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Original Research Article

Effectiveness of Tetracycline Fibers and Chlorhexidine Chip as Local Drug Delivery in Nonsurgical Management of Chronic Periodontitis

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Abstract

Background: Periodontal disease is inflammatory disease which causes destruction of the tissues that affects supporting tissue of tooth in its socket occurs. Mechanical treatment scaling and root planing disrupts the subgingival pathogens and provide clean and biologically smooth compatible root surface. Local drug delivery was investigated to find out limitations of conventional therapy. Local drug delivery is treatment of choice to deliver antibacterials to the site of infection (periodontal pocket).

Aim: Comparison of effectiveness of tetracycline fibres and chlorhexidine chip as local drug delivery in non-surgical management of chronic periodontitis

Materials and Methods: In this study 20 patients of age 25-55 years of age were included. In each patient 3 sites with 5-8mm periodontal pocket had been taken. The whole study is divided into 3 groups: Group a (SRP alone) and Group b (SRP + tetracycline fibres) Group c (SRP+ Chlorhexidine chip). Plaque index, Gingival index, Sulcular bleeding index, Probing depth (PD) and Relative Attachment Level (RAL) were assessed at baseline before scaling and root planing, at 1 month & 3 month after SRP.

Result: Chlorhexidine chip as an adjunct to SRP showed greater improvement in respect to decreased probing depth and gain in clinical attachment level as well as significant improvement in plaque index, gingival index, sulcular bleeding index from baseline to 3 months in comparison to tetracycline fibers as an adjuct to SRP.

Keywords: Tetracycline fibre, Chlorhexidine chip, Chronic Periodontitis, Scaling and Root planning (SRP), Local Drug Delivery.

Introduction

Periodontitis is an inflammatory condition of tissues surrounding teeth which treated commonly by removal of plaque and micro-organisms that adhere to teeth[1]. Chronic periodontitis is type of periodontitis which is inflammatory reactions affects supporting tissues of tooth in its socket.[2] Mechanical debridement disrupts subgingival microorganisms the and provide clean, smooth and biologically compatible root surfaces.[3] Effectiveness of mechanical debridement and systemic administration is limited due to the lack of accessibility to pathogens in the periodontal pocket. Investigation of local delivery of antimicrobials has been done for the possibility of overcoming the limitations of conventional therapy. The use of local drug delivery is treatment of choice to deliver antibacterials to the site of infection is of gaining interest[6]. Contemporary research is now focused on the role of local antimicrobial agents in the treatment of periodontitis.

Aim

Comparison of effectiveness of tetracycline fibers and chlorhexidine chip as local drug delivery in nonsurgical management of chronic periodontitis.

Materials and Methods

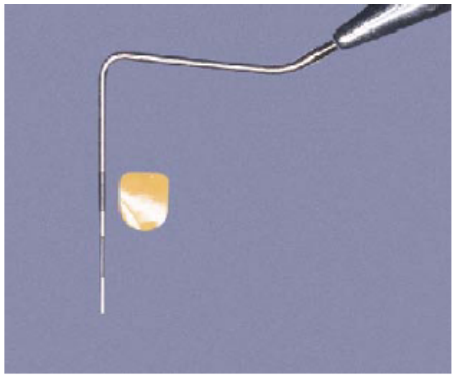

Figure 1: Chlorhexidine chip

Materials: UNC-15 periodontal probe, (Hu-Freidy. USA)

Diagnostic instruments: Supragingival scalers and Subgingival scalers, Gracey curettes (Hu-Freidy No. 1-18), Tetracycline fibers, Chlorhexidine chip, Periodontal dressing, Acrylic template (Occlusalstent) ,Surgical Gloves No.6, Face Mask, Surgical Drape.

Method: The commercially available new controlled-release drug containing tetracycline fibers chlorhexidine chip were used as an adjunct to scaling and root planning in this study. We had initially started study with 30 patients including 90 sites for this study but only 20 patients completed their 1 month and 3 month follow up.

In 20 subjects comprising of both genders, a total of 60 sites, with a probing depth 5-8 in mm, aged between 25 to 55 years were included. This study was divided into 3 groups: Group I(SRP alone) and Group II(SRP + tetracycline fibres) Group III(SRP+ Chlorhexidine chip).

Plaque index, Gingival index [5], Sulcular bleeding index[6], Probing depth (PD) Relative Attachment Level (RAL) were recorded at baseline, at one month, at 3 month. The chlorhexidine chip (Diagram 1) is orange – brown and rectangular rounded on 1 end. A new sustained release chlorhexidine in fish collagen membrane has two contents-chlorhexidine and collagen. Chlorhexidine chip is prepared by incorporating 2.5mg chlorhexidine from a 20% chlorhexidine solution in collagen membrane. Size of the chip is 4x5 mm and thickness is 0.25 - 0.32 mm and 10 mg wt. Collagen is a natural protein, which is chemotactic for fibroblasts, enhances fibroblast attachment via its scaffold-like fibrillar structure and stimulates platelet degranulation, thereby accelerating fibers and clot attachment. They are resorbed after 30 days, however their coronal edge degrades within 10 days. Application of this chip in chronic periodontitis as an adjunct to scaling and root planning procedures has shown reduction in probing pocket depth, gingival bleeding and clinical attachment level compared to scaling and root planning alone. Chlorhexidine chip when used as an adjunct to scaling and root planning significantly reduces loss of alveolar bone and improve the clinical signs of periodontitis.

The tetracycline fibers contains 25mg fibrillar collagen, containing approximately 2mg of evenly impregnated tetracycline HCl. Which release tetracycline at a rate of approx. 2 mcg/mg-hr in the periodontal pocket. After application, each site shows an average gingival fluid concentration of 1500 mcg/ml tetracycline, during the multi modal manner, initially releasing approx 40% tetracycline within the first 24 hrs. and then releasing the remaining tetracycline in an almost linear fashion for 7-10 days.

Figure 2: tetracycline fibers

Study Population :

Inclusion Criteria :

1. Systemically healthy individual.
2. Patients who were able to follow verbal or written oral hygiene instructions.
3. Patients who agreed to sign the informed consent and returned for specified study visits.
4. Patients who were suffering from chronic periodontitis.
5. Patients with periodontal pocket measuring 5-8mm to different quadrants were selected

Exclusion Criteria:

1. Patients who is using anti-microbial mouth rinses within 2 months of the baseline visit or on routine basis.
2. Patients having a history of allergy lo tetracycline; chlorhexidine or lidocaine.
3. Pregnant women or nursing mothers.
4. Patients having history of smoking or are current smokers.
5. Teeth with furcation involvement.
6. Patients who were unable to return for follow-up visits; or uncooperative patients.

A special proforma was designed, so as to have a systematic & methodical recording of all the observations & information. This includes clinical parameters, indices and written consent of the patient.

Observation and results:

We had taken 20 systemically healthy individual suffering with chronic periodontitis of age group 25-55 years of age. In each patient we had taken 3 sites with 5-8 mm periodontal pocket. The clinical parameters had been recorded in three groups at baseline and 1st month and 3rd month, Statistical analysis was done with **"One way Anova analysis"**.

Table 1: plaque index, sulcular bleeding index, gingival index, probing depth, relative attachment level values of group I, group II, group III at baseline and 1 month, 3 months after scaling and root planning.

		Baseline	1 month	3 month	Gain after 1 month	Gain after 3 months
Plaque index	Group III (SRP+Chlorhexidine)	2.59±.46	1.34±.45	1.16±.39	-1.25	-1.43
	Group II (SRP+ Tetracycline)	2.58±.37	1.30±.43	1.12±.45	-1.27	-1.45
	Group I (SRP alone)	2.51±.53	1.29±.35	1.16±.41	-1.22	-1.35
					F=0.06,p>.05	F=0.21, p>.05
Sulcular bleeding index	Group III (SRP+Chlorhexidine)	3.36±1.04	1.73±.65	1.40±.62	-1.63	-1.96
	Group II (SRP+ Tetracycline)	3.65±.93	1.61±.46	1.23±.53	-2.04	-2.42
	Group I (SRP alone)	3.45±1.02	1.48±.56	1.23±.46	-1.96	-2.21
					F=1.37,p>.05	F=1.63,p<.01
Gingival index	Group III (SRP+Chlorhexidine)	2.48±0.48	1.34±0.40	1.06±0.28	-1.14	-1.41
	Group II (SRP+ Tetracycline)	2.52±.43	1.31±.36	1.14±.31	-1.2	-1.37
	Group I (SRP alone)	2.48±.47	1.27±.33	1.14±.35	-1.2	-1.34
					F=0.10,p>.05	F=0.08, p>.01
Probing depth	Group III (SRP+Chlorhexidine)	5.75±.78	4.35±.58	2.40±.59	-1.4	-3.35
	Group II (SRP+ Tetracycline)	5.65±.74	4.45±.60	3.25±.44	-1.2	-2.4
	Group I (SRP alone)	5.40±.50	4.30±.57	4.05±.60	-1.1	-1.35
					F=1.68,p>.05	F=38.15,p<.01
Relative attachment level	Group III (SRP+Chlorhexidine)	8.75±3.07	7.15±2.88	5.40±2.76	-1.6	-3.35
	Group II (SRP+ Tetracycline)	7.85±2.68	6.50±2.58	5.40±2.39	-1.35	-2.45
	Group I (SRP alone)	7.40±2.68	6.25±2.59	6.15±2.51	-1.15	-1.25
					F=2.42,p>.05	F=35.89,p<.01

Table 2: Mean percentage gain in plaque index, sulcular bleeding index, gingival index, probing depth, relative attachment level,

		1 Month	3 Month
Plaque index	SRP+ChlorhexIdineChip	-48.26%	-55.21%
	SRP+Tetracycline Fibers	-49.22%	-56.20%
	SRP	-51.33%	-53.78%
Sulcular bleeding index	SRP+ChlorhexIdineChip	-48.51%	-58.33%
	SRP+Tetracycline Fibers	-55.89%	-66.30%
	SRP	-56.81%	-64.05%
Gingival index	SRP+ChlorhexIdineChip	-45.90%	-58.85%
	SRP+Tetracycline Fibers	-47.60%	-54.36%
	SRP	-48.98%	-54.03%
Probing depth	SRP+ChlorhexIdineChip	-24.34%	-48.26%
	SRP+Tetracycline Fibers	-21.31%	-42.47%
	SRP	-20.37%	-25%
Relative attachment level	SRP+ChlorhexIdineChip	-18.28%	-38.28%
	SRP+Tetracycline Fibers	-17.19%	-31.21%
	SRP	-15.40%	-16.89%

The values of three groups were not significantly different with each other for plaque index, sulcular bleeding index and gingival index but significantly different for probing depth anf relative attachment level and for these two value greater improvement seen in group III than group II and group I(Table I) . The percentage decrease was observed maximum in group III followed by group II and lastly group I for probing depth, relative attachment level and gingival index and with statistical significance as shown in Table II.

Discussion

The present study was undertaken to clinically evaluate and compare the efficacy of commercially available new controlled-release drugs - tetracycline fibers & chlorhexidine chip used as a combination therapy, compared to scaling and root planing alone. Total number of 60 sites in 20 patients of both genders, with periodontal pockets measuring 5 to 8 mm, were enrolled. To fully control the individual subject response, a split-mouth design was used and to minimize the potential for interaction between treatment groups, in each patient separate quadrants were selected and different treatment modalities were assigned randomly, as Group I (SRP alone), Group II (SRP+TTC Fibers) and Group III (SRP+CHX Chip), and clinical parameters like plaque index, gingival index, sulcular bleeding index, probing Depth and clinical attachment level were recorded at baseline, 1 month and 3 month.

Paolantonio et al.[7] resulted in significant benefit of Scaling and root planing with chlorhexidine chip in treatment chronic periodontitis. Study of Haesman et al[8], Goodson et al.[9], Addy et al.[10] also reported statistically significant improvement in plaque index when used local drug delivery with scaling and root planing. The plaque index values changes in this study similar to study by Azmak et al[11] This study shows greater improvement in sulcular bleeding index similar to studies by Aimetti et al.[13] Study done by Goodson et al[14] had same values of gingival index as we had found in our study in all three groups from baseline to 3 months. The mean percentage reduction was highly significant in Group III (SRP +chlorhexidine chip). Similarly Jeffcoat et al [15] reported that sustained release of antimicrobial agent combined with SRP showed a statistically significant reduction in periodontal pocket depth as compared to SRP alone. Various studies by Aimetti et al.[52],Vanderckhove et al.[53],Gordon JM et al.[12], Yi. Xu et al.[54], Adamo Fini et al.[35], Sebastian G Ciancio et al.[11], Haesman et al.[20] and Grisi DC et al.[26], Nishat Sadaf et al.[38], Vishakha Grover et al[36], Eickholz et al.[23], Goodson et al.[55], Kranti K et al.[34] , Paolantonio et al.[56] had proven that the adjunctive use of biodegradable material like chip, gels, fibers etc led to significant improvement in probing depth and clinical attachment level compared to SRP.

The mean percentage reduction in plaque index, from baseline to 1 month and 3 months, in Group II (SRP+TTC Fibers) was 49.22% and 56.20% respectively as shown in table II. Whereas, mean percentage reduction for plaque index in Group III (SRP+CHX Chip) from baseline to 1 month and 3month was 48.26% and 55.21% respectively as shown in table II. Mean percentage reduction for plaque index in Group I (SRP alone) from baseline to 1 month and 3 month was 51.33% and 53.78 % respectively as showed in table II.The percentage reduction for plaque index was maximum in Group III (SRP+CHX Chip) and minimum in Group I (SRP

alone). However, on intergroup comparison the difference between Group II and Group I, from baseline to 1 month and 3 month was found to be statistically significant. These findings were similar to the findings of Azmak et al[57] who studied the effect of subgingival controlled release delivery of 2.5 mg of chlorhexidine chip on clinical parameters of chronic periodontitis patients, in patients receiving SRP+chlorhexidine and SRP alone groups. However, from 1 month to 3 months, none of the intergroup comparisons yielded a statistically significant difference ($p>0.05$) as shown in table II. Haesman et al[20], Goodson et al.[55] also reported statistically significant changes in accumulation of plaque by using local drug delivery.

The mean percentage reduction in sulcular bleeding index, from baseline to 1 month and 3 months, in Group II (SRP+TTC Fibers) was 55.89% and 66.30% respectively, which was statistically not significant at 1 month ($p>0.05$) and statistically significant at 3 month ($p<0.01$) as shown in table II. Whereas, mean percentage reduction for sulcular bleeding index in Group III (SRP+CHX Chip) from baseline to 1 month and 3 month was 48.51% and 58.33% respectively, which was statistically significant ($p<0.01$) as shown in table II. Mean reduction for sulcular bleeding index in Group I (SRP alone) from baseline to 1 month and 3 month was 56.81% and 64.05% respectively as shown in table II. Both groups Group III (SRP+CHX Chip) and Group II (SRP+TTC Fibers) had higher mean percentage reduction for sulcular bleeding index as compared to Group I (SRP+alone), and the intergroup comparisons were significant statistically ($p<0.01$) as shown in table II. From baseline to 3 months, the percentage reduction for sulcular bleeding index was maximum in Group II (SRP+TC fibers), followed by Group III (SRP+CHX chip) and then Group I (SRP alone) as shown in table II. These findings are similar to that of Graca et al15, Ritu Jain et al [2], Aimetti et al.[52]

The mean percentage reduction in Gingival index, from baseline to 1 month and 3months, in Group II (SRP+TTC Fibers) was 47.60% and 54.36% respectively as shown in table II. Percentage reduction for gingival index in Group III (SRP+CHX Chip) from baseline to 1 month and 3 months was 45.90% and 58.85% respectively as shown in table II. Mean percentage reduction for gingival index in Group I (SRP alone) from baseline to 1 month and 3 months was 48.98% and 54.03% respectively as shown in table II. The percentage reduction for gingival index was maximum in Group III (SRP+CHX Chip) and minimum in Group I (SRP alone) as shown in table II. However, there was no significant difference between Group II (SRP+TTC Fibers) and Group III (SRP + CHX Chip), ($p>0.01$), from baseline to 3 months. This study reported that there was marked reduction in gingival index score from baseline to 3 months, Group I (SRP alone), Group II (SRP + Tetracycline fiber), Group III (SRP + Chlorhexidine chip) in accordance to study by Goodson et al[55] and Tanner et al.[15] The mean percentage reduction in Probing Depth, from Baseline to 1 month and 3 months, in Group II (SRP+TTC Fibers) was 21.31% and 42.47% respectively, which was statistically significant ($p<0.001$) as shown in II. Whereas, mean percentage reduction in Probing Depth for Group III (SRP+CHX Chip) from Baseline to 1 month and 3 months was 24.34% and 48.26% respectively, which was statistically significant ($p<0.001$) as shown in II. Mean reduction for Probing Depth in Group I (SRP alone) from baseline to 1 month and 3 months was 20.37% and 25% respectively, which was statistically significant ($p<0.001$) as shown in II. The mean percentage reduction for Probing Depth was maximum in Group III (SRP+CHX Chip), followed by Group II (SRP+TTC Fibers) and then Group I (SRP alone) as shown in II.

Also, from baseline to 3 months, Group III (SRP+CHX Chip) had significantly higher mean percentage reduction for Probing Depth as compared to Group II ($p<0.001$) These findings were similar to that of Jeffcoat MK et al.[58], Heasman PA et al.[20] as shown in II. Whereas, when Group II (SRP+TTC Fibers) and I (SRP alone) were compared, from baseline to 3 months, Group III showed significantly higher percentage reduction for Probing Depth as compared to Group I as shown in table II. These findings were similar to that of Goodson et al.[55], Minabe et al.[59], Newman et al.[60]

The mean percentage gain in Relative Attachment Level, from baseline to 1 month and 3 months, in Group II (SRP+TTC Fibers) was 17.19% and 31.21% respectively, which was statistically significant ($p<0.01$). Whereas, mean percentage gain for relative attachment level in Group II (SRP+TTC Fibers) was 18.28% and 38.28% respectively, which was statistically significant ($p<0.01$). Mean gain for relative attachment level in Group I (SRP alone) from Baseline to 1 month and 3 month was 15.40% and 16.89% respectively, which was statistically significant ($p<0.01$). The mean percentage gain for relative attachment was maximum in Group III (SRP+CHX Chip), followed by Group II (SRP+TCC Fibers) and then Group I (SRP alone). These findings were similar to that of Goodson et al.[55], Minabe et al.[59], Jeffcoat MK et al.[58], Heasman PA et al.[20].Also, from baseline to 3 months Group III (SRP+CHX) had significantly higher mean percentage gain as compared to Group II as well as Group I. These findings were similar to that of Soskolne et al.[61] who studied the changes in probing depth following 2 years of periodontal maintenance therapy including adjunctive 2 years of periodontal

maintenance therapy including adjunctive controlled release of biodegradable chlorhexidine chip. Whereas, when Group II (SRP+TTC Fibers) and I (SRP alone) were compared, no statistically significant difference was present. These finding were similar to that of Drisko et al.[62] From 1 to 3 months, Group III (SRP+CHX Chip) had significantly higher mean percentage gain for relative attachment as compared to Group II. None of the other comparisons showed a statistically significant difference ($p>0.05$) as shown in table I and II. Hence, the results from the present study suggested that maximum improvement was seen in Group III, followed by Group II and then in Group I.

Summary and Conclusion

Local drug delivery is new dimension of treatment in non-surgical management of periodontal disease. This study was conducted, evaluated and compared for the efficacy of commercially available Periocol-TC containing tetracycline fiber and Periocol-CG containing of chlorhexidine chip with SRP alone. Systemically healthy 20 patients with age 25-55 years, both male and female suffering from chronic periodontitis participated in the study. We had taken 3 sites in each individual with 5-8mm periodontal pocket.

Clinical parameters plaque index, sulcular bleeding index, gingival index, probing depth reduction, relative attachment level were assessed from baseline to 3 months.

This conclusion of this study showed statistically significantly result in probing depth reduction and improvement in relative attachment level, gingival bleeding and plaque index in nonsurgical management with local drug delivery. The crux of this study is chlorhexidine chip as an adjunct to SRP showed greater improvement in clinical parameter relative attachment level, probing depth reduction, gingival index, plaque index, sulcular bleeding index followed by tetracycline fiber as an adjunct to SRP then SRP alone.

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