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Original Research Article

Comperative Evaluation of the Locally-Delivered Collagen-Based Tetracycline Fibers and Chlorhexidine Chip Placement in Periodontal Therapy: An in Vivo Study

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Abstract

Aim: The purpose of the present investigation was to evaluate and compare the efficacy of resorbable collagen-based tetracycline fibers and chlorhexidine chip placement in the treatment of chronic periodontitis. ***Methods:*** A split-mouth design was used to conduct this study. Fifty one patients with periodontal pockets ranging from ≥5 mm to ≤7 mm were selected for the study. The treatment sites were randomly divided into the control and experimental groups. All of the selected sites were treated with scaling and root planning, and then collagen-based resorbable tetracycline fibers and chlohexidine chip were placed adjunctively in equal number of experimental sites at the same visit. Baseline and follow-up measurements in both treatment groups included plaque index, probing pocket depth, and relative attachment level. ***Results:*** Although significant clinical benefits were obtained in all the treatment groups, the adjunctive antimicrobial use of chlorhexidine chip demonstrated better results compared to the locally tetracycline fibers over the 3-month observational period. ***Conclusions:*** The delivery of both antimicrobial agent's tetracycline in a collagen Matrix and chlorhexidine chip was found to improve the benefits of scaling and root planing by a larger magnitude in patients with moderate-to-deep pockets.

Keywords: Chronic periodontitis, collagen, periodontal therapy, scaling and root planing, tetracycline fibers.

INTRODUCTION

Bacterial plaque plays a primary role in the etiology of inflammatory periodontal disease [1]. The destructive character of periodontitis can be maintained only in the presence of subgingival plaque [2]. Therefore, the prevention of plaque accumulation on the tooth surfaces is essential to control the incidence and progression of periodontal disease. The primary objective of periodontal treatment is to stop disease progression, and the therapeutic aspect has largely been accomplished by non-surgical, surgical, or a combined approach. The emerging evidence of bacterial specificity in periodontal diseases and questions about the inability of conventional mechanical approaches to completely eliminate the etiologic factors have led to greater interest in the use of antimicrobial agents in periodontal therapy. Mechanotherapy has shown limited results because of poor access to the base of deep periodontal pockets and anatomical complexities, which might limit the efficiency of root planing, resulting in residual bacteria remaining in the dentinal tubules and soft tissues, with the ability of repopulating the scaled teeth, thereby resulting in the failure of the treatment outcome[3]. Antimicrobial agents can be delivered via systemic and local routes. Systemic antibiotic therapy has disadvantages, such as hypersensitivity reaction, organ toxicity, development of resistant bacteria, and the requirement ofhigher doses to attain required gingival crevicular fluid (GCF) concentration at the target site. Patient compliance is also a factor.4 This justifies the use of local drugs directly into the periodontal pocket as a way to minimize the total body dosage and resulting side-effects, and to maintain therapeutic drug levels in GCF over time.5 The topical administration of antibacterial agents in the form of subgingival sustained-release chemotherapeutic devices has shown promising results as an adjunct to scaling and root planing.8 Thus, in the present 3-month study, an attempt was made to evaluate the efficacy of resorbable collagen-based tetracycline fibers and chlorhexidine chip given as an adjunct to scaling and root planing in the treatment of chronic periodontitis.

MATERIALS AND METHODS

Fifty one chronic periodontitis patients of both sexes were randomly selected from the Outpatient

Department of Periodontics and Oral Implantology, Government Dental College and Hospital, Srinagar, India. All patients completed the 3-month follow-up study.

Study population

Patients who qualified for the study fulfilled the following criteria for subject selection: (a) aged 25–50 years(26 males & 25 females); (b) diagnosed as suffering from chronic periodontitis; (c) free from any systemic disease; (d) non-smokers; (e) had not received any type of invasive periodontal therapy in the previous 4 months; (f) no history of antimicrobial drug intake for 7 days or longer in the previous 3 months; (g) periodontal pockets ranging from ≥5 mm to ≤7 mm and (h) were able to attend the hospital at frequent intervals.Before the selected patients were included in the study, they were asked to provide written consent regarding the benefits and protocol of the study. The study was also sent to an ethical committee for approval, and was also approved by the members of the Board of Studies of Government Dental College and Hospital, India.

Fifty one patients were randomly divided into the control group (group 1) and tetracycline group (group 2) and chlohexidine group (group 3). Group 1 patients were treated with scaling and root planing alone; group 2 patients were treated with combination of scaling and root planning and locally tetracycline fiber placement and group 3 included combinations of scaling and root planning and local chlorhexidine chip placement. The local drugs used in the two experimental groups were Periodontal Plus AB fibers (Periodontal Plus, Advanced Biotech Products, India) and chlorhexidine chip (Pericol;CG, Eucare pharma). The selected sites were randomly divided into into 3 groups:

Groups:
group1: included17 sites treated by scaling and root planning alone
group 2: included 17 sites treated by scaling and root planning followed by the placement of tetracycline fibers and
group 3: included 17 sites treated by scaling and root planning followed by the placement of chlorhexidine chip.

Clinical parameters recorded

Patients were given meticulous oral hygiene instructions and recalled after 21 days for baseline examination, at which all the study sites were assessed for plaque index, probing pocket depth, and relative attachment level (acrylic occlusal stents).

Clinical methodology employed

After recording the clinical parameters, full mouth scaling and root planing were done at the baseline visit, followed by the placement of resorbable tetracycline fibers in group 2 sites and chlorhexidine chip in group 3 experimental sites. Before the placement of the drugs, experimental sites were completely dried using an air syringe, and isolated with cotton rolls to prevent contaminationnfrom saliva.

Follow-up visits

Patients were re-evaluated at days 15, 30, and 60 and 90 days for the estimation of all three clinical parameters, which were compared to the baseline values.

Post-treatment changes from baseline to different time intervals in various clinical parameters were analyzed by subjecting the clinical data to statistical analysis usingnSPSS version 16.0 software (SPSS, Chicago, IL, USA). Paired t-test was used to analyze the changes within a group. Intergroup comparisons of post-treatment changes were analyzed by unpaired t-test. P-values <0.05 were considered to statistically significant. The power of the test was found to be 80%.

RESULTS AND STATISTICAL ANALYSIS

The change in clinical parameters in treatment groups and their comparisons at baseline, 15, 30, 60, and 90 days post-therapy are shown in Tables 1–3. At baseline, there was no significant difference between the treatment groups in any of the parameters recorded (P > 0.05). However, there was a gradual decrease in plaque index and probing pocket depth measurements both for all control groups, with more reduction in group3 followed by group 2 and group 1. The difference between the three groups was statistically significant. Similarly, a more statistically-significant gain in clinical attachment level was observed in all the groups with group 3 having the greatest increase in clinical attachment level followed by group 2 and finally group 1. There was significant difference in the reduction in clinical attachment levels in all the groups.

Table-1: Reduction in mean plaque index in control group (group 1) and two experimental groups (group 2 and 3)

Plaque index	Group 1 Mean +_SD	Group 2 Mean +_SD	Group 3 Mean +_SD	P value
Baseline	1.51	1.30	1.26	0.70
15 days	0.85	0.72	0.70	0.02
30 days	0.70	0.61	0.58	0.02
60 days	0.63	0.42	0.40	0.01
90 days	0.55	0.38	0.32	0.01

Table-2: Comparison of mean reduction in probing depth among control group (group 1) and two experimental groups (group 2 and 3) with respect to the baseline

Mean reduction in Probing depth compared to baseline	Group 1 Mean +_SD	Group 2 Mean +_SD	Group 3 Mean +_SD	P value
15 days	2..550	2.410	2.875	0.02
30 days	2.766	2.900	3.210	0.02
60 days	3.210.	3.550	3.938	0.01
90 days	3.500	3.650	3.951	0.01

Table-3: Comparison of mean reduction in clinical attachment levels among control group (group 1) and two experimental groups (group 2 and 3) with respect to the baseline

Mean reduction in clinical attachment levels compared to baseline	Group 1 Mean +_SD	Group 2 Mean +_SD	Group 3 Mean +_SD	P value
15 days	0.525	0.712	1.1000	0.02
30 days	0.675	0.979	1.480	0.02
60 days	0.750	0.1000	1.817	0.01
90 days	0.812	1.110	2.112	0.01

DISCUSSION

The standard treatment of periodontal infection focuses on the removal of subgingival microbial challenge by chemical or mechanical means to allow a reconfiguration of periodontal microbiota by a more "healthy" microbiota. Although mechanotherapy has proven to be effective in most cases in terms of improving overall gingival health and halting the progression of attachment loss [9], the microbiological effects of scaling and root planning have rarely been found to result in the complete removal of periodontal pathogens[10]. This has led to the adjunctive use of antimicrobial agents to improve the therapeutic objectives in the most refractive cases [11].

In the present study, we evaluated and compared the clinical utility of periodontal Plus AB fibers, collagenbased bioresorbable tetracycline fibers and chlorhexidine chip given as an adjunct to scaling and root planning, with scaling and root planning delivered as a monotherapy. In the present study, plaque index scores showed significant reduction from baseline to 3 months in all the treatment groups ($P < 0.001$). Similar observations were made by Morrison *et al*. and Walsh and Robertson [12, 13]. The difference in the mean reduction of plaque indices between experimental and control groups was not statistically significant ($P > 0.05$). This can be attributed to greater attention to oral hygiene practice by all selected participants throughout the study period.

Probing pocket depth measurements also showed significant reduction from baseline to 3 months in bothtreatment groups, with a greater reduction in the experimental groups than the control group. In the control group, the results were consistent with the studies of Morrison *et al*. and Cobb [14, 15] and appear to be due to the reduction of inflammation in connective tissue and the formation of a long junctional epithelium [16, 17]. In the experimental groups a reduction in probing pocket depth from baseline and its statistical significance over the control group at day 90 ($P < 0.05$) were found to be consistent with the studies of Goodson *et al*. and Tonetti *et al*. [17], Relative attachment gain measurements also showed significant increase from baseline to 3 months in all the groups, with a greater gain in the experimental groups than the control group. In the control group, the results were found to be consistent with the studies of Morrison *et al.* and Cobb [14, 15] and appear to be due to the migration of the dentogingival junction to or close to the apical level of root instrumentation following removal of plaque and calculus [16]. In both the experimental groups, an increase in relative attachment gain from baseline and its statistical significance over the control group at day ($P < 0.05$) were found to be consistent with the studies of Goodson *et al*. and Heijl *et al*. [15,16].

CONCLUSION

The present study suggests that, when used as an adjunct to mechanical debridement, both the locally delivered tetracycline as well as the chlorhexidine augments the treatment outcome in chronic adult periodontitis by improving periodontal parameters over a 3-month observational period. Athough the results obtained with chlorhexidine chip were better than tetracycline fibers but the difference between the two groups wasn't statistically significant. Further research needs to be carried out to delineate the effect of this treatment modality in the long-term management of gingivitis and periodontitis.

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