Effect of diabetes mellitus on periodontal health status, salivary flow rate and salivary pH in patients with chronic periodontitis

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ABSTRACT

Background: Diabetes and periodontitis are considered as chronic diseases with a bidirectional relationship between them. This study aimed to determine and compare the severity of periodontal health status and salivary parameters in diabetic and non-diabetic patients with chronic periodontitis.

Materials and Methods: Seventy participants were enrolled in this study. The subjects were divided into three groups: Group I: 25 patients had type 2 diabetes mellitus with chronic periodontitis, Group 2: 25 patients had chronic periodontitis and with no history of any systemic diseases, Group 3: 20 subjects had healthy periodontium and were systemically healthy. Unstimulated whole saliva was collected for measurement of salivary flow rate and pH. All periodontal parameters (plaque index, gingival index, probing pocket depth and clinical attachment level) were recorded for each patient.

Results: The results showed that all clinical periodontal parameters were highest in group 1 in comparison with groups 2 and 3. Comparisons between pairs of groups revealed significant differences between groups 1 and 2 for plaque index, gingival index, probing pocket depth and clinical attachment level, and highly significant differences for plaque index, gingival index between groups 2 and 3, and between groups 1 and 3. The salivary flow rate and pH were lower in group 1 compared to groups 2 and 3. Inter-group comparisons of salivary parameters also revealed a significant difference between groups 1 and 2, with a non-significant difference between groups 2 and 3.

Conclusion: Type 2 diabetic patients have significantly lower salivary flow rate, pH and present with advanced periodontal destruction compared to healthy patients.

Key word: Saliva; periodontitis; diabetes mellitus. **(Received: 29/12/2019; Accepted:1/2/2020)**

INDRODUCTION

Periodontal diseases are inflammatory diseases caused by bacterial infection of the supporting tissues around the teeth.[(1)]Oral microbiota (dental plaque) causes initiation and proliferation of periodontal disease, because of the interaction between these microbiota and immune defenses leading to inflammation and disease occurrences. [(2)]

Diabetes mellitus includes a series of metabolic disorders distinguished by defects in insulin action, secretion or both leading to a hyperglycemic state. [(3)] There are many oral manifestations seen in diabetic patients such as xerostomia, gingivitis, periodontitis, multiple periodontal abscess, dental caries, with burning mouth syndrome.[(4-6)] Diabetes is counted as a risk factor for enhancing periodontal disease. [(7)] Chronic periodontitis (CP) was considered as a complication of diabetes infections of tongue, and oral mucosa-like chronic atrophic candidiasis. [(8)]

A bidirectional cyclical relationship has been noticed between diabetes mellitus and periodontitis. [(8)] Furthermore, in several studies the incidence, prevalence and severity of chronic periodontitis (CP) were found to be higher in the presence of diabetes. [(9)]

Diabetes mellitus manifests in altering the salivary composition and its functions. Change in oral environment initiates pathogenic bacteria, damaging hard and soft tissues of the oral cavity leading to an increased cariogenic activity and periodontal lesions. [(10)]

The salivary glands are affected directly or indirectly by type 2 diabetes mellitus (T2DM). [(11)] Diabetes-associated autonomic neuropathies, microvascular changes, hormonal imbalances or a combination of these are responsible for salivary hypo function and dehydration in diabetics. [(12)]

Saliva-based diagnostics are not limited to oral diseases but have been extended to the entire physiologic system, as most compounds found in the blood are also present in the saliva. Accordingly, saliva can reflect the physiologic state of the body including emotional, endocrinal, nutritional, and metabolic variations, and acts as a source for monitoring oral and systemic health.[(13)] This study aimed to determine and compare the severity of periodontal health status and salivary parameters in diabetic and non-diabetics patients with chronic periodontitis.

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MATERIALS AND METHODS

Total samples were composed of 70 males with age range (35-55) years old, who were carefully informed about the aim of the investigation and were free to accept or refuse to be examined; all of them were selected from subjects attending private dental clinics.

The subjects were divided into three groups:

1. Group 1: 25 males with type 2 diabetes mellitus and chronic periodontitis (HbA1c >7%) had received oral hypoglycemic medication.
2. Group 2: 25 males with chronic periodontitis and no history of any systemic diseases. CP in patients was defined as the presence of at least four sites with PPD ≥ 4 mm and clinical attachment loss of (1-2) mm or greater. [14]
3. Group 3: 20 males with healthy periodontium and systemically healthy.

All the individuals had body mass index (BMI) levels ranging between 18.5 kg/m² - 24.9 kg/m².

Exclusion criteria included participants who were diagnosed with Sjögren's syndrome, rheumatoid arthritis or HIV, a participant who is on antihypertensive, antihistamines, antidepressants or antipsychotic medications; a participant who had head and neck radiation therapy and smoking or alcohol drinking.

Clinical periodontal parameters included plaque index (PL.I) [15], gingival index (G.I) [16], probing pocket depth (PPD) and clinical attachment level (CAL).

The unstimulated salivary samples were collected from all participants under standard conditions. [17] The subject should not eat or drink except having water one hour before the collection of saliva. The subject was asked to rinse his mouth thoroughly with water to insure the removal of any possible debris or contaminating materials and waiting (1-2) minute for water clearance.

When resting saliva is collected, the subject is asked to sit in a relaxed position with elbows resting on knee and head hanging down between the arms. The lips are only slightly open and the subject lets the saliva drool passively over the lower lip into the test tube. Saliva should not be spat into the test tube. Saliva was collected between 9-12 am and the collection period was 5 minutes.

Salivary pH was then measured using the pH indicating paper. The indicator strip was dipped in the saliva for 30 s and the color on the strip was compared with the standard color chart provided by the manufacturer.

Statistical analyses: The study variables were statistically analyzed by using mean, standard deviation, and student t-test, at a level of significance of $p < 0.05$.

RESULTS

The descriptive statistics for PL.I and G.I are shown in Table (1). It was clearly shown that the means of PL.I and G.I were elevated in group 1 compared with groups 2 and 3.

Inter- group comparison of PL,I and G.I using student t-test revealed a significant difference between group I and group 2 and there was high significant difference between group I and group 3, as well as between group 2 and group 3 as shown in Table (2).

Table (3) shows the descriptive statistics for PPD and CAL for group 1 and group 2. The mean was elevated in group 1 compared with group 2 with significant difference as shown in Table (4).

The descriptive statistics for SFR and pH is shown in Table (5). It was clearly shown that the means were lower in group 1 compared with groups 2 and 3.

Inter- group comparison of SFR using student t-test revealed a high significant difference between group 1 and group 2 and between group 1 and group 3 but there was no significant difference between group 2 and group 3 as shown in Table (6).

Inter- group comparison of pH using student t-test revealed a high significant difference between group I and group 2 and between group 1 and group 3 and there was significant difference between group 2and group 3 as shown in Table (6).

Table (1): Descriptive statistics (mean ±SD) of plaque and gingival index in each group.

Statistic	PL.I			G.I		
	G1	G2	G3	G1	G2	G3
Mean	2.42	2.04	0.08	2.50	1.75	0.08
SD±	0.21	0.32	0.13	0.38	0.41	0.01

Table (2): Inter group comparison of mean of plaque and gingival indices with significant difference between groups.

Groups	PL.I			G.I		
	t-test	P-value	Sig	t-test	P-value	Sig
G1 & G2	2.524	0.013	S	3.236	0.025	S
G1 & G3	6.535	0.001	HS	5.316	0.001	HS
G2 & G3	7.188	0.00	HS	6.615	0.000	HS

Table (3): Descriptive statistics (mean ±SD) of PPD and CAL in each group.

Statistic	PPD		CAL	
	G 1	G2	G1	G2
Mean	5.28	4.78	5.46	4.82
SD±	0.42	0.23	0.27	0.35

Table (4): Inter group comparison of mean of PPD and CAL between G1 & G2.

Groups	PPD			CAL		
	t-test	P-value	Sig	t-test	P-value	Sig
G1 & G2	2.78	0.02	S	2.05	0.03	S

Table (5): Descriptive statistics (mean ±SD) of salivary flow rate and salivary pH in control and test group.

Groups	SFR			pH		
	t-test	P-value	Sig	t-test	P-value	Sig
G1 & G2	7.809	0.000	HS	6.147	0.000	HS
G1 & G3	5.914	0.001	HS	4.198	0.001	HS
G2 & G3	0.965	0.743	NS	2.132	0.040	S

Table (6): Inter group comparison of mean of salivary flow rate and salivary pH between groups.

Statistic	Salivary flow rate (ml/min)			pH		
	G1	G2	G3	G1	G2	G3
Mean	0.61	0.67	0.69	6.12	6.82	7.14
SD±	0.11	0.03	0.41	0.12	0.16	0.27

DISCUSION

Result outcomes revealed a significant difference in PL.I between group I (Diabetic patients with chronic periodontitis) and group 2 (systemically healthy patients with chronic periodontitis) and high significant difference between group I and group 3 (systemically healthy patients with healthy periodontium), as well as between group 2 and group 3.These were in agreement with the results of studies [18-21] which found T2 diabetic patients had more sites with plaque than did non-diabetics.

But this study disagrees with other studies which [22,23] found that there was a non-significant difference in PLI among controlled, uncontrolled T2 diabetics and non-diabetics.

These findings underline the fact that patients with diabetes tend to be systemically compromised and that their oral environment is also compromised due to the reduction in the buffering capacity and volume of their saliva, increased salivary viscosity and the change in bacterial flora. [24]

Significant differences were found in G.I between group 1 and group 2, as well as, a high significant difference found between group 2 and group 3 and between group 1 and group 3.

So our results were in agreement with other studies [19,25] who found that there is a significant difference in gingival health between controlled and uncontrolled T2 diabetics, as well as, agreed with studies who found that there is a significant difference between (T2 diabetic and non-diabetic patients) with PD. [18,26]

Our results disagreed with study who found that there is a non-significant difference in GI between controlled and uncontrolled T2 diabetic patients. [27]

Diabetes is often associated with increased gingival inflammation in response to bacterial plaque. This response may be related to the level of glycemic control, thus subjects with poorly controlled DM have significantly increased inflammation. The inflammatory reactions are intensified during poor metabolic control, as the same amount of plaque causes more gingival bleeding in poorly controlled subjects compared to well control subjects.

Regarding the PPD, the present study clarified that the statistical difference between group 1 and group 2 was significant. This result was in acceptance with other studies, [28-31] while in disagreement with other studies [21, 23] which found non-significant variance in PPD between T2DM and non-diabetic patients. The DM causes increase in the production of proinflammatory cytokines like IL-6 by human gingival fibroblasts when compared to non-diabetic. [32]

When the severity of hyperglycemia rises, the periodontal inflammatory response also rise. [30] So, the periodontal parameters became worse in hyperglycemia than in normoglycemic patients. [31]

The results of comparison of CAL demonstrated a significant difference between group 1 and 2. This was in agreement with other studies [28,29,33] who reported that CAL was higher with a significant difference in patients with T2DM compared to non-diabetic patients with CP. These findings in disagreement with other results. [21]

Raising in CAL reported to be associated with high level of glycemic control. [8] The diabetes has been associated with reduction in neutrophils functions (adherence, chemotaxis and phagocytosis) this will lead to more pathogen's proliferation and more periodontal tissue inflammation, so individuals with diabetes have higher incidence, prevalence and severity of periodontitis when compared to non-diabetics. [34]

The results of this study showed a significantly reduced salivary flow rates in diabetic patients when compared with non-diabetic individuals. This result is also supported by findings from different studies. (35-37)

Salivary flow rate was significantly diminished in diabetics as compared to that in non-diabetics can be explained that the thirst and dry mouth characteristic of diabetics was related to the poor glycaemic control in diabetics, which in turn, was associated with increased diuresis and fluid loss.

The present study demonstrated that when the patients with diabetics were compared with the patients without diabetes, diabetic patients had decreased salivary pH values. This result was in agreement with other studies. (38-40)

This causes changes in the metabolic processes due to increased glucose levels, resulting in a more acidic environment and thus associated with periodontitis. The effect could be secondary to decreased salivary flow rates and pH value that leads a series of plaque risk factors especially if the disease is inadequately controlled and uncontrolled. (41)

CONCLUSION

Type 2 diabetic patients had higher destruction in periodontal tissue and significantly lower salivary flow rate, pH than the healthy population.

Conflict of interest: None.

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الخلاصه

الخلفيه: يعتبر مرض السكري والنساع من الامراض المزمنه وتوجد علاقه ثناثيه بينهما.

أهداف الدراسة: هو تقيم ومقارنه الشده في الحالة الصحية للثة لمجموعات الدراسة لمرضى السكري من النوع الثاني وغير المصابين بالسكري وكليهما لديهم نساغ مزمن وكذلك كميه تدفق اللعاب وحموضيته لدى المجموعتين.

المواد والطرق: التحق سبعون شخص في الدراسة مع الفئة العمرية من 35-55 وكانوا ذكور فقط. تم تقسيم الاشخاص الى ثلاث مجموعات,المجموعة الاولى تتكون من 25 مريضا مع السكري والمجموعه الثانيه تتكون من 25 مريضا غير مصاب بالسكري، كل منهم لديه نساغ مزمن، والمجموعة الثالثه تتكون 20 شخص اصحاء واللثة لديهم صحية، كمجموعة ضابطة. مؤشرات ماحول الاسنان السريرية بما في ذلك مؤشرالصفيحة الجرثومية، مؤشرالتهاب اللثة، عمق جيوب اللثة ومستوى الانسجة الرابطة سريريا. تم جمع عينات من اللعاب الغير محفز من كل شخص شارك في الدراسه لغرض تحديد درجة الحموضه والقاعديه ومعدل سريان اللعاب.

النتائج : أظهرت النتائج أن جميع مؤشرات ما حول الاسنان السريرية كانت أعلى لدىالمجوعه الاولى مقرنه يالمجاميع الثانيه بفروق معنويه وكان معدل سريان اللعاب ومعل الحموضه والقاعديه اقل لدى المجموعه الاولى بفرق معنوي مقرنه بالمجاميع الاخرى.

الاستنتاج : تم استنتاج انه مرض السكري النوع الثاني اظهروا التهاب شديد في انسجة اللثة اكثرمن مرضى غير المصابين بالسكرمع انخفاض في معدل سريان اللعاب وزياده حموضيته.