Correlation of serum C - reactive protein with clinical parameters in diabetic patients having chronic periodontitis before and after treatment

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Background and Objectives: Chronic periodontitis is an infectious disease characterized by inflammation within the supporting tissues of the teeth, progressive attachment loss, and bone loss. C-reactive protein, are acute phase proteins monitored as a marker of inflammatory status. The present study was performed to determine whether presence of periodontitis and non-surgical periodontal therapy could influence the serum levels of CRP in type II diabetes mellitus disease patients.

Materials and methods: A total of 60 subjects were selected for study. Venous blood samples were taken at base line and 3 months after non-surgical periodontal therapy for the type II diabetic patients with the clinical signs of chronic periodontitis (group I, n=30) and patients with chronic periodontitis having no diabetic mellitus (group II, n=30) to estimate serum C-reactive protein (CRP) level. Clinical parameters such as glycated hemoglobin (HBA1c ≥ 6.5%), random blood sugar (RBS) and clinical periodontal parameters (Gingival Index, Probing pocket depth, Clinical attachment level and Plaque Index) for the group I and II were measured.

Results: at base line, type II diabetes mellitus patients group I (T2DMCP) were compared to the non-diabetic patients with chronic periodontitis group II (NDMCP) based on the clinical periodontal parameters (GI,PPD, CAL and PI)scores and CRP level, HBA1c , (RBS) with the 3months after treatment. All the result was statically significant except for the GI and PPD scores at base line which was statically non-significant. The result also shows significant decrease in all the periodontal parameters and CRP level at base line as compared to 3months after treatment when group I was compared to group II while there was no significant change in the CRP level in group I and HBA1c in group II at base line as compared to 3months treatment.

Conclusion: The present study concludes that total CRP level were decreased after non-surgical periodontal therapy.

Keywords: Non-surgical periodontal therapy, diabetes mellitus, CRP level, clinical parameters, chronic periodontitis.

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Introduction

Chronic periodontitis (CP) is the most prevalent form of periodontitis. It shows a slowly progressing pattern. However, in the presence of precipitating factors such as diabetes mellitus, smoking or stress that may modify the host response to plaque accumulation, the pattern of disease progression may become more aggressive.[1] Despite its old name, adult periodontitis or chronic adult periodontitis, CP is not only limited to adults but it can also occur in children and adolescents in response to chronic plaque and calculus accumulation. So it can occur at any age.[2]

The chronic metabolic disorder diabetes mellitus is a serious global health problem of epidemic magnitude. Type 2 (noninsulin dependent or adult-onset) diabetes mellitus, is characterized by de-fective insulin secretion and action.[3,4] It doubles the incidence and

severity of chronic periodontitis,[5] and conversely, the presence of periodontitis may also negatively impact the cardio-vascular risk status in type 2 diabetes mellitus (T2DM) patients.[6] Furthermore, as compared to those without periodontitis, periodontitis patients have elevated levels of resting plasma glucose.[7,8]

Several studies have demonstrated an inflated inflammatory response in the monocytes of diabetic patients in response to lipopolysac-charides from gram-negative periodontal pathogens. This leads to the release of large amounts of inflammatory mediators and proin-flammatory cytokines such as IL-1β and TNF-α.[9]

A possible reduction in the severity of systemic diseases follow-ing periodontal therapy due to the reduction in the inflammatory burden, in both systemically compromised patients as well as otherwise healthy individuals, has been reported by many.[10,11] CRP levels in gingival crevicular fluid (GCF) and serum increased proportionately with the severity of periodontal diseases,[12] and studies have also demonstrated in-creased serum CRP levels caused by a moderate inflammatory stimulus after periodontal therapy.[13]

Diagnosis and initial treatment of periodontal disease are usually based on certain clinical parameter such as plaque index (PI), periodontal pocket depth (PPD) and clinical attachment loss (CAL).[14] Despite of their ease to use, these parameters fail to provide a real-time assessment of the disease and prognostic value.[15] Therefore; CRP is used as one of the markers of choice in monitoring the acute phase response because it increases to a relatively high concentration compared to basal concentration.[16]

Thus, the aim of the present study is to compare the level of serum CRP in type 2 diabetes mellitus with chronic periodontitis (T2DM-CP) group I and non-diabetic patient with chronic periodontitis group II (NDM-CP) , and to evaluate the effect of non-surgical periodontal therapy on serum CRP level in both groups and to correlate the level of CRP in serum with clinical parameters in both group I (T2DM-CP) and group II (NDM-CP) before and after treatment.

Materials and methods
Source of data. All subjects were recruited between April 2017 and october 2017, the study was carried out in Department of Periodontics, College of Dentistry, Hawler Medical University, and diabetes center (Shaheed Layla Qassim). The subjects were divided into two groups. Group I included 30 patients with type II diabetic mellitus (having the clinical signs of chronic periodontitis) and group II 30 patients with chronic periodontitis having no diabetic mellitus . Subjects suffering from any systemic diseases (other than diabetes mellitus for group I), pregnant women, lactating mothers, undergoing any periodontal therapy, smokers, taking antibiotic or having taken antibiotics three months prior to the research were excluded. The inclusion criteria in this study were as follows: patients chosen have at least 30% or more of the teeth having greater than or equal to 4mm probing pocket depth, clinical attachment level more than or equal 3mm, age 30-55years 17, both males and females 18   In addition the inclusion criteria for the (group I) in this study were as follows: The glycated haemoglobin (HbA1c) level was measured based on the results participants were diagnosed with type 2 DM if they had HbA1c ≥ 6.5% at base line.The study was approved by Ethical Committee of College of Dentistry/Hawler Medical University. Informed written consent was obtained from all subjects who were selected for the study.
Study Design:

After taking informed consent from the subjects, blood sample was taken under aseptic condition into EDTA tube (K3EDTA, China) and then was transferred for CRP level, RBS, HBAc estimation. Estimation was done using (COBAS C 111, GERMANY). For all the subjects complete supragingival, subgingival scaling and root surface debridment were performed using ultrasonic scalers (NSK varios 350, JAPAN) and Gracey curettes (MEDESY, Italy) in one visit. Good oral hygiene was given for all patients.

For all subjects with chronic periodontitis, the following indices were recorded before scaling and root planing:
Gingival index (Loe and Silness, 1963)
Score 0: Normal gingiva

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Score 1: Mild inflammation-slight change in color, slight edema. No bleeding on probing

Score 2: Moderate inflammation-redness, edema, and glazing. Bleeding on probing.

Score 3: Severe inflammation-marked redness and edema, ulceration. The tendency toward spontaneous bleeding.
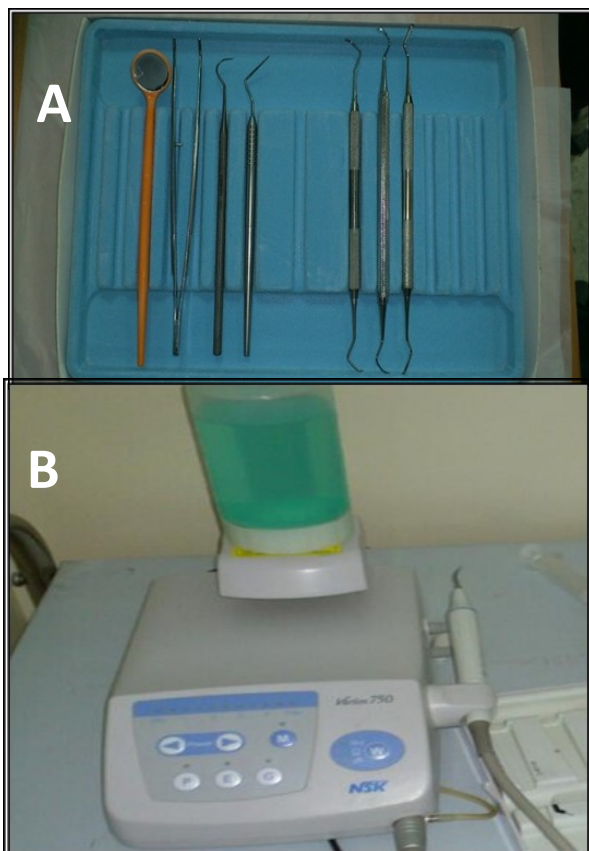

Figure 1: Periodontal instruments A. Disposable mirror, periodontal probe, Sickle scaler, and curette B. Ultrasonic device

Plaque Index (Silness and Loe, 1964)
Score 0: No plaque
Score 1: A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface.
Score 2: Moderate accumulation of soft deposits within the gingival pocket, or the tooth and gingival margin which can be seen with the naked eye.
Score 3: Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.
Probing pocket depth was assessed by using the calibrated periodontal probe UNC- 15 (MEDESY, Italy).[18] The measurement was

taken from the gingival margin to the base of pocket at four surfaces of each tooth. No pressure was used; the probe was allowed to fall by its own weight.[19]

Clinical attachment level was measured by a calibrated periodontal probe (UNC) from cementoenamel junction (CEJ) to the base of the pocket.[19]

Severity of PD and CAL were estimated (total PD / CAL divided by affected surfaces).[20]

The following indices were recorded at base line and 3 months after non-surgical periodontal therapy for the group I and II which was done by two examiners. The sites for measurement were (mid buccal or labial, mesiolabial or buccal, distolabial or buccal, and mid palatal or lingual).

The following indices were recorded at base line and 3 months after non-surgical periodontal therapy for the group I and II.

Blood Sample Analysis. 2 ml of venous blood sample was taken from the subjects by using disposable syringe (Morningside Pharmaceuticals Ltd, UK) and the blood sample was taken at base line before non-surgical periodontal therapy and 3 months after treatment for non-diabetic chronic periodontits patients and patient having diabetes mellitus with chronic periodontitis. The blood sample were analyzed using (COBAS C 111, GERMANY) in private Razen Laboratory.

Figure 2

Statistical analysis was performed by descriptive and analytical statistical methods using the standard program for data processing (MS excel).

Changes in CRP level, RBS, HBA1c,

Gingival Index, Probing pocket depth, Clinical attachment level and Plaque Index following periodontal therapy between and within group I and II can be seen. All data were expressed as mean ± standard deviation (SD). Differences in mean values between groups were compared using Paired t-test. Results were considered significant, if P value ≤ 0.05.

Demographical data	
Gender (group I)	12female 18 male
Gender (group II)	13 female and 17 male
Age (group I and II)	30-55years
Mean age (group I)	**38 ± 3.53**
Mean age (group II)	**39± 4.900**

Results

The mean age of the study were (38 ± 3.53, 39± 4.900) for type II diabetic patients with chronic periodontitis and non-diabetic patients with chronic periodontitis subjects respectively.

Between groups (T2DMCP and NDCP) comparison of the periodontal parameters (GI, PPD, CAL, PI) and CRP level, HBA1C, RBS

The result of the present study shows a non-significant decrease of GI and PPD index at base line P value (0.2, 0.5) respectively as compared with the 3 months after treatment which is significantly decreased P value (0.0001, 0.01) respectively. Our study also shows a statically significant result in CRP level, RBS, HBA1c at base line and 3 months after treatment between group l and II P value (0.04, 0.01), (0.001, 0.001), (0.001, 0.001) respectively. Mean, standard, and T. test for clinical parameters and CRP level, HBA1C,

Table 1: Between groups comparison of Clinical periodontal parameters (GI, PPDL, CAL and PI) at base line and 3 months after treatment (NDCP) (by t--test)

	Base line			3 Months		
Parameters	**T2DMCP (n=30)**	**NDCP (n=30)**	***p*-value**	**T2DMCP (n=30)**	**NDCP (n=30)**	***p*-value**
GI	1.34±0.57	1.65±0.54	0.2	0.88±0.24	1.31±0.48	0.00**
PPD(mm)	5.01±0.47	4.93±0.26	0.5	3.20±0.56	3.7±0.46	0.01*
CAL(mm)	3.76+0.78	4.35±0.85	0.05*	3.05±0.77	2.38±0.92	0.04*
PI	1.73±0.49	2.14±0.54	0.03*	1.37±0.49	1.76±0.53	0.04*

Table 2: between groups Comparison of (CRP level, HBA1c and RBS) at base line and 3 months after treatment (by t--test)

	Base line			3 Months		
Parameters	**T2DMCP (n=30)**	**NDMCP (n=30)**	***p*-value**	**T2DMCP (n=30)**	**NDCP (n=30)**	***p*-value**
CRP	2.51±1.12	1.87±0.80	0.04*	2.09±1.06	1.24±0.46	0.01*
RBS(mg/dl)	258.92±58.07	98.97±3.17	0.001*	181.68±30.52	98.42±3.95	0.001*
HBA1c (%)	7.98±1.28	5.56±0.47	0.001*	7.29±1.03	5.35±0.41	0.001*

RBS in group I and II subjects are shown in table below.

Within groups (T2DMCP and NDCP) comparison of the periodontal parameters (GI, PPD, CAL, PI) and CRP level, HBA1C, RBS.

The present study shows a significant decrease in the GI and PI index at base line as compared to 3months after treatment between group l and II with the p value (0.01, 0.04) , (0.03, 0.03) respectively. In addition, there was a highly statically significant decrease in PPD index at base line as compared to 3 months after treatment between group l and II with the p value (0.0001, 0.0001) respectively. The result also shows a highly statically significant decrease in the CAL at base line as compared to 3months treatment only in group II with p value (0.0001) as compared to group l which is only significantly decreased at base line as compared to treatment with p value(0.01). Our result also shows a non-statically significant decrease of CRP level at base line as compared to 3 months after treatment in group l p value (0.15), which is inconsistent to the result of group II which is significantly decreased at base line as compared to 3 months treatment p value (0.01). The result also shows statically significant decrease in RBS and HBA1C in group I and II at base line as compared to 3 months after treatment except for HBA1C in group II and CRP in group I which was non-significant p value (0.02, 0.01), (0.01), (0.88) and (0.15) respectively. Mean, standard, and T. test for clinical parameters and CRP level, HBA1C, RBS in group I and II subjects are shown in table below.

Table 3: Within groups comparison of clinical periodontal parameters (GI, PPDL, CAL and PI) at base line and 3 months after treatment (by t--test).

Parameters	T2DMCP			NDCP		
	Base line (n=30)	3 months (n=30)	*p*-value	Base line (n=30)	3 months (n=30)	*p*-value
CRP	2.51±1.12	2.09±1.06	0.15	1.87±0.80	1.24±0.46	0.01*
RBS(mg/dl)	218.25 0.19	63.362 0.19	0.02	85.6 16.1	81.21 14.31	0.01
HBA1c (%)	0.98 0.19	1.47 0.49	0.01	0.11 0.08	0.06 0.06	0.88

Table 4: Within groups comparison of (CRP level, HBA1c and RBS) at base line and 3 months after treatment (by t--test) .

Parameters	T2DMCP			NDCP		
	Base line (n=30)	3 months (n=30)	*p*-value	Base line (n=30)	3 months (n=30)	*p*-value
CRP	2.51±1.12	2.09±1.06	0.15	1.87±0.80	1.24±0.46	0.01*
RBS(mg/dl)	218.25 0.19	63.362 0.19	0.02	85.6 16.1	81.21 14.31	0.01
HBA1c (%)	0.98 0.19	1.47 0.49	0.01	0.11 0.08	0.06 0.06	0.88

*Significant ** Highly significant

Discussion

Recent evidence shows that patients with periodontitis present with increased systemic inflammation, as indicated by raised serum levels of various inflammatory markers when compared with those in unaffected control populations.[21] Further, the association between periodontal disease and diabetes has also been explored in several studies, and it is widely accepted that more prevalent and severe periodontal disease is observed in persons with diabetes than in non-diabetic persons.

The two-way relationship of periodontal disease with diabetes mellitus is evident with the improvement in metabolic control by the resolution of periodontal inflammation and infection.[22] Systemic inflammatory markers such as CRP, which is an acute phase protein, closely follow the course of inflammation, and hence are used as measure for many disease processes. The available literature has also reported that T2DM patients with chronic periodontitis exhibit clinical improvement after non-surgical periodontal therapy.

The mean value for GI was significantly higher in group I (T2DM-CP) as compared to group II (NDMCP), indicating that in spite of having poor plaque control habits, group I (NDM-CP) patients showed less PPD, CAL, as compared to group II (T2DM-CP). This indicates an exaggerated destructive response to dental plaque microorganisms in chronic periodontitis patients with T2DM.[23]

Patients with T2DM ,[24] in accordance with the present study, Kardesler et al.[25] also demonstrated a significant reduction in periodontal parameters (PI, GI, CAL) at 3 months after NSPT. PPD levels were highly significantly decreased at 3 months after NSPT[25] between baseline and 3 months.

Mean PPD and mean CAL are a pretty accu-rate ways of evaluating periodontal disease severity and these values were correlated with CRP levels to find any relationship. After analyzing results have shown that higher values of CRP are found as periodontal disease severity increase. This finding could be expected because several reports have indicated how periodontal disease acts as any other chronic infection or inflammatory process in the body. Periodontitis produces bacteraemias[26] and the host responds with elevated levels of interleukin-6 (IL-6), known to induce hepatocytes to produce CRP and other acute-phase proteins and procoagulant mediators.[27] Thus, it is not surprising that high levels of CRP have been observed in peripheral blood samples in patients with diabetes and severe periodontitis.

However, some studies have reported on the impact of periodontal therapy on CRP levels in serum, in T2DM patients. Chen et al.[28] reported effective improvement in periodontal and circulating inflammatory status after non-surgical periodontal treatment (NSPT) in patients with T2DM. This study was primarily performed to evaluate the effects of NSPT on the serum CRP level in patients with T2DM and chronic periodontitis and control one.

Non-surgical periodontal treatment performed in this clinical study was very effective in reducing periodontal inflammation and these results has been report previ-ously.[28] This periodontal improvement was followed by a reduction on CRP values in significant level. These data agree with reports that diabetes is associated with increased CRP[29] and suggest that periodontitis further augments the CRP levels, when T2DM and periodontitis coexist.

An association between serum CRP and periodontitis has been reported in T2DM patients,[30] and periodontal therapy reduces serum CRP in T2DM patients.[31] Chen et al.[28] also reported a gradual and significant decrease in serum CRP levels in diabetes mellitus patients with chronic periodontitis from baseline to 3 months after NSPT, which is comparable to the present study. Analogous to the present study, in a control group (NDM-CP), Kamil et al.[32] Ide et al.[33] and Yamazaki et al. [34] all reported that NSPT resulted in a significant reduction in serum CRP levels in periodontitis patients from baseline to 3 months. We observed a statistically significant decrease overall in serum CRP levels between base line and at 3 months after NSPT between group I and II (NDMCP) (P= 0.01 and 0.04 , respectively). It is well established that T2DM patients have a significantly elevated risk of periodontitis; and periodontitis may exert a

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converse, negative impact upon cardio-metabolic risk status in type 2 diabetic patients. In chronic periodontitis patients with diabetes mellitus, periodontal destruction occurs due to an exaggerated inflammatory response such as hyperactive neutrophils due to reactive oxygen species production, because of increased oxidative stress and in-creased insulin resistance.[35] Studies have shown that insulin resistance is increased in the diabetic patient under the influence of local factors, and hence decreases the healing response of tissue. Here, it can be hypothesized that, after NSPT, local factors are re-moved, leading to a decrease in insulin resistance with a decrease in proinflammatory cytokines (e.g., TNF-α, IL-6) associated with local factors, thus improving insulin sensitivity, ultimately leading to bet-ter glycemic control (HbA1c),[36] and in turn, promoting a better wound healing capacity of tissues in T2DM patients. This hypothesis was further validated by a greater decrease in CRP levels (an acute inflammatory marker) in diabetic as compared to nondiabetic patients. Our results showed that CRP levels in serum were higher in diabetic chronic periodontitis patients as compared to nondiabetic chronic periodontitis patients. Further, there was a significant improvement in both the groups, but better improvement was observed in diabetic chronic periodontitis pa-tients.

Conclusion

Within the limitations of the present study, it can be concluded that CRP levels in serum were higher in T2DM-CP patients as compared to NDM-CP patients. NSPT results in statistically significant improvement in periodontal health parame-ters (PI, GI, PPD, CAL), CRP levels in both group I (T2DM-CP) and group II (NDM-CP).

Acknowledgement

Conflicts of interest

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