

Prevalence of Periodontal Disease in Type 2 Diabetic Patients with and without Vitamin D Deficiency

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Introduction: Diabetes mellitus is one of the most common endocrine disorders in the world and is accompanied with many complications such as periodontal disorders as the most common complications of diabetes in the mouth. It is estimated that 1 million people worldwide are suffering from varying degrees of vitamin D deficiency, and some studies have linked it with periodontitis and diabetes. The purpose of this study is to investigate the relationship between periodontal disease in type 2 Diabetic patients and vitamin D deficiency in Iranian population. **Materials and Methods:** This cross-sectional study conducted on 74 Iranian patients admitted to Baqiyatallah hospital during the years 2017-2019. The type II diabetic patients were selected and non-volunteers patients and those who did not meet the inclusion criteria were excluded. Then, Necessary tests were evaluated in all patients. Patients were divided into two groups of with and without vitamin D deficiency. A questionnaire for periodontal disorders was completed by two different blinded periodontists. The collected data was analyzed using SPSS-21 software using Chi-square and T-test. **Results:** 44 males and 30 females were studied. 37 patients had vitamin D levels below 30 ng/ml. 83.8% of the patients had periodontal disorders. The frequency of periodontitis was higher in diabetic patients with vitamin D deficiency than in diabetic patients with normal levels of vitamin D. Periodontal disorders were also significantly correlated with duration of diabetes, age of patients and HbA1c. **Conclusion:** Periodontal disorder is more prevalent in patients with inadequate vitamin D serum levels. Screening for diabetic patients seems to be necessary both in terms of diagnosis of periodontitis and vitamin D deficiency.

Keywords: Diabetes Mellitus; Periodontal Disorders; Type 2; Vitamin D

Introduction

Periodontal disease is a chronic oral inflammation characterized by destruction of periodontal structures and bone loss (1). Periodontitis as one of the two major dental diseases affects <50% of adult populations (2) and 59.6 %of diabetic patients (3) and it is considered as the sixth major complication of diabetics (3, 4).

Type 2 diabetes mellitus is a common metabolic disorder with a high rate of morbidity and mortality(5). According to world health organization (WHO) 422 million in 2014 suffered from diabetes mellitus(6) and it will increase about 592 million people until 2035(7). Type 2 diabetic patients constitute about 85 to 90 percent of all diabetic patients (4).

Previous studies demonstrated mutual relationship between diabetes and periodontal diseases (8). The TNF- α inflammatory mediator produced due to periodontal

inflammation suppresses insulin function (9). Some of the complications commonly found in diabetics are risk factors for periodontal diseases (1, 4).

On the other hand, lots of diabetic patients suffer from vitamin D deficiency and it has been shown that vitamin D deficiency affects diabetes by impairing insulin synthesis (10). Also vitamin D deficiency may play a role in periodontal disease and loss of teeth by effect on immunity and bone metabolism (2). Due to high frequency of vitamin D deficiency and increasing number of diabetic patients, screening of these patients in order to diagnose or prevent periodontal disease could be helpful. Some studies investigated the relationship between diabete and periodontal diseases and showed conflicting results (11). In a study conducted by Zuk *et al.*, periodontitis was not associated with impaired fasting glucose after controlling socioeconomic variables (12). However, Choi *et al.*, reported that impaired fasting glucose was associated

Table 1. Comparison of different parameters in two study groups (Normal and Inadequate vitamin D serum level)

Parameters	Normal Vit D	Inadequate Vit D	P-value
HbA1c average (%)	8.59	8.59	0.88
Diabetes Duration average(days)	10.56	11.27	0.58
Frequency of periodontal disorders	22	40	0.04*
Gingivitis (%)	18.5	25	0.07
Chronic periodontal disorder (%)	63.5	50	0.03*
Aggressive disorder	4.5	10	0.09
Abscess (%)	9	7.5	0.39
Gingival Deformity (%)	4.5	2.5	1.00
Necrotic periodontal disorder (%)	0	5	0.29

Table 2. Comparison of various factors in different study groups

Vitamin D serum level	Periodontal disease status	Age	Gender		Diabete duration	Blood sugar (Hg A _{1c})
			Male	Female		
Normal	With periodontitis	54.60	21	7	12.00	8.97
	Without periodontitis	45.77	3	6	5.22	7.30
	P-value	0.03*	0.023*		0.00*	0.007*
Inadequate	With periodontitis	47.66	18	16	11.52	8.58
	Without periodontitis	54.7	2	1	8.33	7.80
	P-value	0.189	0.64		0.250	0.217

with higher levels of periodontal attachment loss (13). A study conducted on non-Iranian population found negative relationship between vitamin D serum level and periodontitis severity in type 2 diabetic patients (14), but no study has conducted to investigate the relationship between periodontal disease prevalence in type 2 diabetic patients with different vitamin D serum levels in Iranian population.

For this reason, we decided to study the prevalence of periodontal disease in Iranian type 2 diabetic patients with and without vitamin D deficiency.

Materials and Methods

This cross-sectional descriptive study was carried out on 74 Iranian patients suffering from type 2 diabetes mellitus (DM) referred to the Baqiyatallah hospital clinic in Tehran, Iran, during the years 2017 to 2019 with the mean age of 53.29 ± 9 . Type II diabetic patients who were willing to participate in the research were included in the study and those who were dissatisfied were excluded. The criteria for patient selection was diabetes diagnosis according to criteria defined by American Diabetes Association (15). Also, Patients with the history of chemical, mechanical, thermal stimulation and history of using

vitamin D supplements, hyperparathyroidism, malnutrition, hormonal disorders, blood disorders and history of depression and heavy smoking were excluded from the study. The sampling method in this research was randomised sampling. Vitamin D level was measured using plasma 25-hydroxyvitamin D (25(OH) D) concentrations. Vitamin D deficiency and inadequacy were defined less than 30 ng/ml 25-hydroxy vitamin D. Patient's information and tests results were recorded in specialist's manual by two different blinded periodontists.

According to the test results, Patients were divided into two groups: patients with vitamin D deficiency and patients with normal vitamin D levels. Then 37 diabetic patients with vitamin D deficiency (less than 30 ng/ml) and 37 diabetic patients without vitamin D deficiency (more than 30 ng/ml) were selected randomly.

Then the patients were referred to the Baqiyatallah dental Clinic. The periodontists examined the patients, and then filled out a questionnaire including different types of periodontal diseases based on periodontal indices measured and documented by the examiners included Probing depth (PD), clinical attachment level (CAL) in four surfaces (mesial, distal, buccal and lingual) of all fully erupted teeth except the third molars by using Williams Periodontal probe. The checklist



included the following periodontal disorders according to classification defined by Armitage *et al.*, (16): Gingivitis, Chronic Periodontal Disease, Aggressive Periodontal Disease, Periodontal Disease Relating to Systemic Conditions, Necrotizing Periodontal Disease, Abscesses of the Periodontium, Periodontitis Associated with endodontics lesion and Developmental or Acquired deformities and Conditions. Then the relationship between periodontal disorders and vitamin D serum levels was determined based on age, sex, duration of diabetes and Hb A_{1c}. Ethical considerations

The Ethics Committee of the Baqiyatallah University approved this project, and then patients filled out a written informed consent form.

Statistical analysis

After collecting data, they were entered in the spss-21 software; the data were analyzed using descriptive statistics as well as Chi-square and T-test. Also, to determine the frequency of each of the study variables, Statistic Frequency was utilized. Statistical significance was based *P* values of less than 0.05.

Results

This study consisted 74 patients. The mean age of study participants was 53.29±9 years including 44 men (59.5%) and 30 women (40.5%). The participants were divided into two groups according to vitamin D serum level. Vitamin D serum levels in 37 patients (50%) was less than 30 ng/ml while in others it was normal. The mean HbA_{1c} level was 8.54±1.38 in both groups and on average 10 years have passed since their diabetes diagnosis. 62 (83.8%) patients of the total number of 74 had periodontal disorder. The result showed that the most common disorder is chronic periodontal disorder (63.5%).

Study of the patients basic characteristics in two groups

The investigation of patients' basic characteristics in two groups (with and without vitamin D deficiency) revealed no significant differences in age and sex and in diabetes control regarding HbA_{1c} level. Statistical analysis showed that the frequency of periodontal disorder is significantly higher in patients with low-level vitamin D (*P*<0/05). The study of patients' basic characteristics in two groups is demonstrated in Table 1 and 2.

Considering 74 patients in this study statistical analysis showed that the average age of the patients with periodontal disorder was 54.60 which was significantly higher than the average age of the normal rest which was 47.66 (*P*=0.00). After separating

the patients into two groups according to vitamin D serum level, it was determined that in patients with normal serum level the average age of the patients with periodontal disorder is significantly higher than the other group with no periodontal disease (*P*=0.03). But the difference between patients with and without periodontal disease in vitamin D deficient group in terms of average age was not significant (*P*=0.189). The distribution of patients' gender showed that periodontal disorders and patients' gender had no significant relationship (*P*=0.17). However, after separating patients to two groups according to vitamin D serum level; it was determined that this relation has significant difference in patients with normal vitamin D serum level (*P*=0.023). However, there was no significant difference in vitamin D serum level between two groups of men & women (*P*<0.05). The mean serum levels of vitamin D in men and women were 33.4±17.86 and 23.5± 21.08, respectively.

The diabetes duration in patients with periodontal disorder was significantly high. The statistical analysis showed that diabetes duration in patients with periodontal disorder in group with normal vitamin D serum level is significantly higher than the patients with no disease (*P*=0.00). Blood sugar analysis showed that HbA_{1c} average in patients with periodontal disorder and normal vitamin D serum level is significantly high (*P*=0.007). More detailed information is demonstrated in Table 2.

Discussion

In the current study the periodontal indices were measured in two groups of diabetic patients with vitamin D deficiency and normal levels of vitamin D. In the study of the basic characteristics of patients, the most frequent periodontal disorder was chronic periodontal disease.

According to the results of the current study, vitamin D plays an important role in the periodontal condition of the mouth; and of course it is very important in diabetic patients and also statistical analysis showed that the duration of diabetes in patients with periodontal dysfunction was significantly higher in patients with normal vitamin D than patients without disease.

Overall regarding the patients with normal vitamin D level in this study, the mean age, duration of diabetes and HbA_{1c} were significantly higher in patients with the periodontal disorder compared to healthy subjects. But this difference was not seen in patients with insufficient levels of vitamin D.

In some studies, they have separately examined the relationship between diabetes and periodontal disorders, or the



relationship between vitamin D deficiency and periodontal abnormalities (17-20). In a study conducted on Canadian populations, in diabetic patients with higher mean HbA1C values more severe cases of attachment loss was observed which is the same as the current research (18). The current study investigated the three parameters of diabetes, vitamin d and periodontal status in Iranian population which was rarely investigated in the current literature (21).

There is a hypothesis suggesting that vitamin D can play a role in periodontal disorders by preventing the destruction of alveolar bones and enhancing the immune system and reducing inflammatory responses. Studies have shown that 1.25 hydroxyvitamin D increases the buildup and transcription of antimicrobial peptides which are involved in the fight against aggressive external agents. It also reduces inflammation in dental infections (22). In a study by Thomas Dietrich *et al.*, entitled "Relationship between serum vitamin D and periodontal disease in the United States population", it has been concluded that low serum levels of vitamin D alone, in addition to decreased bone density, causes periodontal disorders and may have worrisome general outcomes due to the high prevalence of vitamin D deficiency and periodontal disease (23). In this study we showed the same result as the frequency of periodontal disorders was significantly higher in patients with vitamin D deficiency.

Yousef Khader *et al.*, in a study comparing the periodontal status of type 2 diabetic patients with type 1 in northern Jordan, concluded that periodontal disease was more severe in diabetic patients, suggesting that this was due to the high gingival index, periodontal pocket depth, teeth adhesion and tooth mobility. But, there was no significant difference in mean plaque index in diabetic and non-diabetic subjects. Also, the severity of periodontal disorder was higher in subjects suffering from diabetes for more than five years than those who were suffering for less than five years (24). The same result was observed in our study while the prevalence of periodontal disorders increased with increasing duration of disease.

In a study by Matu *et al.*, to determine the prevalence and severity of periodontal disease in diabetic patients compared to those without diabetes, it was found that periodontal diseases are more severe and more frequent in diabetics. These results are consistent with the present study on Iranian population (25).

In a study by Antonoglou *et al.*, showed that serum 1, 25 (OH) D level increases after elimination of periodontal inflammation in type 1 diabetic subjects. Their study demonstrated a significant positive association between the

serum 1, 25(OH) D level and periodontal health status. Our study also showed that the frequency of abnormalities is significantly higher in patients with low-level vitamin D. Although they investigated type 1 patients and we studied type 2 but the results were the same (26).

The results of a study conducted on pregnant women showed that sufficient vitamin D is important for maintaining periodontal health and reducing the consequences of the periodontal disease, which is consistent with the current study results on both men and women (2).

In general, limited studies have been conducted in this field; therefore, comparing the results is concise and low and contradictory. In a study was shown that taking a multivitamin or a vitamin D supplement was associated with increased risk of more severe LOA (18). While in another study it was concluded that calcium-vitamin D supplementation enhances systemic inflammation through decreasing IL-6 and TNF- α concentrations in vitamin D-insufficient people with type 2 diabetes.

Therefore more future studies are needed to be conducted with a larger sample size and longer follow- up periods with a control group of non-diabetic subjects in order to examine the effect of taking vitamin D supplements on periodontal disorders and their progression or recovery .

Conclusion

Based on the findings of this study, it can be concluded that the level of vitamin D in addition to the age of the patients, the duration of the disease and the control of diabetes can be considered as predisposing factors in the development of periodontal disorders. Therefore, it is recommended that diabetic patients measure serum levels of vitamin D in order to offset the inadequate levels of this vitamin

Conflict of Interest: 'None declared'.

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