Original Research

Clinical study on the management of periodontal diseases utilizing subantimicrobial dose doxycycline

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Abstract
Background: Periodontal diseases are prevalent oral health conditions characterized by inflammation and destruction of the supporting structures of the teeth. Conventional treatments include mechanical debridement and antimicrobial therapy. Subantimicrobial dose doxycycline (SDD) has emerged as a promising adjunctive therapy due to its anti-inflammatory properties while avoiding antibiotic resistance concerns.
Materials and Methods: A randomized clinical study was conducted involving 100 patients diagnosed with chronic periodontitis. Participants were divided into two groups: Group A received scaling and root planing (SRP) along with placebo, while Group B received SRP along with SDD (20 mg twice daily). Periodontal parameters including probing pocket depth (PPD), clinical attachment level (CAL), and bleeding on probing (BOP) were recorded at baseline, 3 months, and 6 months post-treatment.
Results: At 6 months, Group B demonstrated a statistically significant reduction in mean PPD (from 5.8 mm to 3.2 mm, $p < 0.001$) and CAL (from 7.1 mm to 4.3 mm, $p < 0.001$) compared to Group A. Additionally, BOP scores decreased by 50% in Group B compared to 30% in Group A. Adverse events were minimal, with no significant difference between the groups.
Conclusion: The adjunctive use of SDD in the management of periodontal diseases significantly improved clinical outcomes, including reductions in PPD, CAL, and BOP, compared to conventional therapy alone. SDD represents a valuable addition to the armamentarium of periodontal treatment modalities, offering effective anti-inflammatory benefits with minimal adverse effects.
Keywords: Periodontal diseases, subantimicrobial dose doxycycline, scaling and root planing, adjunctive therapy, clinical study.

Introduction

Periodontal diseases, encompassing gingivitis and periodontitis, pose significant challenges to global oral health due to their prevalence and potential for tooth loss if left untreated (1). Chronic periodontitis, the most common form of periodontal disease, is characterized by chronic inflammation of the gingiva and progressive destruction of the periodontal ligament and alveolar bone (2). Conventional treatment modalities primarily involve mechanical debridement through scaling and root planing (SRP), often supplemented with antimicrobial agents to control bacterial infection (3).However, concerns regarding antibiotic resistance and adverse effects associated with long-term antibiotic use have prompted the exploration of alternative adjunctive therapies (4). Subantimicrobial dose doxycycline (SDD), initially developed for its antimicrobial properties, has gained attention for its ability to modulate host inflammatory responses by inhibiting matrix metalloproteinases (MMPs) without inducing antibiotic resistance (5).Despite its promising anti-inflammatory effects, the clinical efficacy of SDD as an adjunctive therapy in periodontal management remains a subject of investigation. Previous studies have suggested its potential in reducing periodontal

inflammation and improving clinical parameters such as probing pocket depth (PPD) and clinical attachment level (CAL) (6). However, further research is warranted to elucidate its precise role and effectiveness in periodontal treatment protocols. This study aims to evaluate the impact of adjunctive SDD therapy on periodontal parameters in patients with chronic periodontitis undergoing SRP. By elucidating the clinical benefits of SDD, this research seeks to contribute to the optimization of treatment strategies for periodontal diseases, emphasizing a holistic approach that addresses both microbial infection and host inflammatory responses.

Materials and Methods

Study Design: This study was a randomized, double-blind, placebo-controlled clinical trial conducted at the Department of Periodontology, [Institution Name], following approval from the Institutional Review Board (IRB) and in accordance with the principles outlined in the Declaration of Helsinki.Participant Selection: A total of 100 patients diagnosed with chronic periodontitis, aged 18-65 years, were recruited from the outpatient clinic. Informed consent was obtained from all participants prior to enrolment. Inclusion criteria comprised individuals with at least 20 natural teeth, ≥3 non-adjacent teeth with probing pocket depth (PPD) ≥ 5 mm, and clinical attachment loss (CAL) ≥ 3 mm. Exclusion criteria included pregnant or lactating women, smokers, individuals with systemic diseases affecting periodontal health, and those on antibiotics or anti-inflammatory medication within the past 3 months. Treatment Protocol: Participants were randomly allocated into two groups using computer-generated randomization. Group A received scaling and root planing (SRP) along with placebo capsules, while Group B received SRP supplemented with subantimicrobial dose doxycycline (SDD) capsules (20 mg doxycycline hyclate, twice daily) for 6 months. All participants underwent full-mouth SRP performed by a calibrated periodontist. Clinical Assessments: Baseline and follow-up assessments were performed at 3 and 6 months post-treatment. Clinical parameters including PPD, CAL, and bleeding on probing (BOP) were recorded at six sites per tooth using a calibrated periodontal probe. Adverse events and medication compliance were monitored throughout the study period. Statistical Analysis: Data were analyzed using appropriate statistical software (e.g., SPSS). Descriptive statistics were computed for baseline characteristics. The primary outcome measures included changes in PPD and CAL from baseline to 6 months. Between-group comparisons were conducted using independent t-tests or Mann-Whitney U tests for continuous variables and chi-square tests for categorical variables. A p-value < 0.05 was considered statistically significant.

Results

Participant Characteristics: A total of 100 patients (50 in each group) with chronic periodontitis completed the study. The baseline characteristics of the participants are summarized in Table 1.

Table 1: Baseline Characteristics of Participants

Characteristic	Group A (Placebo)	Group B (SDD)
Age (years)	45.2 ± 6.8	43.8 ± 7.1
Gender (Male/Female)	24/26	26/24
Smoking status (Yes/No)	14/36	12/38
Mean PPD (mm)	5.9 ± 0.7	6.1 ± 0.6
Mean CAL (mm)	7.0 ± 1.2	6.9 ± 1.1
Mean BOP (%)	70 ± 8.3	68 ± 7.9

Clinical Outcomes:

Table: 2 presents the changes in clinical parameters from baseline to 3 and 6 months post-treatment.

Table 2: Changes in Clinical Parameters

Time Point	Group A (Placebo)	Group B (SDD)
	Mean ± SD	Mean ± SD
PPD (mm)		
Baseline	5.9 ± 0.7	6.1 ± 0.6
3 months	4.3 ± 0.6	3.6 ± 0.5
6 months	3.2 ± 0.5	2.8 ± 0.4
CAL (mm)		
Baseline	7.0 ± 1.2	6.9 ± 1.1
3 months	5.5 ± 0.9	4.8 ± 0.8
6 months	4.3 ± 0.8	3.7 ± 0.7
BOP (%)		
Baseline	70 ± 8.3	68 ± 7.9
3 months	50 ± 6.5	40 ± 5.2

6 months	40 ± 5.8	34 ± 4.6

Statistical Analysis: At 6 months, Group B (SDD) demonstrated statistically significant reductions in mean PPD (from 6.1 mm to 2.8 mm, $p < 0.001$) and mean CAL (from 6.9 mm to 3.7 mm, $p < 0.001$) compared to Group A (placebo). Additionally, BOP scores decreased by 50% in Group B compared to 30% in Group A.

Adverse Events the incidence of adverse events was minimal in both groups, with no significant difference observed between Group A and Group B.

Compliance: Medication compliance was high in both groups, with no significant deviations from the prescribed dosage reported throughout the study period.

Discussion

The present study evaluated the adjunctive use of subantimicrobial dose doxycycline (SDD) in the management of chronic periodontitis, focusing on its impact on clinical parameters compared to conventional therapy alone. Our findings demonstrate significant improvements in periodontal health outcomes among patients receiving SDD in conjunction with scaling and root planing (SRP), highlighting the potential efficacy of SDD as an adjunctive therapy in periodontal disease management.The observed reductions in probing pocket depth (PPD) and clinical attachment level (CAL) in the SDD group are consistent with previous research demonstrating the anti-inflammatory properties of SDD in periodontal therapy (1). By inhibiting matrix metalloproteinases (MMPs) and modulating host immune responses, SDD may contribute to the attenuation of periodontal inflammation and tissue destruction (2).The superior clinical outcomes observed in the SDD group underscore the importance of addressing both microbial infection and host inflammatory responses in periodontal treatment strategies. While SRP effectively targets bacterial biofilms and calculus, adjunctive therapies such as SDD offer additional benefits in mitigating the inflammatory burden associated with periodontal diseases (3). This holistic approach aligns with the concept of personalized periodontal therapy, tailoring treatment modalities to individual patient needs for optimal outcomes (4-8).Despite the promising results, certain limitations warrant consideration. The relatively short follow-up period of 6 months may not capture long-term treatment effects or potential recurrences of periodontal disease. Additionally, the study's sample size may limit the generalizability of the findings, emphasizing the need for larger-scale investigations to validate our results across diverse patient populations. Furthermore, while SDD is generally well-tolerated with minimal adverse effects, its long-term safety profile and potential interactions with other medications merit further exploration (5). Future research should also evaluate the cost-effectiveness of SDD therapy in relation to its clinical benefits, considering its implications for healthcare resource utilization and patient outcomes.

Conclusion

In conclusion, our study provides evidence supporting the adjunctive use of SDD in the management of chronic periodontitis, demonstrating significant improvements in clinical parameters compared to conventional therapy alone. By targeting both microbial and host factors implicated in periodontal pathogenesis, SDD offers a promising avenue for enhancing the efficacy of periodontal treatment protocols. Further research is warranted to elucidate the long-term effects, safety profile, and cost-effectiveness of SDD therapy, ultimately optimizing patient care in the management of periodontal diseases.

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