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Glycaemic control and Periodontal health status of Patients with Type 2 Diabetes Mellitus that attended a Tertiary health facility in Lagos, Nigeria

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Abstract

Introduction: Diabetes mellitus patients are more likely to have periodontal disease. Poor glycaemic management may be linked to the severity and extent of periodontal disease. In this study, the glycaemic control and periodontal health status of individuals with type 2 diabetes mellitus (T2DM) who visited the periodontal clinic of a tertiary hospital in Lagos State, Nigeria, will be assessed.

Methods: A total of 134 individuals with diabetes mellitus participated in this cross-sectional study. Data were collected using a pretested questionnaire to assess the glycaemic state-related factors. After which, there was an oral examination.

The periodontal health state was then evaluated through an oral examination using the simplified oral hygiene index and the community periodontal index (CPI). Glycated haemoglobin was tested in the lab. Using logistic regression analysis, factors related to glycaemic state were assessed

Results: Women made up 68.9% of the 134 participants. The participants average age was 48.9 (\pm 11.1) years. Most participants (59.7%) have had diabetes mellitus for more than five years. The prevalence of periodontal disease was 92.1% overall. Glycaemic control was significantly correlated with both CPI scores and the length of diabetes.

Conclusion: Patients with poor glycaemic levels exhibited more severe periodontitis than those with excellent glycaemic levels. Periodontal disease should be assessed, prevented and treated in all diabetes individuals. Additionally, oral health interventions should be packaged and presented in plain language so that even the less educated populace may understand them easily.

Keywords: Glycaemic control, periodontal status, oral hygiene status, Type 2DM

Introduction

Periodontitis is an irreversible form of periodontal disease that affects the supportive tissues of teeth and is induced by inflammation. Increased probing depth (PD), gingival recession, or both are the symptoms of the progressive breakdown of the periodontal ligament and alveolar bone. It is caused by certain microorganisms or clusters of closely related microorganisms^[1]. Diabetes mellitus (DM) has six consequences, including periodontitis. Type 1 DM (T1DM) and T2DM are major risk factors for periodontal diseases^[1].

Diabetes mellitus (DM) is a metabolic disorder with long-term complications that is caused by a lack of insulin secretion or action. A wide range of long-term complications in diabetics are caused by hyperglycemia. The most frequently reported complications are cardiovascular disease, kidney disease, neuropathy, microangiopathy and retinopathy^[2, 3].

There is mounting scientific evidence that certain oral diseases are linked to diabetes^[4, 5]. Periodontal diseases, dental caries, dental abscesses, tooth loss, xerostomia, and oral mucosal lesions are the major oral diseases associated with diabetes^[6, 7].

The most common oral complication among T2DM patients is periodontal disease. Diabetes had a higher prevalence of periodontitis and more severe symptoms, when compared to the non-diabetes^[5, 7, 8]. Poor glycaemic management in T2DM patients makes them more vulnerable to or causes more severe periodontal disease^[1, 8].

As a result, glycaemic management is a crucial component of the treatment of people with type 2 diabetes mellitus (T2DM). Numerous studies have recommended that periodontal therapy improve glycaemic control [9, 10].

The primary objective of the study is to determine the prevalence and association between oral hygiene, glycaemic status, and severity of periodontal destruction in T2DM patients who attended the Periodontal clinic of the Dental Center of Lagos State University Teaching Hospital, Ikeja. Lagos state. Nigeria.

Materials and Methods

Study Design and Population

DM patients who attended the Periodontal Clinic of the Lagos State University Teaching Hospital, Ikeja participated in this cross-sectional study. The study population consisted of the patients with known type 2 diabetes who visited the outpatient departments of the above-mentioned health facility. The method of convenient sampling was employed.

Inclusion Criteria

Female and male patients of any age with a T2DM diagnosis were eligible to participate in the study. Included also were those who consented to participate in this study.

Exclusion Criteria

The DM patients who received periodontal therapy three months before the study that had systemic disease other than T2DM. People who smoke, are nursing or pregnant, or are taking medication that can alter the periodontium (such as antiepileptic drugs and immunosuppressants). Those who declined to participate in this study were excluded.

Data Collection and Measurements

Data on the following variables were gathered using a questionnaire: age, sex, smoking status (smoking and non-smoking), duration of diabetes mellitus, HbA1c level, periodontal status (presence or absence of periodontal disease), the oral hygiene using the Oral Hygiene Index Simplified (OHIS), the periodontal status using the Community Periodontal Index (CPI) [11, 12].

Sample Size and Sampling Technique

Sample size/sampling

The Sample size was calculated by using the formula for calculating sample size for descriptive research [13].

$$N = Z^2 p q/d^2$$

N = Sample size, Z = Standard normal deviation = 1.96 at 95% Confidence limit

P = Prevalence rate = 91.3% = 0.913, prevalence rate from an

earlier study [14].

$$q = (1-P) = (1-0.913) = 0.087.$$

d = Error margin = 5% = 0.05,

$$N=122, \text{ Nonresponsive set at } 10\% = 10/100 \times 122 = 12$$

$$\text{Total sample size: } 122 + 12 = 134$$

Periodontal disease Examination

- The participants' periodontal status was assessed by the Community Periodontal Index (CPI)
- All sextants were examined using a calibrated Periodontal probe and a mouth mirror.

Community Periodontal Index (CPI)

CPI values were recorded in scores as:

CPI = 0, healthy.

CPI = 1 and 2, gingivitis.

CPI = 3, periodontal pockets, 4–5 mm.

CPI = 4, periodontal pockets 6 mm. or more;

CPI = X, excluded sextant (fewer than 2 teeth presented).

Periodontal disease was defined as follows

CPI = 1 and 2 as gingivitis.

CPI = 3, pockets <4mm, as mild periodontitis.

CPI = 4, pockets >4mm, as severe periodontitis.

Diagnosing Diabetes Mellitus

Glycaemic state was divided into two categories: excellent (HbA1c < 7%) and poor (HbA1c > 7%) [15].

Ethical Clearance

The Lagos State University Teaching Hospital of Ikeja, Lagos, Nigeria's Research and Ethical Committee granted ethical permission for this project.

Analysis of Statistics.

The analysis of the gathered data was by version 25 of SPSS. The data were presented as frequency percentages for categorical variables and as mean and standard deviation for scale variables. In patients with type 2 diabetes, factors such as age, gender, educational attainment, length of diabetes, dental cleanliness, and periodontal health were compared with glycaemic control levels using the chi-square and Fisher exact tests.

P values < 0.05 was statistically significant. The evaluate of the association between HbA1c and the independent variables was by binary logistic regression, after adjusting for confounders

Results

Table 1: Characteristics of the Study participants

Variable	HbA1c			P-Value
	Controlled (%)	Uncontrolled (%)	Total (%)	
Age				
<65	32 (44.4)	33 (53.2)	65 (48.5)	0.386
>65	40 (55.6)	29 (46.8)	69 (51.5)	
Gender				
Female	50 (69.4)	36 (58.1)	86 (64.2)	0.171
Male	22 (30.6)	26 (41.9)	48 (35.8)	
Education				
None	4 (5.6)	3 (4.8)	7 (5.2)	0.409
Primary	20 (27.8)	13 (21.1)	33 (24.6)	
Secondary	16 (22.2)	22(35.4)	38(28.4)	
Tertiary	32 (44.4)	24 (38.7)	56(41.8)	

Duration of DM (years)				
<5	36 (50.0)	18 (29.0)	54 (40.3)	0.014*
>5	36 (50.0)	44 (71.0)	80 (59.7)	
Frequency of Tooth Brushing				
Once	47 (65.3)	37 (59.7)	84 (62.7)	0.592
Twice	25 (35.7)	25 (40.3)	50(37.3)	
CPITN Scores				
Healthy	10 (13.9)	3 (4.8)	13 (9.7)	0.042*
Bleeding	12 (16.7)	3 (4.8)	15 (11.2)	
Calculus	27 (37.5)	33 (53.2)	60 (44.8)	
Pocket	16 (22.2)	13 (21.1)	29 (21.6)	
Deep Pocket	7 (9.7)	10 (16.1)	17 (12.7)	
Periodontal Status				
Normal	10 (13.9)	3 (4.8)	13 (9.7)	0.27
Gingivitis	39 (54.2)	36(58.0)	75 (56.0)	
Moderate Periodontitis	16 (22.2)	13 (21.1)	29 (21.6)	
Severe Periodontitis	7(9.7)	10 (16.1)	17 (12.7)	
OHI-Score				
Good	18 (25.0)	13 (21.0)	31 (23.1)	0.758
Fair	39 (54.2)	33 (53.2)	72 (53.8)	
Poor	15 (20.8)	16 (25.8)	31 (23.1)	
Total	72 (53.8)	62 (46.3)	134 (100)	

*Significant

Characteristics of the Study Participants

The current study included 134 DM patients. Out of them, 69(51.5%) were above aged 65 years. Mainly, 86 (64.2%) DM patients were female. Over 60% of participants clean their teeth at least once every day. Those that had tertiary education were 56(41.8%), (Table 1).

Prevalence of Periodontal disease among DM Patients

The periodontal disease prevalence among DM patients was 92.1%. Majority, 44.8% of the participants had calculus. Among DM patients with adequate glycaemic control, the

prevalence of periodontitis was 86.1%, while among those with poor glycaemic control, it was 95.2%. Among DM patients with adequate glycaemic control, the prevalence of calculus was 37.5%, but among those with poor glycaemic control, it was 53.2%.

The participants mean HbA1c level was 7.7±2.37. Mostly, 72 (53.8%) of the total DM patients had good glycaemic control. More than half 72(53.8%) of the patients had fair oral hygiene. The CPI scores and the length of diabetes were statistically significant in relation to the glycaemic state (Table 1).

Table 2: Interaction of oral hygiene, glycaemic control and Periodontal diseases

	Variables	Healthy Code 0	Gingivitis (Code1 + Code2)	Moderate Periodontitis Code 3	Severe Periodontitis Code 4	Total	P-Value
Good Oral Hygiene	Good	8 (44.4)	7(38.9)	3(16.7)	0(0.0)	18(100)	0.336
	Poor	3 (23.1)	5 (38.5)	3 (23.1)	2 (15.3)	13 (100)	
Fair Oral Hygiene	Good	2(5.1)	19 (48.7)	12 (30.8)	6 (15.4)	39(100)	0.209
	Poor	0(0.0)	22 (66.7)	5 (15.1)	6 (18.2)	33(100)	
Poor Oral Hygiene	Good	0(0.0)	13 (86.6)	1(6.7)	1(6.7)	15 (100)	0.174
	Poor	0(0.0)	9(56.2)	5 (31.3)	2 (12.5)	16 (100)	
	Total	13(9.7)	75(56.0)	29(21.6)	17(12.7)	134(100)	

Severe periodontitis was more common in participants with poor glycaemic control and good oral hygiene than in those with adequate glycaemic control.

Both those with excellent and poor glycaemic control and with fair oral hygiene exhibited periodontal tissue destruction; those with good glycaemic control had the highest frequency of

moderate periodontitis, while the prevalence of severe periodontitis was more with poor glycaemic control

The frequency of moderate and severe periodontitis was higher in those with poor oral hygiene and poor glycaemic control than in those with poor oral hygiene and good glycaemic control (Table 2).

Table 3: Relationship of the variables and glycaemic control using binary logistic regression

Variables	B	S. E	Wald	DF	Sig
Age	-.756	.405	3.480	1	0.062
Sex	.681	.424	2.581	1	0.108
Education	.000	.213	.000	1	1.000
Diabetes Duration	1.097	.411	7.134	1	0.008*
Toothbrushing frequency	.431	.425	1.030	1	.310
Periodontal status	2.068	.679	9.277	1	0.002*
CPITN	-2.316	.858	7.287	1	0.007*
OHI-Scores	-.303	.309	.964	1	0.615

*Significant

Binary logistic regression (Table 3) shows that duration of the T2DM is significantly related with increased HbA1c ($p=0.008$) with an odd of 1.1, periodontal status was also significant $p=0.002$ with an odd of 2.1 while CPITN was also significant $p=0.007$ with an odd of -2.3. (Table 3).

Discussion

Overall, periodontal disease was present in 92.1% of T2DM participants in current study, comparable to the 90.0% among the examined diabetes that Ojo *et al.* [16] reported. These results are comparable to the report of a study conducted among diabetic patients who visited a tertiary healthcare facility in Nigeria, where none of the diabetes had a healthy periodontium [17], however 34.9% was reported by Alahmari *et al.* [18]. Poor glycaemic management of most of participants in these studies may be the cause of this variation in prevalence. A study linked the high prevalence of periodontal disease in people with diabetes mellitus to poor glycaemic management [19].

Most of the participants had poor glycaemic control, as shown by a mean HbA1c of more than 7.0.

The mean HbA1c is 7.7 ± 2.31 in our study, similar to 8.84 ± 2.57 reported by Kiryowa *et al.* [19], Sundar *et al.* [10] was 8.44 ± 1.87 , while that from the study of Kumar *et al.* [1] was 6.9 ± 0.9 .

Among DM patients with good glycaemic control, the prevalence of periodontitis was 86.1% and 95.2% among DM patients with poor glycaemic control. This was Inconsistent with the 91.8% and 90% from participants with good glycaemic and the poor glycaemic control, respectively [16].

Fifty-six per cent were observed to have gingivitis (bleeding gums and calculus)/ mild periodontal disease (codes 1 and 2) in this study this is consistent with the (56.2%) reported by Khan *et al.* [20], and in contrast to the 41.8% from Ojo *et al.* [16] and 25% from Kiryowa *et al.* [19].

Severe periodontitis code 4 was found to be more in the poorly controlled T2DM than with the adequately controlled. This was consistent with the reports of other studies [21, 22].

Many of this study participants had a fair oral hygiene score of 39(53.8%), consistent with the report of a similar study [23]. This is in contract to that of other studies [21, 22], where the majority had poor oral hygiene.

In accordance with the findings of a related study, most of our participants had fair oral hygiene 39 (53.8%) [23]. This contrasts with earlier research [21, 22], which found that most participants had poor oral hygiene.

Many of the participants with controlled glycaemic had good oral hygiene. This was consistent with the report from some other studies [21, 23].

Poor oral hygiene habits can hasten the build-up of plaque, which is a significant reservoir for periodontal-pathogenic microorganisms [19]. The risk of periodontitis was increased two to five times by poor oral hygiene when compared with adequate oral hygiene [24].

The study's examination of the relationship between, glycaemic control, oral hygiene, and periodontal status revealed that individuals with type 2 diabetes who were in the good, fair, and bad oral hygiene groups and in the poor glycaemic control group reported more severe cases of periodontitis than those in the good glycaemic control group this was in line with Singh *et al.*'s report [23]. This current study agreed with Hasan *et al.* report [25], that participants with poor glycaemic control and poor oral hygiene had more severe periodontitis than those with adequate glycaemic control. In this study, Diabetes duration of more than five years was associated with poor glycaemic control. Similarly reported by

Yakubu *et al.* [26] from their study in the North-western Nigeria. In contrast to the current study, Yakubu *et al.* study but did not show a statistically significant association between diabetes duration and glycaemic control. According to some studies, the prevalence and severity of periodontal disease in diabetic patients increase with the duration of the disease and poor glycaemic levels [8, 20]. According to studies, people who have had diabetes for a long time have a propensity to disregard their dental health [27, 28]. Therefore, it is important to promote and enforce proper oral hygiene practices on a regular basis.

Oral hygiene practice of many diabetics in this study was inadequate, as 62.7% of them brush at least once a day. This was consistent with the reports of Khan *et al.* with 62.7% [20], Ojo *et al.* was 72.7% [16], and from Singh *et al.*, 100% [23]. In addition to increasing the prevalence of periodontal disease, poor oral hygiene and infrequent tooth brushing increased the risk of type 2 diabetes by accumulating plaque, which exacerbates the periodontal condition and eventually leads to tooth loss [29].

A study [25] suggests that practising self-care behaviours, such as adhering to food and exercise guidelines and practising excellent oral hygiene, may help maintain appropriate glycaemic control and reduce the risk of periodontal disease. The findings also indicate that medical and dental professionals, as well as policymakers, should work together to manage diabetes patients, emphasizing the value of diabetic patients adhering to oral hygiene and self-care regimens [25].

Conclusion

According to the findings of this cross-sectional study, participants with uncontrolled type 2 diabetes had worsened oral hygiene scores (calculus and plaque) and periodontal parameters (bleeding on probing, pocket depth) than those with controlled diabetes. Maintaining periodontal health and general well-being in diabetes people requires an interdisciplinary approach.

Conflict of Interest

Not available

Financial Support

Not available

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