Journal section: Periodontology *doi:10.4317/jced.3.e424*
Publication Types: Research

Non-surgical management of chronic periodontitis with two local drug delivery agents- A comparative study.

Jaspreet Singh Gill [1], Vipin Bharti [2], Harinder Gupta [3], Sharanjeet Gill [4]

[1] BDS, MDS. Senior Lecturer, Department of Periodontics and Implantology, SGT Dental College, Hospital and Research Institute, Gurgaon, Haryana, India..
[2] BDS, MDS. Prof & HOD, Department of Periodontics , Government Dental College, Patiala, Punjab, India.
[3] BDS, MDS. Prof & HOD, Department of Periodontics , Government Dental College, Amritsar, Punjab, India.
[4] BDS, MDS. Senior Lecturer, Department of Oral Pathology, Manav Rachna Dental College, Faridabad, Haryana, India.

Correspondence:
Department of Periodontics,
SGT Dental College,
Hospital and Research institute, gurgaon. Haryana.
E-mail address: drjaspreet13137@yahoo.com

Received: 18/01/2011
Accepted: 10/07/2011

Gill JS, Bharti V, Gupta H, Gill S. Non-surgical management of chronic periodontitis with two local drug delivery agents- A comparative study. J Clin Exp Dent. 2011;3(5):e424-9.
http://www.medicinaoral.com/odo/volumenes/v3i5/jcedv3i5p424.pdf

Article Number: 50490 *http://www.medicinaoral.com/odo/indice.htm*

eMail: jced@jced.es

Abstract

Background: The selective removal or inhibition of pathogenic microbes with locally delivered antimicrobials when combined with scaling and root planing is often an effective approach for the managment of chronic periodontitis.

Aim: To compare the clinical efficacy of tetracycline fibers and a xanthan based chlorhexidine gel in the treatment of chronic periodontitis.

Methods and materials: Thirty systemically healthy patients in the age group of 30-50 years suffering from generalized chronic moderate periodontitis were selected. For each subject, two experimental sites were chosen that had probing depth >5mm and were located in symmetric quadrants and the sites were randomized at split mouth level with one receiving tetracycline fibers and the other chlorhexidine gel. Plaque score, bleeding score, probing pocket depth and relative attachment level gain was recorded on day 0 and at the end of 3 months.

Results and conclusion: In both groups, there was statistically highly significant reduction in all the clinical parameters i.e. plaque score, bleeding score and probing pocket depth and relative attachment level gain was seen at different time intervals. Local delivery of tetracycline and chlorhexidine is a safe, easy and efficacious method along with scaling and root planing in the treatment of chronic periodontitis. Inter-comparison of both local drug delivery agents with respect to clinical changes shows that tetracycline fibers are better than chlorhexidine gel for treatment of chronic periodontitis. Nevertheless, long term studies with more samples are suggested to further evaluate and compare the efficacy of both materials.

Key Words: *local delivery, periodontitis, tetracycline fibers, chlorhexidine gel.*

Introduction

Periodontal diseases represent a group of localized microbial induced infections involving gingiva and supporting tissues of the teeth. The role of microorganisms in the etiology and progression of periodontitis is now well documented (1). Periodontal diseases are routinely treated by mechanical procedures which include meticulous scaling and root planing in conjunction with patient's proper plaque control. Although mechanical therapy may provide long term stability for many patients, but it fails to eliminate the pathogenic bacteria completely and may not always result in complete elimination of the disease (2).

Local delivery of antimicrobial agents into periodontal pocket has been extensively developed and investigated since late 1970's (3). Local delivery of antimicrobial agents includes oral rinses, subgingival irrigation and controlled release delivery systems (4). Controlled release systems have received great interest and appear to hold some promise in periodontal therapy. They have been evaluated in several forms such as gels, strips, fibers, chips, ointments etc and using different antimicrobial agents such as tetracycline, doxycycline, metronidazole, minocycline and chlorhexidine (5-10). Pioneering work by Goodson introduced the use of tetracycline as a local drug delivery agent for the treatment of periodontal diseases (11). He and his coworkers developed a local drug delivery system consisting of a polymer and ethylene vinyl acetate impregnated with 25% tetracycline hydrochloride. One such local drug delivery system is available in the form of resorbable tetracycline fibers (Periodontal Plus AB®)

Chlorhexidine is also a highly effective antimicrobial agent that has been extensively studied and shown to be effective as a mouthrinse against supragingival plaque bacteria in prevention of gingivitis and as a treatment for gingivitis (12) .Chlorhexidine has been used for local drug delivery in various formulations such as mouth rinses, gels, sprays, varnishes, chips and subgingival irrigation devices (13-15).Chlorhexidine in form of gel has been used in varying concentrations such as 0.2%, 1% and 2% (13-15). In the present study, xanthan based 1.5% chlorhexidine gel was used as an adjunct to scaling and root planing .The aim of the present study was to compare the efficacy of tetracycline fibers (Periodontal Plus AB®) and chlorhexidine gel (Chlosite®) when used as an adjunct to scaling and root planing in the management of chronic periodontitis.

Material and Methods

Thirty systemically healthy patients in the age group of 30-50 years (both male and female) suffering from generalized chronic moderate periodontitis were selected amongst the patients visiting the Department of Periodontics, Govt. Dental College and Hospital, Patiala (Punjab). Patients did not receive any surgical or non surgical periodontal therapy in past 6 months and were not on any antibiotic therapy since past 3 months. Written informed consent was taken from each patient who participated in the study and ethical clearance was obtained from the institutional committee. For each subject, two experimental sites were chosen that had probing depth >5mm and were located in symmetric quadrants and after scaling and root planing, the two sites were randomized at split mouth level by flip of a coin and divided into two groups:

Group I: Tetracycline fibers (Periodontal Plus AB®) were inserted into the periodontal pocket until pocket was filled. Coe pak® was then applied for 10 days. *(Figure 1)*

Group II: After washing the selected site with distilled water and drying it, chlorhexidine gel (Chlosite®) was applied directly from the syringe into the pocket. Coe pak® was then applied for 10 days. *(Figure 2)*

Recording of various clinical parameters was carried on

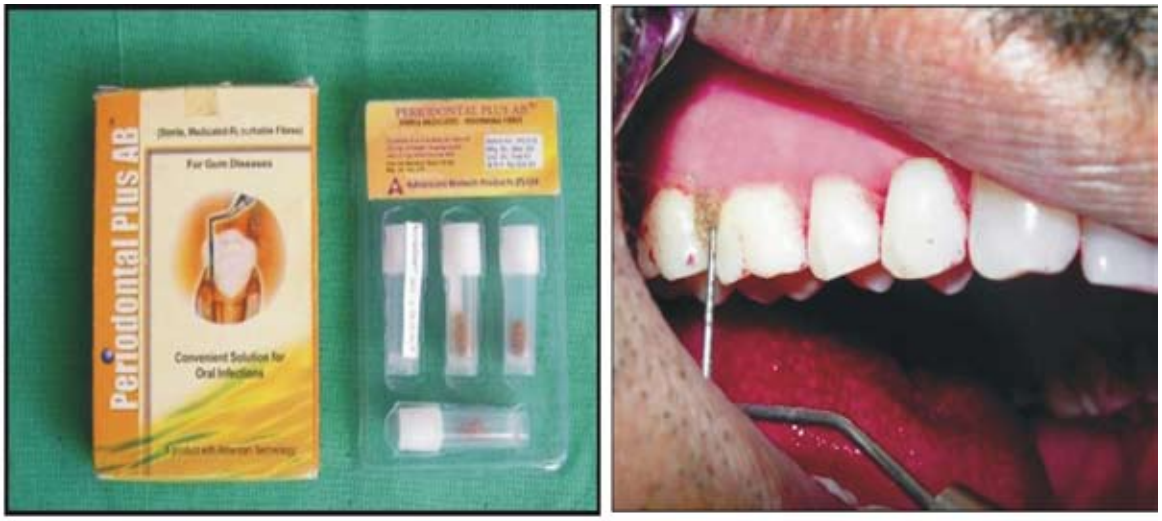

Fig. 1. Showing Periodontal Plus AB® fibers and insertion of fibres into the periodontal pocket

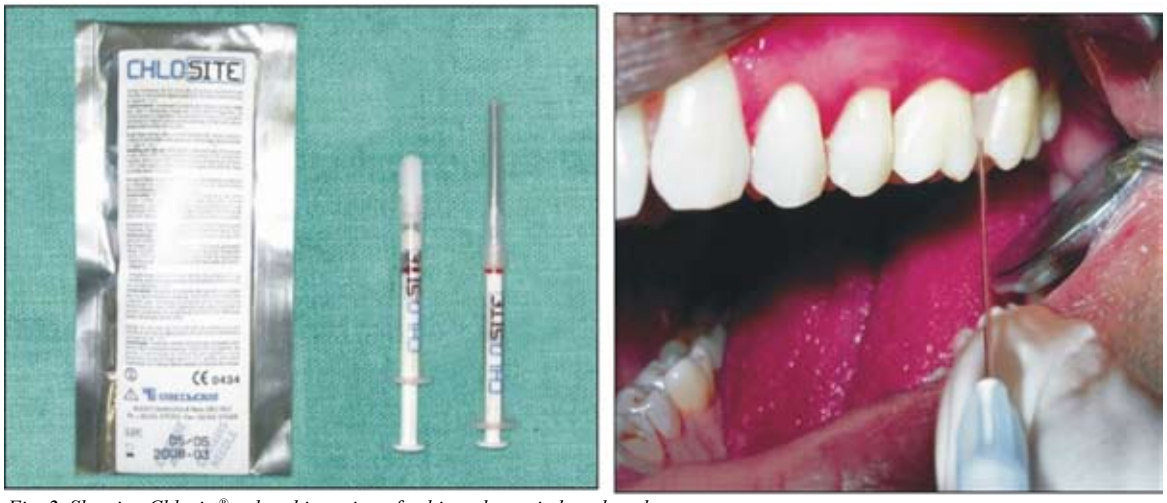

Fig. 2. Showing Chlosite® gel and insertion of gel into the periodontal pocket

day 0 (baseline) and subsequently recording of plaque score and bleeding score was made at the end of 1 month and 3 months, while probing pocket depth and relative attachment level was recorded on day 0 and at the end of 3 months. The course of the study was of 3 months duration. The significance of the differences in plaque index, bleeding score, probing pocket depth and relative attachment level for both the groups at different time intervals was assessed using paired t-test, while the inter-comparison of both the groups was carried out using unpaired t-test.

Clinical Parameters

1. Plaque Index (Quigley - Hein Plaque Index).
2. Probing pocket depth (using Williams's calibrated periodontal probe)
3. Bleeding Index (PBI modified by Muhlemann HR)
4. Relative Attachment Level (Measurement using customized acrylic stent)

Materials

Tetracycline Fibers (Periodontal Plus AB®) #: Resorbable collagen fibers 25mg, impregnated with tetracycline hydrochloride containing approximately 1.7 ± 0.25mg tetracycline hydrochloride.

Chlorhexidine gel (Chlosite®)*: Xanthan based 1.5% chlorhexidine gel containing 0.5% fast releasing chlorhexidine digluconate and 1% in form of slow releasing chlorhexidine dihydrochloride. Xanthan is an optimum substrate for the formation of a stable gel that is easily extruded from a syringe needle.

Periodontal Plus AB®: Advanced Bio Tech Products (Ltd), * *Chlosite®:* Ghimas,Italy

Results

Mean plaque score of both group I (Periodontal Plus AB®) and group II (Chlosite®) score at baseline (day 0) and at the end of 1 month and 3 months was highly significant ($p < 0.001$). On comparison of reduction in mean plaque score of group I (Periodontal Plus AB®) and group II (Chlosite®) at different time intervals it was found that reduction in plaque score after 1 month and 3 months from baseline (day 0) was non-significant ($p > 0.05$). (Table 1)

Mean papillary bleeding score of group I (Periodontal Plus AB®) and group II (Chlosite®) at day 0 and at the end of 1 month and 3 months was highly significant ($p < 0.001$).On comparison , reduction in mean papillary bleeding score between the two groups was significant ($p < 0.05$).(Table 2)

Mean probing pocket depth of group I (Periodontal Plus AB®) and group II (Chlosite®) at day 0 and at the end of 3 months was highly significant ($p < 0.001$). On comparison, reduction in mean probing pocket depth of group I (Periodontal Plus AB®) and group II (Chlosite®) after 3 months from baseline was significant ($p < 0.05$).(Table

Time interval	Group	Mean±SD	't' value	'p' value	Significance
After 1 month from baseline	I	0.92±0.54	0.14	>0.05	NS
	II	0.95±0.58			
After 3 months from baseline	I	1.02±0.57	0.28	>0.05	NS
	II	0.97±0.52			

t-value calculated using unpaired t-test and p value used to determine the statistical significance

Table 1. *Comparison of reduction in mean plaque score of group I (periodontal plus ab®) and group II (Chlosite®) at 1 month and 3 months from baseline (day 0)*

Time interval	Group	Mean±SD	't' value	'p' value	Significance
After 1 month from baseline	I	1.90±0.55	2.50	<0.05	S
	II	1.35±0.81			
After 3 months from baseline	I	2.20±0.41	2.41	<0.05	S
	II	1.80±0.61			

t-value calculated using unpaired t-test and p value used to determine the statistical significance

Table 2. *Comparison of reduction in mean papillary bleeding score of group I (Periodontal Plus AB®) and group II (Chlosite®) at 1 month and 3 months from baseline (day 0)*

Time interval	Group	Mean±SD	't' value	'p' value	Significance
After 3months from baseline	I	1.90±0.55	2.45	<0.05	S
	II	1.45±0.60			

t-value calculated using unpaired t-test and p value used to determine the statistical significance

Table 3. *Comparison of reduction in mean probing pocket depth (mm) of group I (Periodontal Plus AB®) and group II (Chlosite®) after 3 months from baseline (day 0).*

3)

Mean relative attachment level of group I (Periodontal Plus AB®) and group II (Chlosite®) at day 0 and at the end of 3 months was highly significant ($p< 0.001$). On comparison of relative attachment level gain of group I (Periodontal Plus AB®) and group II (Chlosite®) after 3 months was significant ($p< 0.05$) (Table 4).

Discussion

Scaling and root planing in conjunction with proper plaque control results in alteration of the subgingival environment that is sufficient, in most instances to improve periodontal health and arrest further loss of attachment(6). Nevertheless, scaling and root planing alone may not predictably lead to complete elimination of the disease (6). Poor access to the bottom of deep pockets and anatomical complexities may occasionally limit the efficacy of root planing (3). Moreover, some bacteria have been shown to invade deep periodontal tissues, making mechanical therapy alone sometimes ineffective (16) and repopulation of scaled teeth from bacterial reservoirs in dentinal tubules may also be responsible for recurrence of the disease (3).

Various antimicrobial agents have been administered systemically as well as locally/topically by means of mouth rinses or irrigation solutions as an adjunct to scaling and root planing (14). However systemic administration of antibiotics have been associated with side effects, while effectiveness of local delivery of antimicrobial agents in form of mouth rinses and subgingival irrigation has been limited due to inability of the drug to reach the site of action in adequate concentrations and the inability to localize and sustain at disease active sites (17) . Recently, advances in local delivery technology have resulted in control release of drugs that are successful in maintaining effective drug concentration at a lower dosage in the periodontal pocket.

It was observed in the present study, in both group I (tetracycline fibers) and group II (chlorhexidine gel), a reduction in mean plaque score that was statistically highly significant at both time intervals. Similar observations were made by Jeong et al (18), Friesen et al (19), Oosterwaal et al (20), Vinholis et al (12). 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 (21). Moreover, good oral hygiene practiced by patients during the entire study period could have also increased the reduction in plaque. However on comparison of mean plaque scores between group I and group II, statistically non-significant differences were recorded and the findings are in accordance with the study conducted by Unsal et al (15) who evaluated the effects of subgingivally placed 2% chlorhexidine gel and 10% tetracycline paste in periodontal pockets along with scaling and root planing.

Bleeding on probing is an objective sign of inflammation. Research suggests that bleeding on probing often is the first sign of gingival inflammation. Reduction in mean bleeding score in both groups was highly significant at both time intervals and the results are in accordance with studies conducted by Minabe et al (22). In

Time interval	Group	Mean±SD	't' value	'p' value	Significance
After 3months from baseline	I	1.62±0.71	2.57	<0.05	S
	II	1.12±0.50			

t-value calculated using unpaired t-test and p value used to determine the statistical significance

Table 4*. Comparison of gain in mean Relative attachment level (mm) of group I (Periodontal Plus AB®) and group II (Chlosite®) after 3 months from baseline (day 0)*

the present study reduction in bleeding is due to resolution of gingival inflammation after scaling and root planing and well known antimicrobial effect of tetracycline (15, 23).Moreover, average gingival fluid concentration of 1500 µg/ml tetracycline has been observed during the first 10 days treatment period with Periodontal Plus AB®. Tetracycline is released in almost linear fashion for 7-10 days. Similar findings were noted by Aimetti et al (6) and Heijl et al (25). On comparison of bleeding scores between the two groups, reduction in mean papillary bleeding score was significant at both 1 and 3 months ($p< 0.05$). There was more reduction in the tetracycline group, which can be attributed to the fact that tetracycline offers better substantivity (23) and good binding and/or penetration into the root surfaces (24) when compared to chlorhexidine and thereby maintaining antimicrobial effect for a longer time period.

Periodontal probing is one of the most widely used diagnostic tools for clinical assessment of connective tissue destruction and periodontal pocket depth in periodontal disease. In both groups the reduction in mean probing pocket depth was highly significant and a similar result was recorded by Goodson (11), Heijl et al (25), Radvar et al (3), Friesen et al (19) and Stabholz et al (23), Jeffcoat et al (14) and Vinholis et al (12). However, on comparison, mean probing pocket depth reduction between group I and II was significant ($p <0.05$) at the end of 3 months, with better results in group I. Reduction in probing pocket depth in both the groups (Group I and II) is due to resolution of gingival inflammation after scaling and root planing and to well known antimicrobial effects of both locally delivered drugs. Unsal et al (15) and Stabholz et al (23).

Pocket depth might change from time to time even in untreated periodontal disease because of changes in gingival margin, while changes in the level of attachment can be caused only by gain or loss of attachment and thus provide a better indication of the degree of periodontal destruction. There was highly significant gain ($p <0.001$) in both group I (tetracycline fibers) group II (chlorhexidine gel) at the end of 3 months from baseline. Similar findings were recorded by Goodson (11), Heijl et al (25), Radvar et al (3), Friesen et al (19) and Stabholz et al (23), Jeffcoat et al (14), Vinholis et al (12).

On comparison, mean gain of attachment between group I and II was significant ($p <0.05$) at the end of 3 months. There was more gain in relative attachment level in group I (tetracycline fibers), which may be due to substantivity of tetracycline for a longer period(23), collagenase inhibition property(26), anti-inflammatory effects and inhibition of bone resorption by tetracycline and their property to promote attachment of fibroblasts to root surface (27). Alveolar bone remineralization may also be triggered by elimination of infection by tetracycline (6). There was highly significant reduction in periodontal pocket depth in group II (Chlosite®) at the end of 3 months from baseline (day 0), however reduction was lower when compared to group I (Periodontal Plus AB®) at the end of 3 months. This could be attributed to the fact that chlorhexidine offers a low subgingival substantivity and there is poor adsorption of the drug in the subgingival environment when compared to tetracycline (23). In a systematic review on the effects of subgingival chlorhexidine gel adminstration in treatment of chronic periodontitis, it was concluded that the limited data currently available on the effects of subgingival chlorhexidine gel application do not justify its use in the treatment of chronic periodontitis (28) .However in a more recent randomized multicenter trial, xanthan based chlorhexidine gel promoted greater pocket reductions and clinical attachment gains with better microbiologic and biochemical outcomes compared with scaling and root planing alone (29). Moreover addition of chlorhexidine to xanthan gum seem to improve the bioadhesive properties of this material and the cationic charges of chlorhexidine can interact with the anionic charges of the xanthan gum polymer, enhancing its gel structure and substantivity (30).This in concordance with our findings as xanthan based chlorhexidine gel was effective in reducing pocket probing depth and there was gain of attachment.

Conclusion

Both tetracycline fibers and chlorhexidine gel are an effective means of non-surgical treatment modality for the management of chronic periodontitis. The adjunctive use of both the agents along with scaling and root planing resulted in a significant improvement in all the clinical parameters. Although tetracycline fibers resulted in better improvement in probing pocket depth reduction and relative attachment level gain than chlorhexidine gel, more studies with a large sample size are required to further assess the comparative clinical efficacy of both the local drug delivery agents.

References

1. Socransky SS, Haffajee AD. The bacterial etiology of destructive periodontal diseases, current concepts. J Periodontol. 1992; 63:322-31.
2. Van Winkelhoff AJ, Rams TE, Slots J. Systemic antibiotics in periodontics. Periodontology 2000. 1996; 10:45-78.
3. Radvar M, Pourtaghi N, Kinane DF. Comparison of 3 periodontal local antibiotic therapies in persistent periodontal pockets. J Periodontol.1996; 67:860-5.
4. Bonito AJ, Lux L , Lohr KN. Impact of local adjuncts to scaling and root planing in periodontal disease therapy: a systematic review. J Periodontal 2005; 76:1227-36.
5. Hanes PJ, Purvis JP. Local anti-infective therapy: pharmacological agents. A systematic review. Ann Periodontol.2003; 8:79-98.
6. Aimetti M, Romano F, Torta I, Cirillo D, Caposio P, Romagnoli R. Debridement and local application of tetracycline-loaded fibres in the management of persistent periodontitis: results after 12 months. J Clin Periodontol 2004; 31:166-72.
7. Walker CB, Godowski KC, Borden L, Lennon J, Nango S, Stone C et al. The effects of sustained release doxycycline on the anaerobic

flora and antibiotic-resistant patterns in subgingival plaque and saliva. J Periodontol.2000; 71:768-74.
8. Ainamo J, Lie T, Ellingsen BH, Hansen BF, Johansson LA, Karring T et al. Clinical responses to subgingival application of a metronidazole 25% gel compared to the effect of subgingival scaling in adult periodontitis. J Clin Periodontol 1992; 19:723-29.
9. Renvert S, Lessem J, Dahlen G, Lindahl C, Svensson M. Topical minocycline microspheres versus topical chlorhexidine gel as an adjunct to mechanical debridement of incipient peri-implant infections: a randomized clinical trial. J Clin Periodontol. 2006; 33:362-9.
10. Gupta R, Pandit N, Aggarwal S, Verma A. Comparative evaluation of subgingivally delivered 10% doxycycline hyclate and xanthan-based chlorhexidine gels in the treatment of chronic periodontitis. J Contemp Dent Pract. 2008; 9:25-32.
11. Goodson JM, Hogan PE, Dunham SL. Clinical responses following periodontal treatment by local drug delivery. J Periodontol.1985; 56:81-7.
12. Vinholis AH, Figueiredo LC, Marcantonio Junior E, Marcantonio RA, Salvador SL, Goissis G. Subgingival utilization of a 1% chlorhexidine collagen gel for the treatment of periodontal pockets. A clinical and microbiologic study.Braz Dent J. 2001; 12:209-13.
13. Greenstein G. Effects of subgingival irrigation on periodontal status. J Periodontol.1987; 58:822-34.
14. Jeffcoat MK, Bray KS, Ciancio SG, Dentino AR, Fine DH, Gordon JM et al. Adjunctive use of a subgingival controlled release chlorhexidine chip reduces probing depth and improves attachment level compared with scaling and root planing alone. J Periodontol.1998; 69:989-97.
15. Unsal E, Akkaya M, Walsh TF. Influence of a single application of subgingival chlorhexidine gel or tetracycline paste on the clinical parameters of adult periodontitis patients. J Clin Periodontol.1994; 21:351-5.
16. Saglie R, Newman MG, Carranza FA Jr, Pattison GL. Bacterial invasion of gingiva in advanced periodontitis in humans. J Periodontol.1982; 53:217-22.
17. Goodson JM, Offenbacher S, Farr DH, Hogan PE. Periodontal disease treatment by local drug delivery. J Periodontol.1985; 56:265-72.
18. Jeong SN, Han SB, Lee SW,Manusson I. Effects of tetracycline-containing gel and a mixture of tetracycline and citric acid containing gel on non surgical periodontal therapy. J Periodontol.1994; 65:840-47.
19. Friesen LR, Williams KB, Krause LS, Killoy WJ. Controlled local delivery of tetracycline with polymer strips in the treatment of periodontitis. J Periodontol.2002; 73:13-9.
20. Oosterwaal PJM, Mikx FH, van't Hof MA, Renggli HH. Comparison of the antimicrobial effect of the application of chlorhexidine gel, amine fluoride gel and stannous fluoride gel in debrided periodontal pockets. J Clin Periodontol.1991; 18:245-51.
21. Yamagami H, Takomori A, Sakamoto T, Okada H. Intrapocket chemotherapy in adult periodontitis using a new controlled-release insert containing ofloxacin (PT-01). J Periodontol.1992; 63:2-6.
22. Minabe M, Takeuchi K, Tomomatsu E, Hori T , Umemoto T. Clinical effects of local application of collagen film-immobilized tetracycline. J Clin Periodontol. 1989; 16:291-4.
23. Stabholz A, Kettering J, Aprecio R, Zimmerman G, Baker PJ, Wikesjo UM. Retention of antimicrobial activity by human root surfaces after in situ subgingival irrigation with tetracycline HCl or chlorhexidine. J Periodontol.1993; 64:137-41.
24. Gordon JM, Walker CB, Murphy JC, Goodson JM, Socransky SS. Concentration of tetracycline in human gingival fluid after single doses. J Clin Periodontol.1981; 8:117-21.
25. Heijl L, Dahlen G, Sundin Y, Wenander A, Goodson JM. A 4-quadrant comparative study of periodontal treatment using tetracycline containing drug delivery fibres and scaling. J Clin Periodontol.1991; 18:111-6.
26. Steinberg D, Friedman M, Soskolne A, Sela MN. A new degradable controlled release device for treatment of periodontal disease: in vitro release study. J Periodontol.1990; 61:393-8.
27. Seymour RA, Heasman PA. Tetracyclines in the management of periodontal diseases .A review. J Clin Periodontol. 1995; 22:22-35.
28. Cosyn J, Sabzevar MM. A systematic review on the effects of subgingival chlorhexidine gel administration in the treatment of chronic periodontitis.J Periodontol.2005; 76:1805-13.
29. Paolantonio M, D Ercole S, Pilloni A, DArchivio D, Lisanti L Graziani F et al. Clinical, microbiologic, and biochemical effects of subgingival administration of a Xanthan-based chlorhexidine gel in the treatment of periodontitis: A randomized multicenter trial. J Periodontol.2009; 80:1479-92.
30. Needleman IG, Smales FC, Martin GP. An investigation of bioadhesive or periodontal and oral mucosal drug delivery .J Clin Periodontol.1997; 24:394-400.