Association between Periodontal Status, Periodontal Treatment Needs and BMI of Type 2 Diabetic Patients.

Abstract

Objective: The objective of the study was to evaluate the periodontal status and periodontal treatment need in obese type II diabetic patient attending two teaching hospitals in southern Nigeria

Methods: This descriptive study included 220 subjects with diabetes mellitus Type 2. A structured questionnaire was used to get necessary data from participants. The periodontal tissue status and periodontal TN were determined using the Community Periodontal Index of Treatment Needs. (CPITN). Body mass index (BMI) was recorded. Data was analyzed using SPSS statistics for analysis

Results: Periodontitis was high among the participants in the two teaching hospitals. Community Periodontal Index of Treatment Needs. (CPITN) code 2 and 3 were commoner in participants in the two hospitals. Hence, Scaling and root planing was the treatment most commonly required in the diabetes mellitus patients.

Conclusion: The prevalence of periodontitis was high among the study groups; however, periodontitis was not significantly associated with obesity. The treatment need of the participants was majorly CODE 2 (scaling and root planning).

Keywords:, Diabetes Mellitus, Obesity, Periodontal disease, Community Periodontal Index of Treatment Needs

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Introduction

Periodontal disease is both an inflammation and infectious disease of the structures that support the teeth namely: gingiva, periodontal ligament, and alveolar bone. Periodontal disease presents as gingival or periodontal inflammation. Gingivitis is inflammation that is limited to the gingiva, and does not affect the supporting tissues of the tooth, while periodontitis is inflammation that extends to the deeper tissues that support the teeth.[1,2] Periodontitis is characterized by gingival inflammation and loss of attachment, with progressive damage to periodontal ligaments and alveolar bone.[2] Severe periodontal disease causes the teeth to become mobile resulting in eventual tooth loss if left untreated. [3]

Several studies have exposed possible link between periodontitis and various systemic diseases. [4-6] Periodontitis has been described as a potential risk for increased morbidity and mortality for diabetes, insulin resistance, rheumatoid arthritis, chronic obstructive pulmonary disease (COPD), obesity, osteoporosis, anemia, chronic kidney disease and complications of pregnancy among others.[4-6]

Diabetes is a metabolic disorder characterized by hyperglycemia that results in damage to the insulin secretion system and or the actions of insulin.[7] Diabetes currently ranks fourth as a cause of death in most developed countries and has reached epidemic proportions in many developing countries. [8]

Periodontitis is known as the sixth complication of diabetes and such the pathophysiology relationship between them was established. On one side, the role of diabetes mellitus as a risk

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factor for the development of gingivitis and periodontitis is proven and depending on the level of glycemic control, diabetes mellitus increases the response of the gingiva to bacterial plaque than in non-diabetics. On the other hand, periodontitis and gingivitis cause weaker control of blood sugar. Also hyperglycemia increases the amount of glucose in gingival crevicular fluid (GCF), causes a change in quality of bacteria and increases periodontal diseases in patients with uncontrolled diabetes. [9, 10]

Many clinical and epidemiological studies have demonstrated a relationship between diabetes mellitus and periodontal disease. [11, 12]

Obesity is a multifactorial disease and is becoming a worldwide epidemic with an increasing prevalence in recent years, in both adults and children. [13] It is defined as having an excessive amount of body fat. [14] This abnormal accumulation of fat is a leading cause of morbidity for cardiovascular disease and diabetes and has become, in all countries, a socioeconomic burden. [14]

Evidence suggests that obesity is a direct and indirect risk factor for periodontal disease because it affects glycemic control indirectly. It induces the secretion of a vast number of hormones and pro-inflammatory cytokines called adipokines or adipocytokines (interleukin-6 and tumor necrosis factor-α) derived from immune cells in fat tissue causing a series of inflammatory reactions that can cause periodontal disease. [15-18]

Diabetics are at a higher risk of becoming obese due to insulin resistance of the muscle cells and islet alpha cells. This results in increased hepatic glucose production and insulin levels. [19]

One of the main risk factors for diabetes mellitus is obesity.[19] There is substantial evidence linking obesity, and diabetes. [20-22] Diabetic individuals are at a higher risk of becoming obese

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due to insulin resistance of the muscle cells and islet alpha cells. This insulin resistance results in increased hepatic glucose production and insulin levels which are the causes of obesity. [19]

There is increasing concern about the triangular relationship between diabetes, obesity, and periodontitis. [23] Both Type II diabetes and obesity affects the periodontium through the immune responses from the pro inflammatory cytokines such as tumor necrosis factor (TNF) and interleukins-6 (IL-6). [24]

Moreover, it has been proposed that periodontitis prompts an inflammatory alteration in adipose tissue, which is associated with obesity, DM, and periodontal disease. [23]

Studies have highlighted the need for comprehensive periodontal treatment in patients suffering from diabetes, [25] and diabetic obese patients. [24] It was seen reported that a vast majority of diabetic cases, i.e., about 70% need TN III (complex treatment), and TN II (20.1%; scaling and root planing, [25] (73.3%) patients required scaling and root planing treatment (TN II), and 2 (13.3%) patients required complex treatment (TN III). [3] The periodontal treatment needs were from minimal to moderate, hence related to the prevalence of the periodontal diseases. [26]

The necessity of complex periodontal treatment also increased with increasing blood glucose levels.[33] Previous research has shown that, poor metabolic control, led to a higher prevalence of periodontal disease and increased periodontal TN.[27] Poor oral hygiene increases the risk of periodontitis by two to five fold compared with good oral hygiene.[28]

Hence the rationale for this study was to evaluate the periodontal status and periodontal treatment need in obese type II diabetic patient.

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Materials and Methods

Subjects were selected from patients attending the diabetic outpatient clinic of the departments of Medicine of two Diabetic clinics of the Lagos State University Teaching Hospital (LASUTH) and University of Port Harcourt Teaching Hospital (UNIPORT) in Nigeria.

A self-administered structured questionnaire was used to record the demographic data of participants such as the name, sex, address, and diabetic profile as well as their heights and weights.

Informed consent was obtained from all the participants.

Inclusion criteria were patients with Diabetes Mellitus Type 2 between 30 and 80 years diagnosed chronic periodontal disease and having at least 20 remaining natural teeth

Exclusion criteria were patients with past or present history of malignant disease, patients taking medication known to influence periodontal status such as antimicrobial medication and those with history of periodontal treatment in the past 6 months prior to the study.

Sample size

The minimum sample size was determined using the following formula:

$N = Z^2 P q/d^2$ [29]

Where d = degree of accuracy desired, set at 0.05

p = the proportion in the target population estimated to have a particular characteristic,

P = 15.4.0% (0.154) based on a previous report of good oral hygiene status. [24]

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Z = standard normal deviation, set at 1.96 which corresponds to 95% confidence level.

q = 1.0 − p

N = (1.96)2 (0.154) (0.846)/(0.05)2 = 200+20 of none responsive =220

Finally, 220 patients were selected from these two centres in equal proportions, i.e., 110 from Lagos and 110 from Port Harcourt.

Obesity was assessed by means of Body Mass Index (BMI). BMI was calculated as the ratio of weight in kilograms to the square of height in meters following World Health Organization (WHO) guidelines. [30]

The participants were divided into three BMI classes with BMI >30 (obese) and BMI of 25-29.99 (overweight), and BMI 18.5 to 24.99 (normal)

The periodontal tissue status and periodontal TN were determined based on the Community Periodontal Index of Treatment Needs (CPITN) index.

The CPITN was used to assess the periodontal status of the patients. The scoring criteria were as follows:

Code 0 = healthy,

Code 1 = bleeding on probing,

Code 2 = supra‐.or subgingival calculus,

Code 3 = periodontal pockets with a depth of 4–5 mm,

Code 4 = periodontal pockets with a depth of more than 6 mm, and

X = a sextant with <2 teeth (excluded sextant).

Using the CPITN, the TN categories were as follows:

TN 0 = no treatment (code 0),

TN I = improvement in personal oral hygiene (code 1),

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TN II = oral hygiene + scaling (codes 2 and 3), and

TN III = oral hygiene + scaling + complex treatment (code 4). [3,31]

Ethical approval was obtained from the Lagos University Teaching Hospital, Health Research and Ethics Committee before commencement of the study.

Statistical analysis

Data was entered in to SPSS statistics for analysis. Data analysis includes descriptive statistics (frequency distribution & cross tabulation). Chi square was used to examine associations between and within variables and the level of significance was set at $p < 0.05$

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Results

Table 1

Characteristics of the study population

Characteristics	UPTH N (%)	LASUTH N %	P value
Age			0.07
<45	23 (20.9)	14 12.7	
>45	87 89.1	96 87.3	
Gender			0.12
Female	69 62.7	78 70.9	
Male	41 37.3	32 29.1	
Education			0.23
None	6 5.4	6 5.4	
Primary	20 18.2	32 29.1	
Secondary	29 26.4	29 26.4	
Tertiary	55 50.0	43 39.1	
BMI			0.004
Normal	28 25.5	45 40.9	
Overweight	56 50.9	32 29.1	
Obese	26 23.6	33 30.0	
Total	**110 (100.0)**	**110 (100.0)**	

There were 220 participants in this study with 110 from UPTH and LASUTH respectively. One-fifth and one-tenth of the participants from UPTH and LASUTH respectively were less than 45 years of age. There were 69(62.7%) and 78(70.9%) females from UPTH and LASUTH respectively. Over three-quarters of the participants in UPTH had secondary and tertiary education, while more of participants from LASUTH had primary and tertiary education. BMI was normal in 45 (40.9%) of participants in LASUTH and in UPTH 56 (50.9%) were

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overweight. About three-quarters and three-fifth of participants from UPTH and LASUTH respectively were either overweight or obese. [Table 1]

Table 2. CPI and TN Scores of participants in UPTH and LASUTH

Variables			**Hospitals**				
CPI	**UPTH N(%)**	**LASUTH N (%)**	**Total N(%)**	**TN**	**UPTH N(%)**	**LASUTH N(%)**	**Total N%**
0	0 (0.0)	12 (10.9)	12 (5.4)	0	0 (0.0)	12 (10.9)	12(5.4)
1	18 (16.4)	16 (14.5)	34(15.5)	I	18 (16.4)	16 (14.5)	34(15.5)
2	57 (51.8)	53 (48.2)	110(50.0)	II	85 (77.2)	75 (68.2)	160(72.7)
3	28 (25.4)	22 (20.0)	50(22.7)				
4	7 (6.4)	7 (6.4)	14(6.4)	III	7(6.4)	7(6.4)	14(6.4)
Total	110	110	220		110	110	220
P <0.01*				p<0.005*			

The periodontal disease prevalence in UPTH was 100%, while in LASUTH, it was 89.1%

About 11% of the participants from LASUTH do not require any periodontal treatment.

Majority of the participants from both centers had CPI score of 2, and 3(code II TN). [Table 2]

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Table 3a. The prevalence of periodontitis of participants based on BMI

Hospitals	**UPTH**				**LASUTH**		
			BMI				
CPI	**Normal**	**Overweight**	**Obese**	**CPI**	**Normal**	**Overweight**	**Obese**
	N %	**N %**	**N %**		**N %**	**N %**	**N %**
0	0 (0.0)	0 (0.0)	0 (0.0)	0	4 (8.9)	5 (15.6.)	3 (9.1)
1	4 (14.3)	10 (17.9)	4 (15.4)	I	5 (11.1)	6(18.8)	5 (15.2)
2	13 (46.4)	27 (48.2)	17(65.4)	2	26(57.8)	13 (40.6)	14 (42.4)
3	8 (28.6)	16 (28.6)	4 (15.4)	3	6 (13.3)	8 (25.0)	8 (24.2)
4	3 (10.7)	3 (5.4)	1(3.8)	4	4 (8.9)	0 (0.0)	3 (6.4)
Total	**28 (100)**	**56 (100)**	**26 (100)**	**Total**	**45 (100)**	**32 (100)**	**33 (100)**

None of the study subjects in the 3 BMI groups in UPTH had healthy periodontium, while in LASUTH some of the participants in the 3 BMI groups had healthy periodontium with the highest 5(15.6%) in the overweight group. Most of the participants in all three BMI groups in UPTH and LASUTH respectively had CPI 2. About 3(11%) of participants from UPTH and 4(9%) from LASUTH with normal weight had CPI score 4. [Table 3a].

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Table 3b. Periodontal treatment need of participants based on BMI

Hospitals	**UPTH**			**LASUTH**				**p-value**
	BMI							
TN	Normal N %	Overweight N %	**Obese N %**	**TN**	Normal N %	Overweight N %	Obese N %	
0	0(0.0)	0 (0.0)	0 (0.0)	0	4 (8.9)	5 (15.6.)	3 (9.1)	
1	4(14.3)	10(17.9)	4 (15.4)	I	5 (11.1)	6(18.8)	5 (15.2)	
II	21(75.0)	43(76.8)	21(80.8)	II	32(71.1)	21(65.6)	22(66.6)	
III	3(10.7)	3(5.4)	1(3.8)	III	4 (8.9)	0 (0.0)	3(6.4)	
Total	**28 (100)**	**56 (100)**	**26 (100)**	**Total**	**45 (100)**	**32 (100)**	**33 (100)**	

BMI was not statistically significant with periodontal treatment need in both hospitals.. The Periodontal treatment needs among participants in both centers were mostly TN code I and code II. There was no participant in the overweight group in LASUTH that had TN code 3 treatment need. [Table 3b]

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Discussion

All the participants of the two teaching hospitals had periodontitis. However, periodontitis was not significantly associated with obesity in the study group. This compares with the study done by Pham et al. [32] on the interaction among obesity, Type 2 diabetes mellitus, and periodontitis in Vietnamese patients that did not find an association between periodontitis and obesity. Other studies reported a possible link between obesity and periodontal disease. [33, 34]

Some of our participants had healthy periodontium. This is not surprising as diabetes alone will not give rise to gingival or periodontal disease, but it can cause exaggerated response of the gingiva to bacterial plaque accumulation. [35] In addition, periodontal pathogens in the oral microbial flora of diabetic subjects, which is accumulating due to a higher concentration of glucose in saliva and crevicular fluid, also contributes to the severity of periodontal status.

The most frequent CPI among study participants in both hospitals was CPI code 2.

Calculus was found more in 65.4% of the obese group in UPTH and 57.8% in the non-obese in LASUTH. Many factors contribute to the role of diabetes in the initiation and development of the periodontal disease. Poorly controlled diabetics with extensive calculus on their teeth had more periodontitis and tooth loss than well‐controlled diabetics or non-diabetics [3]

In our study reported CPI code 3 and 4 in all BMI groups was similar to the report of SriChinthu et al [24] among their participants.

Our findings indicated that the severity of periodontitis was higher in obese diabetic group than the non-obese group. Similar results were reported by Pham et al [32] in Vietnamese population and by Hajimaghsoodi et al.[36] in Iranian population,

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Studies have reported that diabetics with poor metabolic control have more periodontitis than diabetics who maintain good control.33[25] Previous studies have shown that well controlled diabetic patients had better periodontal health than the poorly controlled, and that within the diabetic group the prevalence of periodontal pocket declined as the control of diabetes improved. [25, 37]

BMI was not statistically significant with periodontal treatment need in both Hospitals. This is similar to the report of Chatzopoupus et al [26] in their study on association between BMI, diabetes and periodontal treatment need in Greece.

The TN of the participants was mostly scaling and root planing. This is consistent with the study done on periodontal disease and treatment needs among patients with T2DM in Bandung City (3) In the study of Chatzopoupus et al [26] the periodontal treatment need was more of TN codes II and III in contract to the present study where the periodontal treatment needs were more of TN codes I and II.

Conclusion

Though the prevalence of periodontitis was high among the study groups, however, periodontitis was not significantly associated with obesity. The treatment need of the participants was majorly CODE 2 (scaling and root planing).

Ethical approval

Ethical clearance was obtained from the Research and Ethics Committee of LASUTH, and UNIPORT

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