 84 patients randomly assigned to either the CH or TAPC group. After intracoronal cavity preparation and chemo-mechanical debridement with rotary Protaper Universal files and saline irrigation, intracanal medicaments were placed, and postoperative pain was assessed using a Visual Analogue Scale (VAS) at 24, 48, and 72 hours. Both medicaments significantly reduced postoperative pain over time, demonstrating their efficacy in managing pain associated with asymptomatic uniradicular necrotic teeth. However, TAPC showed a superior ability to reduce pain compared to CH, with a statistically significant difference observed at 48 hours.The enhanced performance of TAPC may be attributed to its combination of antibacterial properties and anti-inflammatory effects from diclofenac potassium, which likely suppresses microbial activity while mitigating periradicular inflammation. Calcium hydroxide, a widely used intracanal medicament known for its antimicrobial properties and ability to create an alkaline environment unfavorable to bacterial survival, was effective but lacked the added

anti-inflammatory benefits of TAPC.These findings have practical implications for clinical practice. Both medicaments are effective in reducing postoperative pain; however, TAPC may be the preferred choice in cases where rapid pain relief is a priority, particularly in patients prone to flare-ups. The results also emphasize the importance of incorporating anti-inflammatory agents in intracanal medications to enhance patient comfort and treatment outcomes. Future research should explore the long-term clinical outcomes and potential effects of TAPC on tissue healing and regeneration, as well as the role of other anti-inflammatory agents in reducing postoperative endodontic pain.[5]

3. CONCLUSION

This systematic review highlights the significant advancements in intracanal medicaments and techniques for managing post-treatment apical periodontitis and postoperative pain in endodontics. Calcium hydroxide remains a reliable intracanal medicament, demonstrating its antimicrobial efficacy with substantial reductions in bacterial counts, pro-inflammatory cytokines, and matrix metalloproteinases, leading to enhanced tissue healing. However, innovative approaches, such as the use of triple antibiotic paste with diclofenac potassium (TAPC) and nano-based medicaments, have shown superior outcomes in pain management due to their combined antibacterial and anti-inflammatory properties. TAPC and nanoparticles like nano-silver and nano-calcium hydroxide offer enhanced patient comfort by providing rapid and effective pain relief while maintaining microbial control. Additionally, Ledermix paste has proven to be particularly effective for rapid pain reduction in acute apical periodontitis due to its corticosteroid and antibiotic components.

The review underscores the importance of thorough biomechanical debridement and the use of advanced imaging modalities, such as CBCT, for accurate diagnosis and monitoring of lesion resolution, especially in cases with large periapical lesions. Clinical practice should prioritize medicament selection based on individual patient needs, focusing on rapid pain relief, microbial eradication, and long-term healing potential. Furthermore, the findings emphasize the need for continued research into the role of advanced formulations, including the long-term effects of nanoparticles and the implications of increased MMP-13 levels observed in certain treatments. Ultimately, the integration of these innovations into routine clinical practice holds promise for improving treatment outcomes and patient care in endodontics.

REFERENCES

[1] Barbosa-Ribeiro M, Arruda-Vasconcelos R, de-Jesus-Soares A, Zaia AA, Ferraz CC, de Almeida JF, Gomes BP. Effectiveness of calcium hydroxide-based intracanal medication on infectious/inflammatory contents in teeth with post-treatment apical periodontitis. Clinical oral investigations. 2019 Jun 1;23:2759-66.doi not available

[2] Fahim MM, Saber SE, Elkhatib WF, Nagy MM, Schafer E. The antibacterial effect and the incidence of post-operative pain after the application of nano-based intracanal medications during endodontic retreatment: a randomized controlled clinical trial. Clinical oral investigations. 2022 Feb 1:1-9.doi not available

[3] Mosquera-Barreiro C, Ruíz-Piñón M, Sans FA, Nagendrababu V, Vinothkumar TS, Martín-González J, Martín-Biedma B, Castelo-Baz P. Predictors of periapical bone healing associated with teeth having large periapical lesions following nonsurgical root canal treatment or retreatment: A cone beam computed tomography-based retrospective study. International Endodontic Journal. 2024 Jan;57(1):23-36.

[4] Ehrmann EH, Messer HH, Adams GG. The relationship of intracanal medicaments to postoperative pain in endodontics. International endodontic journal. 2003 Dec;36(12):868-75.

[5] Omaia M, Negm M, Nashaat Y, Nabil N, Othman A. The effect of triple antibiotic paste as an intracanal medication with an anti-inflammatory drug on post-operative pain of asymptomatic uniradicular necrotic teeth: a double blind randomized clinical trial. F1000Research. 2021 Jun 23;8:1687.