

A Randomized Controlled Experiment Evaluating the Effect of Endodontic Therapy with Various Intracanal Medicaments on Periodontal Attachment Level in Endodontic-Periodontal Lesions. A 12 Month Study with 4 Intracanal Medicaments

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Abstract: ***Aim:** The purpose of this study is to assess the effect of various intracanal medicaments used during endodontic treatment on periodontal attachment levels in concurrent endodontic-periodontal diseases without communication. **Materials and Methods:** Hundred teeth with mixed endodontic-periodontal lesions were randomly assigned to four groups: Test Group 1 (calcium hydroxide [Ca(OH)₂] + iodoform), Test Group 2 (2% chlorhexidine + Ca(OH)₂), Test group 3 (Triple Antibiotic Paste), and Control Group (no intracanal medicament). Standard procedures were used to perform root canal therapy (RCT). Teeth in test groups were treated with the appropriate medications for 28 days before to obturation. Baseline characteristics were recorded, and follow-up assessments were conducted at three, six, and 12 months. Parameters such as reduction in apical radiolucency, presence of periapical healing, bleeding on probing (BOP) percentage, clinical attachment level (CAL), and periodontal depth were evaluated. **Results:** All three groups showed significant improvement in PD, CAL, %BOP, and PAI scores ($P < 0.05$) from baseline to 6 months. The presence of periapical healing was more frequent in Group 1 (85%) and Group 2 (80%) compared to Group 3 (77%) and Group 4 (60%). Group A showed the lowest mean BOP percentage (15.2 ± 3.5), followed by Group B (18.6 ± 4.2), Group C ($19.7.1 \pm 4.8$) Group C (22.1 ± 4.1). **Conclusion:** In this study, both calcium hydroxide and triple antibiotic paste demonstrated potential therapeutic effects in promoting healing and reducing apical radiolucency compared to the control group. Calcium hydroxide exhibited the most favorable outcomes, with a higher presence of periapical healing, lower BOP percentage, and superior CAL and periodontal depth measurements. These findings contribute to the understanding of intracanal medicaments' effectiveness in apical periodontitis management.*

Keywords: endodonticperiodontal diseases, intracanal medicaments, calcium hydroxide, periodontal healing, apical radiolucency

1. Introduction

Endodontic-periodontal lesions typically provide several diagnostic and treatment issues to clinicians. Concurrent endodontic-periodontal disorders affect teeth with distinct periapical and periodontal lesions. Teeth with these lesions have an infected pulp space, apical periodontitis, and marginal periodontitis with pocket development. These extremely infrequent lesions have received little attention in the literature, and there is little data on their occurrence.

Apical periodontitis treatment aims to reduce radiolucency, resolve clinical symptoms, and restore healthy periapical tissues. Intracanal medications aid in this process by providing antibacterial, anti-inflammatory, and tissue-regenerative properties. Calcium hydroxide and triple antibiotic paste are often used in endodontic treatments. Calcium hydroxide is extensively used for its antibacterial qualities and capacity to promote apical healing, whereas triple antibiotic paste provides broad-spectrum antimicrobial properties.

Because the root tissues are adjacent to the periodontal structures, the root canal space may act as a reservoir for the therapeutic release of intracanal medicaments to both the root dentinal tissue and the external surface. In vitro investigations

have shown that hydroxyl ions can diffuse through exposed dentinal tubules and elevate pH at the external root surface after intracanal Ca(OH)₂ medication. In concurrent endodontic-periodontal lesions, intracanal insertion of Ca(OH)₂ medication, its combinations with CHX and Triple Antibiotic Paste improved clinical periodontal parameters following endodontic treatment. Chlorhexidine (CHX) has gained a lot of interest in recent years as a prospective root canal irrigator and intracanal medication. Although the use of combined Ca(OH)₂ and CHX as an intracanal medicament has not been studied in well-controlled clinical studies, early research indicates that this may be a sensible combination with antibacterial efficacy equivalent to or slightly superior to any of the components used alone.

This observational study aims to evaluate the effect of intracanal medicaments, specifically calcium hydroxide and triple antibiotic paste, on the healing of apical periodontitis. By assessing parameters such as reduction in apical radiolucency, presence of periapical healing, bleeding on probing (BOP) percentage, clinical attachment level (CAL), and periodontal depth, the study aims to provide a comprehensive understanding of the therapeutic effects of these medicaments. Furthermore, the study will assess the

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sustainability of treatment outcomes over a 12-month follow-up period.

This observational study employed a prospective design involving a cohort of 304 teeth from 215 patients. This sample size was determined using the sample size calculations of an earlier study conducted on similar grounds [10]. The patients were selected through non-probability convenient sampling, considering individuals aged between 18 and 65 years, with no systemic diseases affecting oral health. Ethical approval was obtained from the Institutional Review Board, and informed consent was obtained from all participants.

2. Materials And Methods

Study Population and Experimental Design

The present study was conducted as a randomized controlled, parallel-design, double-blind clinical trial. It was conducted in accordance with the principles outlined in the Helsinki's Declaration on experimentation involving human subjects. Written informed consent was obtained from all patients. 100 Teeth in 100 patients (49 males and 51 females) aged 21–65 years. Eligibility criteria included a negative response to vitality tests with radiographic evidence of periapical radiolucency and probing depth ≥ 5 mm coupled with generalized chronic periodontitis. Patients who were having root-filled tooth, unrestorable tooth, perforated/fractured roots, history of periodontal therapy with in previous 6 months, inflammatory root resorption, Grade 3 mobile teeth, serious medical illness, requirement for antibiotic prophylaxis before dental care, and concurrent endodontic-periodontal lesion with communication were excluded from this study.

Data collection:

The data collection process commenced with a thorough clinical examination and radiographic assessment of the affected teeth. Baseline measurements, including patient demographics, medical history, tooth location, and preoperative radiographic findings, were recorded. The selected patients were then categorized into three groups based on the type of intracanal medicament used: Group 1 (calcium hydroxide), Group 2 (Calcium Hydroxide+CHX), and Group 3 (Triple antibiotic paste) Group 4 Control (NO Intracanal Medicament). Random allocation of patients to each group was performed using computer-generated random numbers.

After baseline measurements, supragingival scaling with ultrasonic scaler was done and oral hygiene instructions were provided. Root canal treatment (RCT) was carried out by an endodontist following a standardized treatment protocol. Canals were enlarged three times larger than the initial binding

file followed by step back and irrigated with 10 ml NaOCl (1%) using a 30-gauge Appli-Vac™ Pre-Tipped Syringes (Vista apex Racine, Wisconsin, USA). Smear layer was removed by irrigating with 5.0 mL 17% EDTA (Roth Vista apex Racine, Wisconsin, USA) for 1 min followed by 5.0 mL 1% NaOCl, and the final irrigant being 5 ml of distilled water. Canals were then thoroughly dried with paper points. Following this protocol, all the teeth were randomly allocated to the following three groups:

- Test Group 1 – Ca(OH)₂paste (DIAPEX PLUS, Diadent Burnaby, BC, CANADA)
- Test Group 2 – Paste made by mixing Ca(OH)₂powder (Pulpdent Corporation, Watertown, USA) and 2% CHX PLUS liquid (Balas Vista apex Racine, Wisconsin, USA)
- Test Group 3 - a triple antibiotic paste containing ciprofloxacin, metronidazole, and minocycline
- Control Group 4 – No intracanal medicament.

Randomization:

Baseline values were documented before starting endodontic therapy. A calibrated 15-mm periodontal probe (HuFriedy, Chicago, IL, USA) was used to measure clinical attachment level (CAL), probing depth (PD), and bleeding on probing (BOP) at six locations per tooth (mesiobuccal, midbuccal, distobuccal, mesiolingual, mid-lingual, and distolingual).

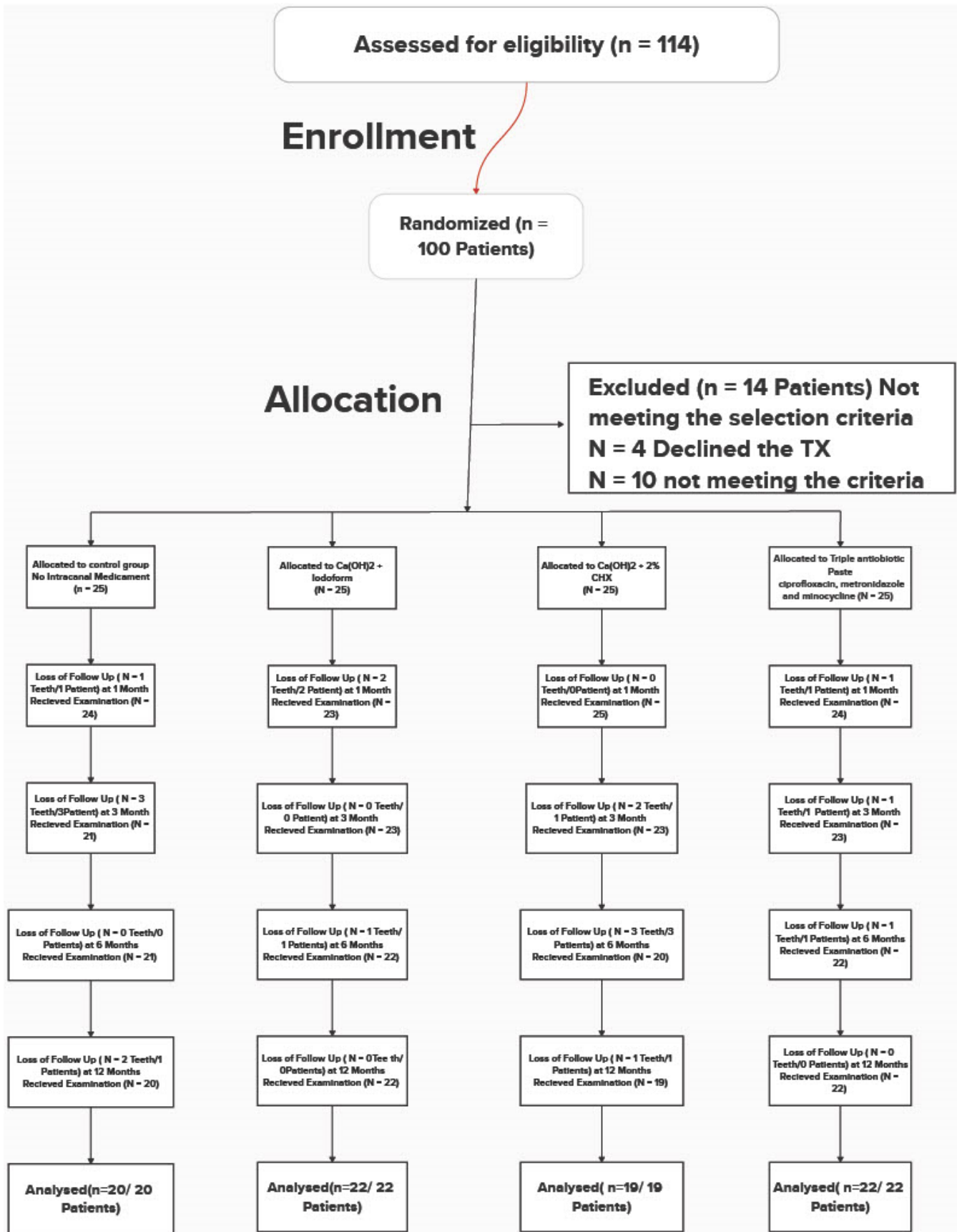
The periapical status was determined using the periapical index (PAI), and the level of alveolar bone at the proximal root surface was evaluated using CDR DICOM. Using the software, a parallel straight line to the root surface was drawn over the digital image to measure the distance between the cemento-enamel junction and the most coronal bone level, at which the width of the periodontal ligament space was considered normal on both the mesial and distal surfaces. The alveolar bone level and PAI score were measured at baseline, 6-month, and 1-year intervals.

Follow up Schedule:

Periodontal parameters were recorded at 1, 3, 6 and 12 months after endodontic intervention (1 month after completion of endodontic treatment and supragingival scaling; 2 months after completion of scaling and root planning (SRP); and 5 months after SRP, respectively.

3. Result

A total of 100 teeth were included in the study (40 incisors, 49 molars and 11 Premolars). Recall rate was 96% at 1 month, 89% at 3 months, 86% at 6 months and 83% at 12 months. Demographic characteristics for each treatment group are listed in the table below.



Demographic characteristics and the analysis of radiographic evaluation of marginal bone levels and periapical index scores for each group.

Parameter	Time Point	Control	Ca(OH) ₂	Ca(OH) ₂ + CHX	Triple Antibiotic Paste
Male		14	13	15	13
Female		11	12	10	12
Age		33 - 61	28 - 74	36 - 79	31 - 66
Marginal Bone Level					
Mesial	Baseline	6.56 ± 2.3	4.79 ± 1.3	5.91 ± 1.3	5.81 ± 1.70
	6 Months	6.16 ± 1.9	4.29 ± 1.7	5.21 ± 1.7	5.12 ± 1.30
	Change	0.4 ± 0.3	0.50 ± 1.3	0.70 ± 1.3	0.69 ± 1.40
Distal	Baseline	7.16 ± 1.7	4.56 ± 2.1	4.16 ± 1.2	4.26 ± 2.7
	6 Months	6.56 ± 2.0	4.23 ± 1.3	3.83 ± 1.1	3.86 ± 1.3
	Change	0.60 ± 1.9	0.23 ± 1.6	0.33 ± 1.4	0.40 ± 1.9
PAI Score	Baseline	3.60 ± 1.9	4.10 ± 1.9	3.90 ± 2.10	4.39 ± 1.5
	6 Months	2.89 ± 2.6	3.49 ± 1.8	3.10 ± 1.70	3.69 ± 1.8
	Change	0.71 ± 2.1	0.61 ± 2.1	0.80 ± 1.90	0.70 ± 1.70

For statistical analysis, the highest measurement for PD and CAL, taken from six aspects of each affected tooth, was used. The Kruskal-Wallis test showed no statistically significant differences among the Control, Ca(OH)₂, 2% CHX + Ca(OH)₂, and TAP (triple antibiotic paste) groups in terms of mean PD reduction (P = 0.159), mean CAL gain (P = 0.569), and mean % BOP (P = 0.452) at the 1-month interval, at the 3-month interval (PD: P = 0.159, CAL: P = 0.56, % BOP: P = 0.863), as well as at the 6-month interval (PD: P = 0.714, CAL: P = 0.689, % BOP: P = 0.935), and the 12-month interval (PD: P = 0.809, CAL: P = 0.789, % BOP: P = 0.95).

Additionally, there was no significant difference in marginal bone levels either at baseline or at the 6-month period (mesial, P = 0.751; distal, P = 0.714).

All three groups showed a statistically significant reduction in PAI scores from the baseline assessment to the 6-month evaluation (group I: P = 0.003, group II: P = 0.004, group III: P = 0.002, Group 4 = 0.005). However, there were no statistically significant differences among the groups at either the baseline examination (P = 0.823) or the 6-month evaluation (P = 0.659).

Parameter	Time Point	Control	Ca(OH) ₂	Ca(OH) ₂ + CHX	Triple Antibiotic Paste
CAL ± SD	Baseline	7.12 ± 1.7	6.96 ± 1.4	7.16 ± 1.7	6.76 ± 1.2
	1 Month	6.19 ± 1.3	5.98 ± 1.6	6.09 ± 1.3	5.21 ± 1.2
	3 Months	6.16 ± 1.6	5.16 ± 1.2	5.69 ± 1.6	4.89 ± 1.6
	6 Months	6.12 ± 1.9	4.71 ± 1.7	5.14 ± 1.9	4.25 ± 1.9
	12 Months	6.09 ± 1.2	4.02 ± 1.3	4.51 ± 1.2	3.81 ± 1.2
	Change	1.03 ± 1.4	2.94 ± 1.4	2.65 ± 1.4	2.95 ± 1.4
PD(mm) ± SD	Baseline	7.24 ± 1.3	5.94 ± 1.26	6.84 ± 1.7	7.98 ± 1.9
	1 Month	6.94 ± 1.3	5.02 ± 1.3	5.98 ± 1.2	6.76 ± 1.4
	3 Months	6.76 ± 1.5	4.88 ± 1.7	5.16 ± 1.3	6.16 ± 1.6
	6 Months	5.82 ± 1.9	4.12 ± 1.3	4.98 ± 1.6	5.42 ± 1.9
	12 Months	5.19 ± 1.6	3.84 ± 1.3	4.79 ± 1.8	4.69 ± 1.2
	Change	2.05 ± 1.3	2.10 ± 1.5	2.05 ± 1.4	3.29 ± 1.7
Percentage BOP ± SD	Baseline	76 ± 13	79 ± 19	83 ± 28	89 ± 21
	1 Month	72 ± 19	64 ± 21	74 ± 28	76 ± 24
	3 Months	67 ± 16	57 ± 22	69 ± 16	62 ± 19
	6 Months	52 ± 21	49 ± 24	58 ± 26	58 ± 16
	12 Months	44 ± 26	41 ± 23	47 ± 22	42 ± 12
	Change	32 ± 19	38 ± 19	36 ± 13	47 ± 19

4. Results

This study assessed periodontal healing after root canal treatment (RCT) in concurrent endodontic-periodontal lesions, using Ca(OH)_2 , 2% CHX + Ca(OH)_2 paste, and triple antibiotic paste as intracanal medicaments, compared to a control group without medicament. Statistically significant reductions in pocket depth and bleeding sites, along with gains in attachment levels, were observed in all groups over a 6-month follow-up period. These findings indicate improved clinical periodontal parameters and an increase in alveolar bone levels in most cases after performing RCT prior to periodontal treatment in endodontic-periodontal lesions. RCT eliminates infection in the pulp space and prevents remaining microbial irritants from accessing the periodontal area by sealing the pathways between the pulp space and periodontal tissues. Since the cases selected for the study involved necrotic teeth with periapical pathology, it would be unethical to have a periodontal control group without performing endodontic treatment. Thus, a periodontal control group was not included in our study.

The observed periodontal healing in both the medicament and non-medicament groups in our study may be attributed to effective cleaning and shaping, adequate obturation, and proper periodontal debridement. It appears that the use of intracanal medicaments does not provide additional benefits; rather, once optimal reduction of intracanal bacteria is achieved following RCT, healing is accelerated. The lack of significant impact from intracanal medicaments on periodontal healing in this clinical trial could also be related to the limited or nonexistent transfer of $\text{Ca(OH)}_2/\text{Ca(OH)}_2 + \text{CHX}$ to the external root surface. Although there was little over edge to those where the intracanal medicament was extruded periapically. Improved healing was observed in those cases where observed specially in Ca(OH)_2 and TAP Group.

5. Conclusion

Within the limits of this study, we can conclude that treatment of endodontic-periodontal lesions by performing endodontic treatment before periodontal therapy results in significant improvement in the periodontal parameters. However, short-term Ca(OH)_2 , 2% CHX+ Ca(OH)_2 paste and Triple antibiotic paste as an intracanal medicament therapy may not have a significant effect on the periodontal healing.

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Nil

Conflict of Interest

There are no conflicts of interest.