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Efficacy of Chlorhexidine Intracanal Medicament on Periodontal Healing in Concomitant Endodontic-Periodontal Disease with Communication: A Randomized Clinical Trial

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Abstract
Endodontic-periodontal disease with communication presents a significant challenge in dental practice, necessitating effective therapeutic approaches. Chlorhexidine, a widely used antimicrobial agent, has demonstrated efficacy in endodontic and periodontal treatments. This study aims to evaluate the efficacy of Chlorhexidine as an intracanal medicament on periodontal healing in patients with concomitant endodontic-periodontal disease with communication. This randomized clinical trial was conducted at DR. B.R. Ambedkar Institute of Dental Sciences and Hospital, Patna. A total of 60 patients diagnosed with endodontic-periodontal lesions with communication were randomly assigned to two groups. The test group (n=30) received Chlorhexidine as an intracanal medicament, while the control group (n=30) received standard calcium hydroxide. Clinical parameters, including probing depth (PD), clinical attachment level (CAL) and radiographic bone fill, were assessed at baseline, 3 months and 6 months post-treatment. Statistical analysis was performed using paired t-tests and ANOVA. The test group demonstrated a significant reduction in probing depth (PD) from 7.5±0.8 mm at baseline to 4.2±0.5 mm at 6 months ($p<0.001$). The clinical attachment level (CAL) improved from 8.2±0.7 mm to 5.0±0.6 mm ($p<0.001$). Radiographic bone fill increased by 45% compared to the baseline. In the control group, PD reduced from 7.4±0.9 mm to 5.1±0.6 mm, and CAL improved from 8.1±0.8 mm to 5.7±0.7 mm ($p<0.05$). The difference in the improvement between the test and control groups was statistically significant. The use of Chlorhexidine as an intracanal medicament significantly enhances periodontal healing in patients with concomitant endodontic-periodontal disease with communication compared to standard calcium hydroxide treatment. Chlorhexidine's superior antimicrobial properties contribute to better clinical outcomes, making it a viable option for managing complex endodontic-periodontal lesions.

INTRODUCTION

Endodontic-periodontal lesions represent a complex interplay between periodontal and endodontic infections, often leading to significant clinical challenges. These lesions can manifest due to the anatomical proximity and shared pathways between the periodontal and endodontic tissues, allowing for the spread of infection and inflammation[1]. Effective management of such conditions is crucial for ensuring optimal oral health and function.

Chlorhexidine, a broad-spectrum antimicrobial agent, has been widely used in dentistry for its efficacy against a range of oral pathogens. It is known for its substantivity, which allows it to adhere to dental tissues and exert prolonged antimicrobial effects[2]. Its use in endodontics, particularly as an intracanal medicament, has been explored to enhance microbial control within the root canal system[3]. Studies have demonstrated that Chlorhexidine can effectively reduce bacterial load, contributing to improved treatment outcomes in endodontic therapy[4,5].

Periodontal healing in the context of endodontic-periodontal lesions requires not only the resolution of infection but also the regeneration of the periodontal attachment apparatus. Traditional intracanal medicaments, such as calcium hydroxide, have been used for their antimicrobial properties and ability to induce hard tissue formation[6]. However, the need for more effective antimicrobial agents to address the dual infection pathways in endodontic-periodontal lesions has led to the exploration of Chlorhexidine as a potential alternative[7].

This randomized clinical trial aims to evaluate the efficacy of Chlorhexidine as an intracanal medicament on periodontal healing in patients with concomitant endodontic-periodontal disease with communication. By comparing the outcomes with those of standard calcium hydroxide treatment, this study seeks to provide evidence on the potential benefits of Chlorhexidine in managing these complex lesions. Understanding the impact of Chlorhexidine on clinical parameters such as probing depth (PD), clinical attachment level (CAL) and radiographic bone fill will contribute to improving treatment protocols for endodontic-periodontal lesions.

MATERIALS AND METHODS

Study Design and Setting: This randomized clinical trial was conducted at DR. B.R. Ambedkar Institute of Dental Sciences and Hospital, Patna. The study was approved by the institutional ethics committee and written informed consent was obtained from all participants.

Patient Selection: A total of 60 patients, aged 18-60 years, diagnosed with concomitant endodontic-periodontal lesions with communication were included in the study. Patients were selected based on the following inclusion criteria:

- Presence of teeth with endodontic-periodontal lesions exhibiting clinical signs of inflammation, probing depth (PD) = 6 mm and radiographic evidence of bone loss.
- No systemic conditions affecting periodontal health.
- No history of periodontal therapy or antibiotic use in the past six months.
- Patients with non-communicating endodontic-periodontal lesions, teeth with poor prognosis, or those who were pregnant or lactating were excluded.

Randomization and Allocation: Patients were randomly assigned to one of two groups using a computer-generated randomization table. The test group (n = 30) received Chlorhexidine as an intracanal medicament, while the control group (n = 30) received calcium hydroxide. Allocation concealment was ensured using opaque, sealed envelopes.

Treatment Procedure: All patients underwent initial periodontal therapy, including scaling and root planing. Endodontic treatment was performed under local anesthesia using a standardized protocol:

- **Access Cavity Preparation:** An access cavity was prepared, and the working length was determined using an electronic apex locator and confirmed radiographically.
- **Canal Preparation:** Root canals were prepared using rotary NiTi instruments with a crown-down technique. Irrigation was performed with 2.5% sodium hypochlorite solution.

Intracanal Medicament:

- Test Group: After canal preparation, 2% Chlorhexidine gel was placed into the canals using a lentulo spiral.
- Control Group: Calcium hydroxide paste was placed into the canals using a lentulo spiral.

The canals were temporarily sealed with Cavit and patients were recalled after two weeks for further assessment.

Clinical and Radiographic Assessment: Clinical parameters, including probing depth (PD) and clinical attachment level (CAL), were measured at baseline, 3

months and 6 months post-treatment by a blinded examiner using a UNC-15 periodontal probe. Radiographic bone fill was assessed using standardized periapical radiographs at the same time intervals.

Statistical Analysis: Data were analyzed using SPSS software version 25.0. Descriptive statistics were computed for all variables. Paired t-tests were used to compare within-group changes over time, and ANOVA was used to compare between-group differences. A $p<0.05$ was considered statistically significant.

Blinding: Both the patients and the outcome assessors were blinded to the group assignments. The dentist performing the treatments was not blinded due to the nature of the interventions.

This comprehensive methodology ensures the reliability and validity of the study findings, providing a robust framework for evaluating the efficacy of Chlorhexidine as an intracanal medicament in periodontal healing.

RESULTS AND DISCUSSIONS

Demographic Data: A total of 60 patients were enrolled in the study, with 30 patients in each group. The demographic characteristics of the patients, including age and gender distribution, were comparable between the two groups (Table 1).

Clinical Outcomes: The clinical parameters, including probing depth (PD) and clinical attachment level (CAL), were measured at baseline, 3 months and 6 months post-treatment. The results showed significant improvements in both groups, with the test group demonstrating superior outcomes.

Radiographic Outcomes: Radiographic analysis showed a significant increase in bone fill in both groups, with the test group exhibiting a greater percentage of bone fill.

Statistical Analysis: The differences in PD, CAL, and bone fill between the test and control groups were statistically significant at 3 months and 6 months ($p<0.05$).

Summary:

- **Probing Depth:** The test group showed a reduction from 7.5±0.8 mm to 4.2±0.5 mm, while the control group reduced from 7.4± .9 mm to 5.1± 0.6 mm ($p<0.001$).
- Clinical Attachment Level: The test group improved from 8.2±0.7 mm to 5.0±0.6 mm and the control group from 8.1±0.8 mm to 5.7±0.7 mm ($p<0.001$).
- Radiographic Bone Fill: The test group achieved a 45% ± 5% increase, compared to 30%±4% in the control group ($p<0.05$).

These results indicate that Chlorhexidine as an intracanal medicament significantly enhances periodontal healing compared to calcium hydroxide in patients with endodontic-periodontal lesions.

The results of this randomized clinical trial indicate that Chlorhexidine as an intracanal medicament significantly enhances periodontal healing in patients with concomitant endodontic-periodontal disease with communication. This study contributes valuable insights into the management of these complex lesions, highlighting the potential benefits of Chlorhexidine over traditional calcium hydroxide treatments.

Chlorhexidine's superior antimicrobial properties likely underlie its effectiveness in this study. Previous research has demonstrated its broad-spectrum activity against various oral pathogens, including those implicated in endodontic and periodontal infections[1,2]. The substantivity of Chlorhexidine allows it to remain effective over extended periods, providing continuous antimicrobial action within the root canal system[3]. This persistent effect is particularly advantageous in managing endodontic-periodontal lesions, where sustained microbial control is essential for successful healing.

The significant reduction in probing depth (PD) and improvement in clinical attachment level (CAL) observed in the test group align with findings from other studies investigating Chlorhexidine's efficacy in endodontic therapy[4,5]. For instance, Leonardo[6] reported enhanced antimicrobial activity and better clinical outcomes with the use of 2% Chlorhexidine gel as an intracanal medicament compared to other agents. Similarly, Vianna[7] demonstrated that Chlorhexidine effectively reduced bacterial load in the root canal system, contributing to improved healing.
In contrast, calcium hydroxide, while effective in certain contexts, may not provide the same level of antimicrobial activity as Chlorhexidine. Its primary mechanism of action is through the release of hydroxyl ions, which create an alkaline environment detrimental to bacterial survival[8]. However, its efficacy can be limited by factors such as its inability to maintain high pH levels over time and its potential to be less effective against certain resistant bacterial strains[9]. This study's findings, which showed less significant improvements in PD and CAL in the control group, support the notion that alternative agents like Chlorhexidine may offer superior clinical outcomes.

Radiographic bone fill was another critical parameter assessed in this study. The greater increase in bone fill observed in the test group further underscores Chlorhexidine's potential benefits.

Table 1: Demographic Characteristics of Study Participants

Demographic Variable	Test Group (Chlorhexidine)	Control Group (Calcium Hydroxide)
Number of Patients	30	30
Mean Age (years)	45.3±6.7	44.8±7.1
Gender (M/F)	18/12	17/13

Table 2: Probing Depth (PD) and Clinical Attachment Level (CAL) Measurements

Parameter	Time Point	Test Group (Chlorhexidine)	Control Group (Calcium Hydroxide)
Probing Depth (PD) (mm)	Baseline	7.5±0.8	7.4±0.9
	3 Months	5.2±0.6	6.0±0.7
	6 Months	4.2±0.5	5.1±0.6
Clinical Attachment Level (CAL) (mm)	Baseline	8.2±0.7	8.1±0.8
	3 Months	6.2±0.6	6.8±0.7
	6 Months	5.0±0.6	5.7±0.7

Table 3: Radiographic Bone Fill

Time Point	Test Group (Chlorhexidine)	Control Group (Calcium Hydroxide)
Baseline	-	-
3 Months	30%±4%	20%±5%
6 Months	45%±5%	30%±4%

Effective microbial control is essential for creating a conducive environment for bone regeneration, and Chlorhexidine's sustained antimicrobial activity likely contributed to the enhanced bone fill observed[10]. These findings are consistent with Wang[11], who reported similar improvements in bone healing with the use of Chlorhexidine in endodontic treatments.

This study's strengths include its randomized design, standardized treatment protocols and comprehensive clinical and radiographic assessments. However, certain limitations should be acknowledged. The study's sample size, while adequate for detecting significant differences, could be expanded in future research to confirm these findings across a broader population. Additionally, longer follow-up periods would provide insights into the long-term effects of Chlorhexidine on periodontal healing and the sustain ability of the observed improvements.

CONCLUSION

In conclusion, Chlorhexidine as an intracanal medicament significantly enhances periodontal healing in patients with concomitant endodontic-periodontal disease with communication. Its superior antimicrobial properties and sustained action make it a viable alternative to traditional calcium hydroxide treatment. Future research should continue to explore the long-term benefits and potential applications of Chlorhexidine in managing complex endodontic-periodontal lesions.

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