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Assessment of the Efficacy of Two Local Drug Delivery Systems in the Treatment of Chronic Periodontitis

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ABSTRACT:

Aim: Aim of the present study was to assess the efficacy of two local drug delivery systems in the treatment of chronic periodontitis. Materials and Methods: A total of 40 patients aged around 30–55 years were included in the present study.The enrolled patients underwent initial phase therapy which comprised scaling and root planning done by a single operator. Patients who fulfilled the selection criteria for the study were randomly allocated to two groups. Group 1: Tetracycline Fibers, Group 2: Chlorhexidine Gel. The plaque index (PI), the gingival index (GI), and periodontal pocket depth (PPD) were noted during baseline visit (before the local drug delivery), and these indices were rerecorded after 30 days after the local drug delivery. Results: The reduction of mean plaque index score was seen more in group 1 compared to group 2. There was no statistically significant difference found between the groups. The reduction of mean gingival index score and periodontal pocket depth was seen maximum in group 1 compared to group 2. There was a statistically significant difference found between the groups after the intervention. Conclusion: The present study concluded that, although thorough scaling and root planing are effective treatment methods for elimination of chronic

periodontal pockets, improved results can be obtained by adjunctive use of locally administered tetracycline fibers and chlorhexidine gel.

Keywords: chlorhexidine gel, chronic periodontitis, local drug delivery, tetracycline fibers.

Introduction:

Periodontitis is an infection of the periodontium. It is considered an infection because there is a bacterial etiology and an immune response. Once destruction of tissue occurs, the condition is referred to as a disease. Usually, the host response can contain subgingival bacterial challenges, and subclinical infections are resolved without any clinical manifestation of pathosis.[1] However, if the host-parasite equilibrium becomes unbalanced, an exuberant host response can result in destruction of the periodontium. Conventional therapy (e.g., scaling and root planing [SRP] and ultrasonic debridement) without adjunctive chemotherapy is often sufficient to suppress bacterial pathogens, thereby attaining periodontal health.[2]

Antimicrobial therapy has also been directed at specific bacteria associated with clinically diseased sites to help augment the mechanical treatment aimed at the removal of sub-gingival calculus and toxins. However, the inability to achieve and maintain therapeutic concentrations of the antibiotic in the crevicular fluid with systemic administration can limit its effectiveness.[3]

Also, the Systemic administration of antimicrobial agents requires frequent dosing which is associated with the risk of developing resistant organisms and super infection as well as adverse effects such as gastrointestinal disturbances.[4]

To complement the non-surgical therapy, there are multiple options of antimicrobials that can be locally delivered into the mucosa. Local delivery of antimicrobial agents into periodontal pocket has been extensively developed and investigated since late 1970's. Local delivery of antimicrobial agents includes oral rinses, subgingival irrigation and controlled release delivery systems. Controlled release systems have received great interest and appear to hold some promise in periodontal therapy.[5]They have been evaluated in several forms such as gels, strips, fibers, chips, ointments etc, such as metronidazole, chlorhexidine, minocycline, doxycycline and tetracycline. These drugs are used in periodontal pockets and can inhibit or eliminate the periodontopathogenic microorganisms as well as modulate the inflammatory response of the tissues.[6] So the present study was conducted to assess the efficacy of two local drug delivery systems in the treatment of chronic periodontitis.

Materials and Methods:

The present study was conducted in the Department of Periodontics, Guru Gobind Singh College of Dental Sciences And Research Centre, Madhya Pradesh.A total of 40 patients aged around 30–55 years were included based on the following inclusion and exclusion criteria:

Inclusion criteria: Patients diagnosed as generalized chronic periodontitis, Patients were with good systemic health (free from hypertension, stroke, poorly controlled diabetes, etc.), Patients having a) two contra-lateral sites with ≥5 mm periodontal pocket with active lesion, and

radiographic evidence of bone loss. b) Clinical attachment loss ≥ 3–5 mm at the base line. Patients who had not undergone any surgical or nonsurgical periodontal therapy in the past 6 months and patient who are not willing for surgical therapy.

Exclusioncriteria: Patients who had taken antibiotic therapy in the past 6 months, Patients having history of allergy to tetracycline, pregnant woman and lactating mothers, smoking, tooth with furcation involvement, aggressive periodontitis.

Initial phase therapy:

The enrolled patients underwent initial phase therapy which comprised scaling and root planning done by a single operator (P6 Piezo electric scaler, BONART, Taiwan, ROC; and GraceyCurrettes, Hu Freidy, Chicago, IL, USA), post which oral hygiene instructions were given. After one week of initial phase therapy, patients were recalled and evaluated to confirm the criteria for selection. Patients who fulfilled the selection criteria for the study were randomly allocated to two groups.

Group 1: Tetracycline Fibers:

Scaling and root planing was done at baseline till an even, clean, and hard surface was obtained as expected by the investigator. The product contains 25 mg pure fibrilar collagen, containing approximately 2 mg of evenly impregnated tetracycline HCl. The periodontal pocket was filled with tetracycline fibers. The site was sealed with coe-pak to prevent ingress of oral fluids and to prevent the dislodgement of fiber.

Group 2: Chlorhexidine Gel:

1.5% chlorhexidine gel containing 0.5% fast releasing chlorhexidinedigluconate and 1% in form of slow releasing chlorhexidinedihydrochloride. Xanthan is an optimum substrate for the formation of a stable gel that is easily extruded from a syringe needle.

The plaque index (PI), the gingival index (GI), and periodontal pocket depth (PPD) were noted during baseline visit (before the local drug delivery), and these indices were rerecorded after 30 days after the local drug delivery. The preliminary periodontal treatment included oral hygiene instructions for plaque control and patient motivation was also provided.

Statistical Analysis:

The data was analysed by using the SPSS version 20. Means and standard deviations of the clinical indices were calculated, following which the oral examination scores between the two local drugs were compared with an Independent sample t test. The level of significance was set at 5%.

Results:

The table1 shows the mean values of plaque index at baseline and after 30 days. The mean plaque index scores were 1.41±0.02, 1.37±0.36 respectively in group 1 and 2 at baseline. The reduction of mean plaque index score was seen more in group 1 (0.815±0.01) compared to group 2 (0.922±0.08). There was no statistically significant difference found between the groups.

The table 2 depicts the mean values of gingival index at baseline and after 30 days. The mean gingival index scores were 1.63±0.12, 1.61±0.09 respectively in group 1 and 2 at baseline.

The reduction of mean gingival index score was seen maximum in group 1 (0.81±0.44) compared to group 2 (1.09±0.18). There was a statistically significant difference found between the groups after the intervention.

The table 3 reveals the mean values of periodontal pocket depth at baseline and after 30 days. The mean periodontal pocket depth scores were 5.24±0.28, 5.61±0.16 respectively in group 1 and 2 at baseline. The reduction of mean periodontal pocket depth score was seen more in group 1 (3.81±0.14) compared to group 2 (4.88±0.26). There was a statistically significant difference found between the groups after the intervention.

Table 1: Assessment of plaque index score before and after local drug delivery

	Groups	n	Mean± Std. Deviation	Significance (p value)
Baseline Scores	**Group 1: Tetracycline Fibers**	20	1.41±0.02	0.086
	Group 2: Chlorhexidine Gel	20	1.37±0.36	
After local drug delivery	**Group 1: Tetracycline Fibers**	20	0.815±0.01	0.061
	Group 2: Chlorhexidine Gel	20	0.922±0.08	

Table 2: Assessment of gingival indexscore before and after local drug delivery

	Groups	n	Mean± Std. Deviation	Significance (p value)
Baseline Scores	**Group 1: Tetracycline Fibers**	20	1.63±0.12	0.06
	Group 2: Chlorhexidine Gel	20	1.61±0.09	
After local drug delivery	**Group 1: Tetracycline Fibers**	20	0.81±0.44	**0.01**
	Group 2: Chlorhexidine Gel	20	1.09±0.18	

Table 3: Assessment of periodontal pocket depthscore before and after local drug delivery

	Groups	n	Mean± Std. Deviation	Significance (p value)
Baseline Scores	**Group 1: Tetracycline Fibers**	20	5.24±0.28	0.08
	Group 2: Chlorhexidine Gel	20	5.61±0.16	
After local drug delivery	**Group 1: Tetracycline Fibers**	20	3.81±0.14	**0.01**
	Group 2: Chlorhexidine Gel	20	4.88±0.26	

Discussion:

It is well established that diseases caused by microbial biofilms, such as chronic periodontitis, are extremely difficult to treat. Dental biofilms are difficult therapeutic targets as they are not easily disrupted. In a non sterile environment such as the mouth, it is virtually impossible to completely prevent their formation. The scientific rationale for adding locally applied anti-infective agents to SRP is that certain broad-spectrum antimicrobial agents can theoretically reduce the number of subgingival bacteria left behind after SRP.[7]Although mechanical removal or disruption of subgingival biofilms by SRP is usually an effective therapeutic approach for the treatment of chronic periodontitis, it does not sterilize the subgingival environment. Almost immediately after SRP, bacteria left behind begin to recolonize the subgingival environment to form a new biofilm.[8]

The frequent intake of systemic antibiotics over a long period of time may lead to possible risks such as, development of resistant bacterial strains, patient incompliance, and superimposed infections. Thus, the local delivery of antimicrobials offers an important resolution to these difficulties. The increased concentrations of the drugat the target site, minimal dosage, and superior acceptance by patients and reduced number of applications are the chief advantages of local drug delivery system.[9]

Most widely used local drug delivery system reports in periodontal literature are of Tetracycline as reported by Goodson,[10]Chlorhexidine by Addy et al.[11]In the present study, collagen-impregnated tetracycline fibers was used which was found to be advantageous among other drug.

Tetracyclines are superior to other antibiotics as they are the only class of antibiotics which has the ability for retention to the tooth cementum and soft tissues. They are the only antibiotics, which can achieve higher levels of gingival fluid concentrations than serum levels.[12]Tetracycline has also been to inhibit collagenase activity, collagen degradation and bone

resorption as reported by Lindhe J et al.[13]The substantivity of tetracyclines have proved to be effective against gram-positive and gram-negative anaerobic microflora associated with chronic adult periodontitis. They exert their antimicrobial effect by inhibiting protein synthesis.

It was observed in the present study, in both group 1 (tetracycline fibers) and group 2 (chlorhexidine gel), showed a reduction in mean plaque score. Similar observations were made by Friesen et al[14]. This reduction in supragingival plaque score could be attributed to chemical control of subgingival plaque by tetracycline fibers which could also have an inhibitory effect on supragingival plaque. Reduction in mean bleeding score in both groups was statistically significant after the intervention and the results are in accordance with studies conducted by Minabeet al[15]. Reduction in probing pocket depth in both the groups (Group 1 and 2) is due to resolution of gingival inflammation after scaling and root planing and to well known antimicrobial effects of both locally delivered drugs.

Further studies should be conducted over a long-term with follow-up period would be useful in demonstrating the actual interpretation of these results. Studies with bigger sample size are needed in the future to assess the clinical effectiveness of these drugs as a local drug delivery system in patients with chronic periodontitis.

Conclusion:

The present study concluded that, although thorough scaling and root planing are effective treatment methods for elimination of chronic periodontal pockets, improved results can be obtained by adjunctive use of locally administered tetracycline fibers and chlorhexidine gel.

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