Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 10, Issue, 04, pp.68527-68532, April, 2018

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

ADJUNCTIVE APPLICATION OF XANTHAN BASED CHLORHEXIDINE GEL IN DIABETIC PATIENTS WITH CHRONIC PERIODONTITIS

[1],*Dr. Pooja Palwankar, [2]Dr. Ashish Verma and [3]Dr. Priyanshu Anand

[1]Professor and Head, Department of Periodontology, ManavRachna Dental College, Faridabad, Haryana, India
[2]Associate Professor, Department of Periodontology, ManavRachna Dental College, Faridabad, Haryana, India
[3]Post-Graduate student, Department of Periodontology, ManavRachna Dental College, Faridabad, Haryana, India

ARTICLE INFO

Article History:
Received 20th January, 2018
Received in revised form
26th February, 2018
Accepted 02nd March, 2018
Published online 30th April, 2018

Key words:
Chlorhexidine gel, Diabetics, Scaling and Root planing (SRP), Periodontitis, Probing Pocket Depth, Attachment Loss.

Glossary of Abbreviations

PPD – Probing Pocket Depth
T2DM – Type 2 Diabetes Mellitus
SRP – Scaling and Root planing
CAL – Clinical attachment level
SD – Standard Deviation.
PD – Probing Depth.

ABSTRACT

Background: Periodontal disease is considered to be the sixth complication of diabetes. Periodontal infection has been implicated as a risk factor for systemic diseases such as coronary heart disease and type 2 diabetes mellitus (T2DM). The interrelationship between diabetes mellitus and periodontitis has been studied for many years. Diabetes and Periodontitis seem to interact in a bidirectional manner. The aim of the study was to evaluate the effect of xanthan based chlorhexidine gel diabetic patients with chronic periodontitis.

Method: A split mouth case control study was conducted on 120 sites with probing pocket depth of 5-8 mm diabetic patients from both the sexes visiting to the Out Patient department of periodontology. The selected sites were divided into two groups. Control group- scaling and root planing and Test group- scaling and root planingand immediate insertion of xanthan based chlorhexidine gel.

Results: Both the groups showed reduction in probing pocket depth (PPD) and attachment loss at follow up visits when compared with baseline.

Conclusion: The results from the present study suggest that the application of Xanthan based chlorhexidine gel when used as an adjunct to scaling and root planing is beneficial in the treatment of chronic periodontitis patients with diabetes.

Clinical Relevance: The two way relationship between diabetes mellitus and periodontal disease is well established and diabetic patients have been shown to have greater amount of periodontal destruction. Pocket anatomy is a significant limiting factor in mechanical access and sufficient reduction in bacterial load may not be achieved, hence the effect of xanthan based chlorhexidine gel on the clinical parameters is being evaluated when used as an adjunct to scaling and root planing.

Citation: Dr. Pooja Palwankar, Dr. Ashish Verma and Dr. Priyanshu Anand. 2018. "Adjunctive application of Xanthan based chlorhexidine gel in Diabetic Patients with chronic periodontitis", *International Journal of Current Research*, 10, (04), 68527-68532.

INTRODUCTION

Periodontitis is an infectious disease characterized by loss of periodontal tissue support. In order to remove bacterial desposits, calculus and cementum contaminated by bacteria and endotoxins, mechanical scaling and root planing is advocated. However, specific systemic diseases including uncontrolled diabetes may increase an individual's susceptibility to progressive periodontitis as well as influence the treatment outcome (Martorelli de Lima, 2004).Periodontal infection has been implicated as a risk factor for systemic diseases such as coronary heart disease and type 2 diabetes mellitus (T2DM).

Corresponding author: **Dr. Pooja Palwankar**
Professor and Head, Department of Periodontology, ManavRachna Dental College, Faridabad, Haryana, India.

Patients with T2DM generally have more severe periodontal disease levels compared with non-diabetic individuals (Matsumoto, 2009). Diabetes mellitus is a group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action or both (American Diabetes Association screening for type 2 diabetes, 2000). Diabetes is often asymptomatic in its early stages and can remain undiagnosed for many years in more than 50% of the patients (Harris, 1992; Khader *et al.,* 2006). Patients with undiagnosed diabetes mellitus are at significantly increased risk of complications such as retinopathy, nephropathy, neuropathy, micro and macrovascular diseases, altered wound healing and periodontitis. Periodontal disease is considered to be the sixth complication of diabetes. The interrelationship between diabetes mellitus and periodontitis has been studied for many years. Diabetes and Periodontitis seem to interact in a bidirectional manner.

Both these conditions can produce disability and clinicians have long assumed that these diseases are biologically linked (Kaur, 2012). Although scaling and root planing (SRP) removes the deposits from the tooth surface and shifts the pathogenic microbiota to one compatible with periodontal health (Claffey, 1990; Ramjford, 1987) But, the pocket anatomy is a significant limiting factor in mechanical access, and sufficient reduction of the bacterial load may not be provided (Cosyn, 2005). Surgical intervention provides accessibility to previously inaccessible root surfaces and helps in reduction or elimination of pockets along with production of healthy dentogingival junction. However, certain systemic conditions do not warrant the use of such invasive procedures. Moreover, the refractory and aggressive forms of disease require the use of most intensive and comprehensive therapeutic modalities. In addition, disturbance in host response all play a role in outcome of the treatment. This has led to a more direct approach using antimicrobial agents as an integral part of therapeutic armamentarium, to achieve enhanced clinical outcomes. Success of any antimicrobial agent depends on its ability to achieve bacteriostatic or bactericidal concentrations at the base of the pocket. It must also facilitate retention of medicament long enough in the pocket (Goodson, 1989). Systemic antibiotics require the administration of large doses in order to gain sufficient concentrations at the disease sites, and suffer from potential for the development of bacterial resistance, side-effects, drug interactions or inconsistent patient compliance (Somayaji *et al.,* 2002). The use of supra- and subgingival irrigation devices has proven to be ineffective due to the inability to obtain biologically significant concentrations of drug for sufficient lengths of time (Greenstein, 1987). The inherent limitations of systemic or topical chemotherapies led to the development of local delivery systems for the administration of antimicrobials directly into the periodontal pockets. This form of therapy offers little or no systemic drug uptake, reduced risk of drug resistance, reduced side-effects and higher concentrations at the targeted site (Jeffcoat, 1998). Numerous studies have evaluated the effect of this treatment modality either during the initial phase (Reip, 1999) or during the maintenance phase of periodontal therapy (Verma, 2012). However literature provides controversial reports regarding the response of mechanical therapy in diabetic patients with all studies reporting improving clinical parameters but metabolic control remains a matter of debate with some showing no improvements and other providing a positive result. The aim of the study was to evaluate the effect of Xanthan based Chlorhexidine Gel chlosite^{R} (Ghimas, Italy) as an adjunct to scaling and root planing in known type 2 diabetic patients with chronic periodontitis.

MATERIALS AND METHODS

Study design and participant selection

A split mouth case control study was conducted on 120 sites in 10 patients with probing pocket depth of 5-8 mm in known diabetic patients from visiting to the Out Patient Department of Periodontology. Informed consent was obtained from all participants before enrollment and also the study was approved by the institutional ethical committee. The selected sites were randomly divided into two groups, Control and Test sites. The control group received Scaling and root planing and the test Group received Scaling and root planing+ immediate insertion of local drug delivery agent Xanthan based Chlorhexidine Gel.

The inclusive criteria included known diabetic patients under medication (random blood glucose levels ≤200mg/dl and Hb1Ac 6-8%) with pocket depth of 5-8mm between the age group of 30-60 yrs with mean age- 45 years. Patients with two non-adjacent interproximal sites and bled on probing at the initial visit were selected for the study. The exclusion criteria included patients with mobile teeth and furcation involvement, trauma from occlusion, all forms of tobacco users, pregnant and lactating females, patients undergone any periodontal treatment within the last 6 months, patients under antibiotics, patients with systemic conditions apart from diabetes mellitus and patients allergic to chlorhexidine digluconate and chlorhexidine dihydrochloride.

Treatment Procedure: At baseline, all the 120 sites in 10 patients received scaling and rootplaning (SRP). Patients were assigned to test group and control group by computer randomization. The test group received xanthan based chlorhexidine gel at baseline and control group received a placebo gel. Following SRP at baseline, the clinical measurements were made using UNC-15 probe using acrylic stent to guide angle of insertion of probe. The apical margin of the acrylic splint was used as the fixed reference point. Following measurements were made at the selected site (Fig 1):

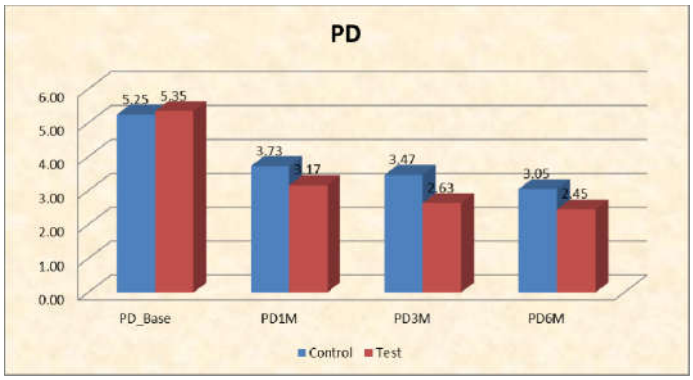

Figure 1. Mean pocket depth at various time intervals.

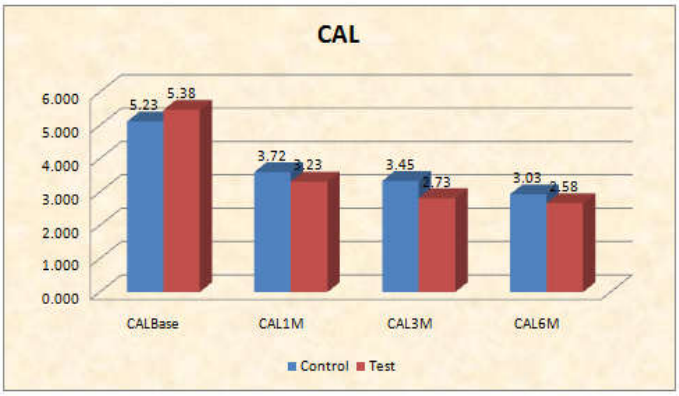

Figure 2. Mean clinical attachment levels at various time intervals

- Reference point (RP) to the Base of Pocket (BOP).
- Reference point (RP) to the Gingival Margin (GM).
- Reference point (RP) to Cemento-Enamel Junction (CEJ).

The following calculations were made from these measurements:

- Pocket Depth (RP to BOP)- (RP to GM)
- Clinical Attachment level: (RP to BOP)- (RP to CEJ)

Random blood glucose and Glycosylated hemoglobin levels –

Random blood glucose levels and Hb1Ac levels were evaluated at baseline and 6 months post therapy by High Performance Liquid Chromatography method in the standardized laboratory

Method of Application

After the clinical measurements were recorded, the selected pocket was irrigated with normal saline and then dried with paper points. Chlosite was then applied directly from the syringe into the deepest pocket and then, while continuing to extrude the material, the needle was slowly withdrawn till it reached the superior portion of the pocket. No dietary limitations were imposed during or after treatment. Patients were instructed not to use any chemotherapeutic mouth rinses or oral irrigation devices. Patients were asked to report immediately if pain, swelling or any other problem occurred. Oral hygiene procedures were standardized by informing the patient to use Bass brushing technique, but the patients were instructed to abstain flossing or use of any other interdental aids for next 10 days. Patients were recalled after one month. Further evaluation of clinical parameters was carried out at baseline and after 1, 3 and 6 months. No treatment was performed in any selected sites at the recall visits.

Statistical Analysis

The statistical analysis was performed using the student t-test for the unpaired observation for the intergroup comparison and the paired t-test for the paired observation intragroup comparison. Mean values and standard deviation were calculated for each variable and at various intervals respectively.The baseline, 1 month, 3 months and 6 months values were compared for changes that occurred in various parameters plaque index, gingival index, probing pocket reduction (table 1,2,3) and clinical attachment gain (table 4). Probabilities < 0.05 were considered significant. The paired t-test and student t-test were utilized to evaluate and establish the differences between baseline 1, 3 and 6 months values.

RESULTS

None of the subjects reported any oral symptoms such as toothache (including dental or gingival), pain, inflammation, allergy, abscess, altered taste and increased salivation, etc. All subjects completed their 6 months recall.

Clinical Parameters

In both groups, there were improvements in the plaque index (P <0.0001) (Table 1) and gingival index level between baseline and 3 months and between 3 and 6 months (Table 2). Statistically significant improvements were also observed in pocket depth in control and test group (Fig 1, Table 3, 4) and clinical attachment levels between baseline and 3 months (P <0.0001), baseline and 6 months (P <0.0001), and 3 and 6 months (P <0.001) (Fig 2, Table 5,6). Results obtained showed a small positive metabolic response to the periodontal treatment with a slight improvement in Hb1Ac level from baseline to post therapy which was not statistically significant.

DISCUSSION

Last few decades have seen a lot of scientific evidence evaluating the relationship between diabetes and periodontal disease and the treatment response in subjects with diabetes. Diabetes is associated with several complications and some have been linked to the chronic hyperglycemic state. It is also frequently associated with pathological changes in blood vessel walls. It is interesting to note that the increased susceptibility to periodontal diseases in diabetics does not directly correlate with increased levels of plaque and calculus[9]. In diabetics, a more severe attachment loss and bone resorption may be noticed. The extent of bone resorption and of attachment loss in patients with uncontrolled diabetes is apparently higher in comparison with those who keep their disease under control. The diabetic state impairs the gingival fibroblast synthesis of collagen and glycosaminoglycan, enhances crevicular fluid collagenolytic activity, results in the loss of periodontal fibres, loss of the alveolar supporting bone, loosening and finally exfoliation of the teeth.

Table 1.Comparison Of Mean Values Of Plaque Index Scores At Baseline, 1 Month, 3 Months And 6 Months

Time Interval	Mean± Sd	Difference From Baseline	P Value	Difference From 1 Month	P Value	Difference From 3 Month	P Value
BASELINE	2.04±0.16	-	-	-	-	-	-
1 MONTH	0.75±0.51	1.29±0.51	<0.001	-	-	-	-
3 MONTHS	0.39±0.16	1.64±0.16	<0.001	0.35±0.16	0.04	-	-
6 MONTHS	0.40±0.36	1.63±0.32	<0.001	0.34±0.32	0.09	-0.013±0.32	0.89

Statistically significant at p <0.05

Table 2. Comparison of Mean Values of Gingival Index Scores at Baseline, 1 Month, 3 Months and 6 Months

Time Interval	Mean± Sd	Difference From Baseline	P Value	Difference From 1 Month	P Value	Difference From 3 Month	P Value
BASELINE	2.07±0.16	-	-	-	-	-	-
1 MONTH	0.7±0.5	1.37±0.5	<0.001	-	-	-	-
3 MONTHS	0.34±0.25	1.72±0.25	<0.001	0.35±0.25	0.018	-	-
6 MONTHS	0.39± 0.40	1.67±0.45	<0.001	0.3±0.45	0.07	-0.05±0.45	0.5

Statistically significant at p <0.05

Table 3. Comparison of Mean Values of Pocket Depth at Baseline, 1 Month, 3 Months And 6 Months (Control)

Time Interval	Mean± Sd	Difference From Baseline	P Value	Difference From 1 Month	P Value	Difference From 3 Month	P Value
Baseline	5.25 ± 0.44	-	-	-	-	-	-
1 Month	3.73 ± 0.45	1.51 ± 0.50	<0.001	-	-	-	-
3 Months	3.37±0.5	1.78±0.52	<0.001	0.26±0.44	<0.001	-	-
6 Months	3.25±0.29	2.2±0.51	<0.001	0.68±0.50	<0.001	0.11±0.53	<0.001

Table 4. Comparison of Mean Values of Pocket Depth at Baseline, 1 Month, 3 Months and 6 Months (Test group)

Time Interval	Mean± Sd	Difference From Baseline	P Value	Difference From 1 Month	P Value	Difference From 3 Month	P Value
Baseline	5.35±0.58	-	-	-	-	-	-
1 Month	3.17±0.42	2.18±0.50	<0.001	-	-	-	-
3 Months	2.63±0.55	2.71±0.71	<0.001	0.53±0.50	<0.001	-	-
6 Months	2.35±0.50	2.9±0.75	<0.001	0.71±0.55	<0.001	0.28±0.39	<0.001

Table 5. Comparison of Mean Values of Clinical Attachment at Baseline, 1 Month, 3 Months and 6 Months (Control group)

Time Interval	Mean± Sd	Difference From Baseline	P Value	Difference From 1 Month	P Value	Difference From 3 Month	P Value
Baseline	5.23±0.46	-	-	-	-	-	-
1 Month	3.72±0.49	1.51±0.50	<0.001	-	-	-	-
3 Months	3.35±0.53	1.718±0.52	<0.001	0.26±0.44	<0.001	-	-
6 Months	3.23±0.26	2.2±0.51	<0.001	0.68±0.50	<0.001	0.11±0.53	<0.001

Statistically significant at p <0.05

Table 6. Comparison of Mean Values of Clinical Attachment at Baseline, 1 Month, 3 Months and 6 Months (Test group)

Time Interval	Mean± Sd	Difference From Baseline	P Value	Difference From 1 Month	P Value	Difference From 3 Month	P Value
Baseline	5.38±0.56	-	-	-	-	-	-
1 Month	3.23±0.53	2.15±0.51	<0.001	-	-	-	-
3 Months	2.73±0.73	2.65±0.75	<0.001	0.5±0.50	<0.001	-	-
6 Months	2.58±0.78	2.8±0.81	<0.001	0.65±0.57	<0.001	0.25±0.36	<0.001

Statistically significant at p <0.05

The prevalence of diabetes mellitus patients is more than 2 times high in patients with periodontitis than periodontally healthy patients (Kaur, 2012). Studies have stated that there is a positive result of scaling and root planing on the gingival tissues in controlled diabetic patients which is almost comparable to patients who are healthy. Local drug was used as an adjunct to get additional benefits of scaling and root planing. The present study was designed to evaluate the clinical efficacy of xanthan based chlorhexidine gel when used as an adjunct to scaling and root planing in known diabetic patients with good glycemic control. A total of 120 sites in 10 patients were enrolled in this study with Hb1Ac count between 6-8% and random blood sugar ≤200mg/dl. The selected patients had at least three interproximal sites showing a probing pocket depth of 5-8 mm. The sites were randomly divided into control and test groups. Controls were treated with scaling and root planing with placebo gel and test group with scaling and root planing +immediate insertion of chlorhexidine gel respectively. Both the groups were evaluated for clinical parameters of plaque index, gingival index, pocket depth and clinical attachment level at baseline, 1 month, 3 months and 6 months respectively. A control group was taken so as to be sure that the experiment was done under the standard conditions and were giving true results. At baseline the selected sites in each patient was stratified into 2 treatment groups. The split mouth study design with interproximal sites was selected for the insertion of chlorhexidine gel based on the assumption that:

- The variable host response could be negated.
- The oral hygiene maintained for both the sites will be the same.
- Interproximal sites are not easily cleaned as compared to facial and lingual surfaces.
- Interdental gingiva is more prone to infections.

The selected interproximal sites were at least one tooth apart in order to minimize the potential for interaction between the treatment areas.

This was done in accordance with the study by Salvi *et al.* (2002) and Azmak *et al.* (2002).The clinical parameters were recorded at baseline, prior to scaling and root planing as done by Soskolne *et al.* (1997).In the present study, all the clinical parameters were recorded at baseline, 1 month, 3 months and 6 months. The mean reduction in plaque index score from baseline to 1, 3 and 6 months was 1.29 mm, 1.64 mm and 1.63 mm respectively. The mean reduction in gingival index score from baseline to 1, 3 and 6 months was 1.37 mm, 1.72 mm and 1.67 mm respectively. The mean reduction in Hb1Ac count was also calculated and showed a decrease in the levels from a mean value of 7.2 to 7. Similar observations have been reported in the studies conducted by Dodwad *et al.* (2012), Ricardo *et al.* (2006) and Santos *et al.* (2009).The reduction in plaque and gingival scores from baseline could be due to the recording of these parameters before scaling and root planing at the baseline visit. The antiplaque and antibacterial role of chlorhexidine that may have leached out of the pockets may also have contributed to the clinical outcome. Whereas there was a slight amount of increase in the gingival and plaque index between 3-6 months. Although not statistically significant, this can be attributed to the fact that scaling and root planing was done only at baseline (Greenstein, 1986).Intragroup observations showed statistically significant reduction in probing depth from baseline to 1 month, 3 months and 6 months, in both the groups. The mean pocket depth reduction from baseline to 1 month, 3 months and 6 months was found to be 1.51 mm, 1.78 mm and 2.2 mm respectively for Group A and 2.18 mm, 2.71 mm and 2.96 mm respectively for Group B. The reduction in pocket depth, from 1 to 3 months and 3 to 6 months were also found to be statistically significant. The results are consistent with the findings of Lima *et al.* (2009), Cosyn *et al.* (2005), Soskolne *et al.* (1997), Salvi *et al.* (2002) and Heasman *et al.* (2001). Intergroup comparison shows that the treatment strategy, supplementing mechanical debridement by subgingival chlorhexidine insertion, provides significantly greater pocket depth reductions as compared with those obtained by scaling and root planing alone.

At the termination of the study, Group B showed an additional pocket depth reduction of 0.90 mm over the control group, which is statistically significant. This additional pocket depth reduction in Group B can be attributed to the bactericidal concentrations achieved, within day 1 at the selected sites and this higher concentration levels were maintained for two weeks thereafter. Therefore, enhanced healing may have occurred at the test sites, in the absence or following reduction of microbial load. These findings are supported by the studies conducted by Cosyn *et al.* (2005) and Rusu *et al.* (2005), Gupta *et al.* (2008), Chandra *et al.* (2011)and Verma *et al.* (2011). Verma *et al.* (2012)reported that the application of xanthan based chlorhexidine gel following SRP in the maintenance phase proved be beneficial in treatment of the chronic periodontitis in comparison to SRP alone.These results are in contrast to the studies conducted by Zofiropoulos *et al.* (1997)and Grisi *et al.* (2002). The reduction in the glycemic count was observed at the termination of the study but was non-significant clinically. This might be attributed to the fact that patients selected for the study had good glycemic control. However, Darre *et al.* (2008)and Kinane *et al.* (2011) confirmed that effective periodontal therapy in diabetic patients resulted in a significant reduction of HbA1c of 0.46% following scaling and root planing.

In the current study gain in attachment levels was observed in all the sites when compared with the pre-treatment values. The improvements were statistically significant in both the groups at 1, 3 and 6 months when compared to those at baseline. The mean clinical attachment gain from baseline 1 month, 3 months and 6 months were found to be 1.51 mm, 1.78 mm and 2.2 mm respectively for Group A, 2.15 mm, 2.65 mm and 2.8 mm respectively for Group B. Maximum gain in attachment level was observed in the test group when compared to the control sites. Similar findings were reported in studies by Unsal *et al.* (1994), Perinetti *et al.* (2004), Lima *et al.* (2009) and Verma *et al.* (2012). Most of the improvement occurred during the first month in Group A and B, with continued smaller improvements till the 6^{th} month. The overall improvement was better in Group B at all the intervals. Group B showed 0.65 mm more improvement in clinical attachment level than Group A, which was statistically significant. The reason for the not achieving optimal improvement in the attachment level in the test groups as compared to changes in pocket depth may be due to presence of gel during the stages of healing, which may have provided the mechanical interference or may be due to gingival recession as seen in twos of the cases. Similar effects were seen by Unsal *et al.* (1994) using gel in their study, Grisi *et al.* (2002) using PerioChip and Cosyn *et al.* (2005), using varnish. The reason for achieving almost similar results in the present study with controlled diabetic patients as compared to healthy individuals with periodontitis as seen in previous studies is because the host immune response in controlled diabetic patients is almost similar to that of a healthy individual. There was also an improvement of 12% in the Hb1Ac count of the patients post therapy.

Conclusion

The results from the present study suggest that the application of Xanthan based chlorhexidine gel when used as an adjunct to scaling and root planing is beneficial in treatment of chronic periodontitis and improving clinical parameters for 6 months duration in diabetic patients.

REFERENCES

Al-Mubarak S,CiancioS, Aljada A. *et al.* 2002. Comparative evaluation of adjunctive oral irrigation in diabetics. *J ClinPeriodontol,* 29 (4):295–300.

American Diabetes Association. Screening for type 2 diabetes. *Diabetes Care* 2000;23:20–23.

Azmak Z, Atilla G, Luoto, H. 2002. The effect of subgingival controlled release delivery of chlorhexidine chip on clinical parameters and matrix Metalloproteinase-8 levels in gingival crevicular fluid. *J Periodontol.,* 73;608-615.

Chandra C, Valavalkar N, Vandana KL. 2011. The comparative evaluation of xanthan gel with chlorhexidine (Chlosite) in smokers and non-smokers: A clinical and microbiological assessment. *J Indian SocPerio.,* 15:221–227.

Claffey N, Nylund K, Kiger R. 1990. Diagnostic predictability of scores of plaque, bleeding, suppuration and probing depth for probing attachment loss 3.5 years observation following initial periodontal therapy. *J ClinPeriodontol* , 17:108–114.

Cosyn J, Wyn I, Rouck TD. 2005. A chlorhexidine varnish implemented treatment strategy for chronic periodontitis. *J ClinPeriodontol,* 32:750–756.

Darre L, Vergnes JN, Gourdy P. *et al.* 2008. Efficacy of periodontal treatment on glycaemic control in diabetic patients: a meta-analysis of interventional studies. *Diabetes Metaolism.,* 34::497–506.

Dodwad V, Ahuja S, Kukreja B. 2012. Effect of locally delivered tetracycline hydrochloride as an adjunct to scaling and root planing on Hba1c, C-reactive protein, and lipid. *ContempClin Dent.,* 3:150–154.

Goodson JM. 1986. Pharmacokinetic principles controlling the efficacy of oral therapy. *JDent Res* 1989*;*68:1625–1632.

Greenstein G, Berman C, Jaffin R. Chlorhexidine-An adjunct to periodontal therapy. *J Periodontol.,* 57:370-377.

Greenstein G. 1987. Effects of subgingival irrigation on periodontal status*. J Periodontol,* 58;827–836.

Grisi DC, Salvador SL, Figueiredo LC. 2002. Effect of a controlled release chlorhexidine chip on clinical and microbiological parameters of periodontal syndrome. *J ClinPeriodontol.,* 29:875-881.

Gupta R, Pandit N, Aggarwal S, *et al.* 2008. Comparative evaluation of subgingivally delivered 10% doxycycline hyclate and xanthan-based chlorhexidine gels in the treatment of chronic periodontitis. *J. Contemp Dent Pract.,* 9:25-32.

Harris MI,Klein R, Welbornt A, *et al.* 1992. Onset of NIDDM occurs at least 4–7 yr before clinical diagnosis. *Diabetes Care.,* 15:815–819.

Heasman PA, Heasman L, Stacey F. 2001. Local delivery of chlorhexidine gluconate (PerioChip) in periodontal maintainence patients. *J ClinPeriodontol.,* 28:90-95.

Jeffcoat MK,Bray KS, Ciancio SG, *et al.* 1998. Adjunctive use of a subgingival controlled release chlorhexidine chip reduces probing depth and improves attachment level compared with scaling and root planning alone. *J Periodontol.,* 69:989–997.

Kaur H, Jain S, Bansal S. 2012. Minimal invasive chair side procedure for the estimation of glucose level using gingival crevicular blood. *Indian Journal of Dental Sciences,* 4:43-46.

Khader YS, Al-Zu'bi BN, Judeh A, Rayyan M. 2006. Screening for type 2 diabetes mellitus using gingival

crevicular blood. *International Journal of Dental Hygiene,* 4:179–182.

Kinane DF, Preshaw PM, Loos BG. 2011. Host-response: understanding the cellular and molecular mechanisms of host-microbial interactions—Consensus of the Seventh European Workshop on Periodontology. . *J ClinPeriodontol.,* 38:44–48.

Lima A, Cury C, Palioto D, Duro A, Silva R, Wolff L. 2004. Therapy with adjunctive doxycycline local delivery in patients with type 1 diabetes mellitus and periodontitis. *J ClinPeriodontol.,* 31:648–653.

Martorelli de Lima AF, Cury CC, Palioto DB, *et al.* 2004. Therapy with adjunctive doxycycline local delivery in patients with type 1 diabetes mellitus and periodontitis. *J ClinPeriodontol.,* 31:648–653.

Matsumoto S, Ogawa H, Soda S, *et al.* 2009. Effect of antimicrobial periodontal treatment and maintenance on serum adiponectin in Type 2 Diabetes Mellitus. *J ClinPeriodontol.,* 36:142–148.

Perinetti G, Paolantonio M, Cordella, C. *et al.* 2004. Clinical and microbiological effects of subgingival administration of two active gels on persistent pockets of chronic periodontitis patients. *J ClinPeriodontol.*31: 82-285.

Ramjford S, Caffesse R, Morrison E. 1987. Four modalities of periodontal treatment compared over five years. *J ClinPeriodontol.*14:445–452.

Reip B, Purucker P, Bernimoulin JP. 1999. Repeated local metronidazole therapy as adjunct to scaling and root planing in maintenance patients. *J ClinPeriodontol.*26:710–715.

Ricardo FA, Ana N, Bascones A. 2006. A clinical and metabolic changes after conventional treatment of type 2 diabetic patients with chronic periodontitis. *J Periodontol.,* 77;591-598.

Rusu, D, Benta A, Necker A. 2005. Non-surgical periodontal therapy using a novel chlorhexidine based xanthan gel: a split mouth study.*IntPosterJ Dent Oral Med.,*7:286.

Salvi GE, Mombelli A, Mayfield L. 2002. Local antimicrobial therapy after initial periodontal treatment. *J ClinPeriodontol.*29:540-550.

Somayaji EF, Jariwala U, Jayachandran P. 2002. Evaluation of antimicrobial efficacy and release pattern of tetracycline and metronidazole using a local delivery system. *J Periodontol.*69:409–413.

Soskolne WA, Heasman PA, Stabholz A. 1997. Sustained local delivery of chlorhexidine in treatment of periodontitis: A multi center study.*J Periodontol.,* 68:32-38.

Unsal E, Akkaya M, Walsh TF. 1994. Influence of a single application of subgingival chlorhexidine gel or tetracycline paste on the clinical parameters of adult Periodontitis patients. *J ClinPeriodontol.,* 21:351-355.

Vanessa RS, Jadson AL, Adriana CM, Maria BBM, *et al.* 2009. Effectiveness of full-mouth and partial-mouth scaling and root planing in treating chronic periodontitis in subjects with type 2 Diabetes. *J Periodontol.,* 80:1237-1245.

Verma A, Sanghi S Grover D, *et al.* 2012. Effect of insertion of xanthan-based chlorhexidine gel in the maintenance phase following the treatment of chronic periodontitis. *J Indian SocPerio.,*16:381–385.

Verma A, Sanghi S, Aggarwal S. *et al.* 2011. Effect of insertion of xanthan based chlorhexidine gel when used as an adjunct to SRP in the treatment of chronic periodontitis. *Indian Journal of Dental Specialities and Research,* 29:175-178.

Zafiropoulus GGK, Kalkakis G, Ciancio S. 1997. Chlorhexidine sustained release dosage system for the treatment of periodontal disease. . *J Periodontol.,* 68:419-421.

****