Comparative evaluation of efficacy of three treatment modalities – tetracycline fibers, scaling and root planing, and combination therapy: A clinical study

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**Abstract:**

**Background:** Tetracycline is one of the primary antibiotics prescribed for antimicrobial therapy in periodontics. It has a broad spectrum of activity being effective against most bacteria as well as spirochetes. Due to limitations of systemic drug therapy, recent formulations of the drug for local administration in the subgingival area have been introduced, including collagen fibers impregnated with tetracycline. **Aims and Objective:** To compare the effectiveness of tetracycline fibers alone or in combination with scaling and root planing (SRP) on clinical parameters in chronic periodontitis patients. **Materials and Methods:** A total of twenty patients comprising of both sexes in the age group of 35-60 years with chronic periodontitis were selected. Split-mouth design was used, and three teeth from each patient with periodontal pocket measuring > 5 mm were selected which were treated with different treatment modality. They were randomly divided into site A (SRP), site B (tetracycline fibers only), and site C (combination therapy). Clinical parameters of plaque index (PI), gingival index (GI), pocket probing depth, and clinical attachment level (CAL) were recorded at 0, 30, and 45 days. The data obtained was compiled and put to statistical analysis. **Results:** All the three groups showed improvement in PI, GI, probing pocket depth, and CAL. Results of the study showed greater improvements in clinical parameters in Group C compared to Group A and Group B. **Conclusion:** The results indicate that the adjunctive use of tetracycline fibers with SRP is a clinically effective and simple nonsurgical treatment method to improve periodontal health.

**Key words:** Chronic periodontitis, scaling and root planing, tetracycline fibers

**INTRODUCTION**

Chronic periodontitis is an infection involving the destruction of supporting tissues surrounding the tooth.[1] There is considerable evidence supporting the role of bacteria as the etiology of periodontal disease. Elevated numbers of subgingival microorganisms have been associated with destructive periodontal disease activity. The elimination or reduction of microbial pathogens present in subgingival plaque is one of the primary objectives of periodontal therapy. Recognition of specific role of certain bacteria in chronic periodontitis has tended to consolidate ideas in therapeutic management of such diseases.[2] Removal or inhibition of subgingival plaque thus plays an important role in the maintenance of oral health.[3] The main goal of periodontal therapy is not only to stop periodontal destruction but also to prevent the recurrence of disease and regeneration of lost tissues.[4] Mechanical debridement alone may fail to eliminate the putative pathogens from the pockets completely because of the location of these organisms within gingival tissue or in deeper areas inaccessible to periodontal instrumentations and thus results in recurrence of disease. Therefore, the selective removal or inhibition of pathogenic microbes with systemic
or topical antimicrobial agents in combination with scaling and root planing (SRP) is often considered as an effective approach at specific disease active sites.

Drugs administered systemically are absorbed into the blood stream and distributed throughout the body through the circulation. However, systemic drug therapy is limited by adverse reactions such as toxicity, acquired bacterial resistance, and drug interactions. Patient compliance is also a recognized problem. In contrast, local administration of the drug allows the therapeutic agent to be delivered at the diseased periodontal site with increased therapeutic effect and minimal side effects. However, topically applied drugs do not have sufficient time to exert their bacteriostatic or bactericidal effect on targeted microorganisms residing in the subgingival area.

To overcome all these problems, various local delivery methods for administering antimicrobial agents directly into the periodontal pocket have been tested. These methods further minimize the side effects of systemically administered drugs and also maintain a high level of antimicrobial agents within the gingival crevicular fluid over an extended period. Local drug delivery avoids most adverse reactions and disadvantages with little or no systemic effects. The local concentration achieved may be much higher than that is possible through the systemic route. Among the antimicrobials used in periodontal therapy, much attention has been focused on tetracycline.

Tetracycline offers a broad-spectrum antimicrobial activity and may be a useful adjunct to periodontal therapy. Tetracyclines are the most commonly prescribed antimicrobials in periodontal therapy. The groups of tetracyclines are generally considered to be more effective against Gram-positive bacteria than Gram-negative bacteria and display good activity against most spirochetes as well as many anaerobic and facultative bacteria. High drug concentrations have been reported in gingival crevicular fluid making them particularly suitable for periodontal applications. The findings of Golub showed that apart from their antimicrobial action, tetracyclines may inhibit tissue collagenase and therefore retard the breakdown of collagen as seen in periodontal disease. This was also confirmed by the studies of Rifkin and Vermilo on the anti-collagenase activity of tetracyclines. The other properties of tetracyclines are inhibition of bone resorption, anti-inflammatory actions, and to promote the attachment of fibroblasts and connective tissue to root surfaces in periodontal therapy. Thus, tetracycline has improved outcomes as an adjunct to nonsurgical and surgical periodontal therapy. Various systems for insertion of tetracyclines into periodontal pockets have been introduced which include hollow fibers, ethylene vinyl acetate copolymer fibers, ethyl cellulose fibers, acrylic strips, collagen preparations, and hydroxypropylcellulose films.

A newer delivery system of tetracycline fibers within collagen fibers “Periodontal Plus AB™” (Advanced Biotech Products, Chennai) containing 25 mg of pure fibrillar collagen along with 2 mg of tetracycline HCL has been introduced [Figure 1]. Since there are limited numbers of studies conducted with the above concentration of tetracycline hydrochloride, the present study was undertaken to determine the effects of tetracycline in the treatment of chronic periodontitis when used alone and in combination with SRP.

MATERIALS AND METHODS

A total of twenty human subjects comprising of both sexes, aged 35–60 years, who came to the outpatient Department of Periodontology were selected. The design of this study was a randomized, controlled, split-mouth study. A pro forma was designed so as to have a systematic and methodical recording of all the observations and information, and prior written consent was attained from each patient. Approval for the study was obtained from the institutional ethics committee.

Chronic periodontitis patients with minimum of three periodontal pockets (probing depth of ≥ 5 mm) in different quadrants of the mouth who had not received any periodontal therapy during the past 3 months were selected as study participants. Patients with any history of systemic diseases (cardiovascular disease, diabetes, hepatitis, and renal disorder), taking antibiotics, and antibacterial mouthwashes during the last 3 months, pregnant women or lactating mothers, and those allergic to tetracycline or cyanoacrylate were not included.

Site and tooth selection

Three teeth from each patient with periodontal pockets measuring ≥ 5 mm each in different quadrants of the mouth (using split-mouth design) were selected. The sites were divided into 3 sites randomly. SRP was performed in site A; whereas in site B, only tetracycline fibers were placed; and in site C, both SRP as well as the tetracycline fibers were placed.

Clinical parameters

Before doing the SRP, each selected site was subjected to recording of plaque index (PI) (Silness and Loe 1964), gingival index (GI) (Loe and Silness 1963), pocket depth (PD), and clinical attachment level (CAL). For standardizing the measurement of PD and CAL, customized acrylic occlusal stents were prepared [Figure 2].

Measurement of pocket depth

The stents were used to fix the position and alignment of periodontal probe, and PD was measured to the nearest millimeter from the gingival margin to the base of the pocket using UNC-15 probe (Hu-Friedy, USA).

Measurement of clinical attachment level

CAL was measured from the reference point, i.e., the lower border of the stent to the base of the pocket using UNC-15 graduated probe nearest to one millimeter.

Clinical parameters were recorded at 0, 30, and 45 days.

Material used

The product Periodontal Plus AB consists of 25 mg of pure fibrillar collagen containing approximately 2 mg of evenly impregnated tetracycline HCL, USP/IP.

Periodontal therapy

After recording the clinical parameters, full mouth phase I therapy was performed with the help of ultrasonic scaler and Gracey curettes except site B.
Administration of tetracycline fibers

After the fibers were soaked in saline, they were then placed into the pocket with the help of periodontal probe with gentle pressure. The fibers were completely inserted into the gingival sulcus, and the gingiva was carefully adapted to close the entrance of the gingival margin [Figure 3]. The gingival margin was sealed with Coe-pak (Coe-PakSM, CG American Inc. USA) to prevent ingress of oral fluids for at least 10 days. The patients were refrained from chewing hard and sticky food, flossing on the treated site, and not to disturb the area with tongue, finger, or tooth pick.

Statistical analysis

The values were represented in number(%) and mean ± standard deviation. The baseline data were checked for normality using Kolmogorov–Smirnov test. For intergroup and group differences in clinical parameters, Kruskal–Wallis and Mann–Whitney U-tests were performed, respectively. Interval comparison was done using Wilcoxon signed-rank test. The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 software (IBM SPSS Statistics, India).

RESULTS

A total of 20 patients, 16 (80%) males and 4 (20%) females, age ranging from 35 to 53 years with a mean of 40.15 ± 4.52 were included in the study. Most commonly involved tooth was #26 (n = 14) followed by #16 (n = 10). At baseline, all the four clinical parameters, namely, PI, GI, CAL, and PPD were observed to be matched in all the three groups showing no significant intergroup difference (P > 0.05) [Table 1]. At day 30, PI, GI, and CAL in three groups did not show a significant difference among groups (P > 0.05). However, for PD, a significant intergroup difference was observed (P = 0.026) [Table 2]. Statistically significant difference in PPD was observed between Group B and C with higher P-value seen in Group B on comparison with Group C. Between-group comparisons revealed no significant difference for all the comparisons except for the comparison for probing PD between Groups B and C (P = 0.017) [Figure 4 and Table 3].

With reference to PPD, statistically significant intergroup difference was observed (P < 0.05). At day 45, PI, GI, and CAL in three groups did not show a significant difference among groups (P > 0.05). However, for PD, a significant intergroup difference was observed (P = 0.017) [Table 4 and Figure 5]. Higher values for PPD were seen in Group B and lower values in Group C [Table 5]. In Group A, for all the parameters, a fall in mean value was observed with time. The mean value for all the parameters was maximum on day 0 and minimum on day 45 [Table 6]. In Group B, for all the parameters, a fall in mean value was observed with time. The mean value for all the parameters was maximum on day 0 and minimum on day 45 [Table 7]. In Group C, a gradual decrease in the values of all clinical parameters from baseline to 45 days was observed [Table 8].

DISCUSSION

Periodontal disease comprises of a group of oral infections with a prime etiology being dental plaque, resulting in an inflammatory lesion in the supporting tissues and leading to its destruction.[18] The prime objective of Phase I and II periodontal therapy is to remove the cause, i.e., plaque and its detrimental effects on periodontal structures. Local drug delivery system allows the therapeutic agents to be targeted to the diseased sites and also avoids unnecessary exposure of the patient to systemic antibiotic therapy. In the present study, tetracycline was chosen as it has been proved to be effective in the management of periodontal diseases because of its properties.[19]

In this study, the reduction in plaque and GI was observed to be associated with proper home care by patients and was reflected in respective decrease in PD and gain in loss of attachment. The reduction in PI scores may be attributed to...
The meticulous oral hygiene insisted on all the patients during the entire study period. It would possibly be explained on the basis that the residual effect of the drug from its reservoir, that is periodontal pocket, and tissues in the vicinity, over a prolonged period of time, disrupted the biofilm formation on the tooth surface. Thus, oral hygiene status is reflected by screening, randomization, and balancing than that of disease severity on the basis of plaque scores. This particular finding in our study signifies the clinical utility of SRP in changing the microbial environment in and around the tooth surface. Heijl et al. observed similar improvement in clinical parameters with all three treatment modalities.

With reference to intergroup comparisons at day 30 and 45, a statistically significant difference in clinical parameters was observed between Group B and Group C, with less improvement seen when fibers were used alone. This observation simply reflects changes in composition of periodontal tissues, rather than gain of new attachment. The least reduction in probing PD in Group B can be explained by the fact that the subgingival debridement was not performed.
These anticipated therapeutic benefits with tetracycline fibers therapy should be weighed against the possible side/adverse effects of subgingival insertion such as allergy, gingival erythema, pain, discomfort, periodontal abscess formation, and oral candidiasis. However, owing to the minimal systemic uptake of the drug, no adverse reactions/complications were noticed in any case participating in the present study. The observation period in the present study was not long enough, so further long-term prospective studies should be encouraged to elucidate the true results/outcomes of local drug delivery in the management of periodontal diseases.

**CONCLUSION**

The study demonstrates that application of tetracycline fibers after debridement is more effective and beneficial to patients suffering from chronic periodontitis, with results demonstrating an improvement in periodontal parameters.

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**Conflicts of interest**
There are no conflicts of interest.

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