Original Article

Demographic, Clinical and Microbiological Characteristics of Patients with Periodontitis in a Tertiary Hospital in Nigeria

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ABSTRACT

Background: Periodontitis is a global health problem and plays a major role in both oral and systemic health. The aim of the study was to assess the demographic, clinical features and, the association of six periodontopathogens of periodontitis in patients in Nigeria. **Methods**: A cross-sectional study among systemically healthy patients with periodontitis at Lagos University Teaching Hospital. Participants completed a semi-structured questionnaire and underwent a full periodontal examination. Subgingival dental plaque biofilm was assessed for the presence of six periodontopathogens using both culture and polymerase chain reaction (PCR). Data were analyzed with SPSS to determine the association of demographic, behavioural, clinical and microbiological features with severity of the disease. **Results**: Forty-two patients were recruited with a mean age of 56.7 ± 13.4 years. The peak age group was 40 - 59 years (61.9%). Most of them (71.4%) brushed their teeth once a day, with only a few (11.9%) having good oral hygiene. The mean periodontal probing depth of diseased sites was 5.53 ± 0.98mm. A little over half of them (52.4%) had localized periodontitis. Very few (9.5%) of the patients had severe periodontitis. All six periodontopathogens were detected and *Porphyromonas gingivalis* was the most commonly occurring (17.6%) in deep periodontal probing sites ($\geq$7mm) in severe periodontitis. **Conclusion:** In this study, periodontitis was more common in males and the middle-aged. Oral hygiene practices and oral hygiene were poor. Severe periodontitis was not a common feature of periodontitis. Majority of the periodontopathogens were detected in mild/moderate periodontitis.

Keywords: Periodontitis, oral hygiene, periodontopathogens, *Porphyromonas gingivalis,* Nigeria

INTRODUCTION

Periodontitis is a destructive inflammatory disease of the periodontium initiated by a dysbiotic polymicrobial dental plaque biofilm.[1] This triggers a dysregulated host immune response that sustains and perpetuates the inflammatory state.[2] The progressive destruction of the periodontal tissues ensues with gingival bleeding, periodontal pocketing, and eventual tooth loss.[2] *Porphyromonas gingivalis* has been postulated to play a prominent

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role in the dysbiosis that triggers periodontitis.[1,3] Periodontitis is characterized by dental plaque accumulation, gingival inflammation, soft tissue attachment loss, increased probing depth of the gingival sulcus, alveolar bone loss and, tooth mobility.[1,4] This results in impaired masticatory function, aesthetics and speech.[1] It could therefore be a basis for social inequality, and reduction in the quality of life with impairment of general health.[1,5] In recent years, periodontitis has gained significant clinical importance due to its recognition as a risk factor for some systemic conditions.[4,6]

Periodontal disease is highly prevalent among 35-45year-olds globally.[7] Severe periodontitis has been recognized as the sixth most prevalent health condition affecting 743 million people worldwide.[8] The reported prevalence of periodontitis in Nigeria is between 42.6 to 48.9% in adults, [9,10] and as high as 73.9% in the elderly.[11] Periodontal disease is a significant oral health problem in Africa especially with the challenges in oral health-care delivery.[12,13] Certain risk factors such as male gender, increasing age, poor oral hygiene, low socioeconomic status, body mass index, and the certain periodontal microflora predispose individuals to periodontitis.[14]

The successful management and treatment of periodontitis include early and proper diagnosis, identifying and controlling contributing factors and long-term supportive therapy.[15] An understanding of the demographic and clinical characteristics of individuals with periodontitis will impact positively on its contemporary management and treatment. The purpose of this study was to determine the demographic, clinical and microbiological characteristics of periodontitis in adults attending the Periodontology clinic of a teaching hospital in South-West Nigeria.

METHODOLOGY

Study Design
This study was part of a larger study involving the assessment of periodontopathogens in the subgingival plaque of adult patients with periodontitis at the Periodontology clinic of Lagos University Teaching Hospital (LUTH), Lagos, Nigeria between June, 2015 and August, 2016.[16] Patients were diagnosed with periodontitis according to the case definition by the American Academy of Periodontology/Center for Disease Control and Prevention (AAP/CDC) Joint Group.[17] Patients 20 years and older, with an absence of any medical history of systemic illness, with at least 12 teeth excluding the third molars were included in the study. Pregnancy or nursing mothers, periodontal

therapy in the 6 months prior to the study, use of topical oral or systemic antibiotics in the last 3 months, use of anti-inflammatory, immunosuppressant, anti-convulsant or calcium-channel blocker medications and a history of smoking were the exclusion criteria. All patients who met the criteria for inclusion within the study period were recruited.

Data collection
Data was collected from each subject using a semi-structured interviewer-administered, questionnaire based on standard of care for periodontal examination. Information on the subjects' age, sex, weight, height, oral hygiene practice and dental visits and previous history of periodontitis. were recorded. The participants' heights and weights were measured and the body mass index (BMI) was calculated as a ratio of an individual's weight in kilograms (kg) to the square of their height in metres (m^2). The BMI was categorised into underweight = <18.5 kg/m^2, normal weight = 18.5 to 24.9kg/m^2, overweight = 25 to 29.9kg/m^2 and obesity $\geq$30kg/m^2.

A single investigator conducted the full mouth periodontal examination using a dental mouth mirror and University of North Carolina (UNC)-15 periodontal probe, (Hu-Friedy, Chicago, Illinois, USA), which has a blunt rounded tip with graduations from 1-15 millimeter (mm). The examination included the of number of teeth present and missing, mobile teeth, oral hygiene status, gingival status, sites with bleeding on probing (BOP), periodontal probing depth (PPD), gingival recession and clinical attachment loss (CAL). The Simplified Oral Hygiene Index (OHI-S),[18] Plaque Index (PlI)[19] and. the Gingival Index (GI)[20] were used in assessing the oral hygiene status and gingival health status respectively. The periodontal probing depths (PPD), clinical attachment loss (CAL) and, gingival recession on six sites (mesio-buccal, mid-buccal, disto-buccal, disto-lingual, mid-lingual and mesio-lingual) of all teeth present excluding the third molars were measured and approximated to the nearest millimeter.

Plaque sample collection and analysis
The full microbiological protocol has been previously outlined.[16] Subgingival plaque samples were collected a week later on the second visit to allow recovery of the tissues after the periodontal probing. The two PPD sites with the least depth of $\leq$3mm and the greatest depth of >3mm were selected in each subject. The indicated teeth were isolated and sampled twice for subgingival plaque to obtain

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four samples from each subject. Anaerobic culture and Polymerase chain reaction (PCR) analysis were performed to detect the presence of *Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Prevotella intermedia, Fusobacterium nucleatum, Tannerella forsythia* and *Treponema denticola* respectively. One sample each from the PPD ≤3mm and PPD >3mm sites were cultured. Both samples had their bacterial DNA extracted and amplified with PCR using 16S rRNA species-specific primers. The PCR products were analysed using 1.5% agarose gel electrophoresis.[16]

Data analysis

Data entry, validation and analysis were done using Statistical Package for Social Sciences (SPSS) version 17.0 (IBM Inc., Chicago, USA). Continuous variables such as age, body mass index (BMI), PlI, GI, PPD, CAL etc., were presented as mean and standard deviation (SD) where they fulfilled the assumptions of normality otherwise, they were presented as median and interquartile range (IQR). Categorical variables such as gender, oral hygiene practice, oral health behaviour and presence/absence of periodontopathogens etc., were summarised as frequencies and percentages. Independent variables and severity of periodontitis were dichotomized, and Fisher's exact test was used to determine the association between them. Significant associations were determined at $P < 0.05$.

Ethical Approval

Ethical approval was obtained from the Health Research and Ethical Committee (HREC) (ADM/DCST/HREC/1944) of LUTH, Lagos, Nigeria.

RESULTS

Demographics

Forty-two consecutive patients who met the inclusion criteria were conveniently sampled for the study, with a male to female ratio of 1.5:1. The mean age was 56.7 ± 13.4 years. Thirty-one (73.8%) of the subjects were of the Yoruba ethnic group. Slightly more than half, 24 (54.8%) of the subjects had attained a tertiary level of education. Their demographics are described in Table 1.

Oral hygiene practices

The oral hygiene practice and the pattern of dental visits of the participants are outlined in Table 1. A high proportion of them (85.7%) used toothbrush and paste to clean their teeth with 71.4%, cleaning only once a day. Close to three quarter of the

participants (69.0%) had visited a dentist prior to the study. Almost half (44.8%) of those who had been attended to by a dentist claimed they had never been told they had periodontal disease.

Table 1: Demographics, oral hygiene practice, dental visits and history of periodontitis of patients with periodontitis (n = 42)

Variables	Frequency (%)
Sex	
Male	25 (59.5)
Female	17 (40.5)
Age	
21 – 39 years	1 (2.4)
40 – 59 years	26 (61.9)
60 years and above	15 (35.7)
BMI categories (kg/m²)	
Underweight (<18.5)	1 (2.4)
Normal (18.5 - 24.9)	14 (33.3)
Overweight (25 - 29.5)	19 (45.2)
Obesity (≥ 30)	8 (19.0)
Education	
None	2 (4.8)
Primary	6 (14.3)
Secondary	11 (26.2)
Tertiary	23 (54.8)
Mouth cleaning aids	
Toothbrush and paste	36 (85.7)
Chewing stick	4 (9.5)
Both	2 (4.8)
Frequency of toothbrushing	
Once a day	30 (71.4)
Twice a day	11 (26.2)
More than twice a day	1 (2.4)
Technique of toothbrushing	
Up and down	15 (35.7)
Side to side	16 (38.1)
Both	11 (26.2)
Last dental visit	
Less than 6 months	3 (7.1)
6 to 12 months	5 (11.9)
More than 12 months	21 (50.0)
Never	13 (31.0)
Last scaling and polishing	
6 to 12 months	4 (9.5)
More than 12 months	17 (40.5)
Never	21 (50.0)
Previous diagnosis of periodontitis	
No	29 (69.0)
Yes	13 (31.0)
Treatment of periodontitis	
No	39 (92.9)
Yes	3 (7.1)
Family history of periodontitis	
No	24 (57.1)
Yes	6 (14.3)

BMI = Body mass index

Clinical parameters

Regarding their clinical parameters, only a few of the participants (11.9%) had good oral hygiene according to the Simplified Oral Hygiene Index (OHI-S). The mean periodontal probing depth of diseased sites was 5.53 ± 0.98mm. The highest prevalence of periodontitis was in the 40 - 59 years age group.

With regard to extent of periodontitis, slightly less than half (47.6%) of the participants had generalized periodontitis while only 9.5% of the participants had severe periodontitis. Other clinical parameters are shown in Table 2. None of the variables were statistically significantly associated with the severity of periodontitis (Table 3).

Table 2: Clinical parameters of patients with periodontitis (n = 42).

Parameter	Summary Indices
Number of teeth present	24.19 ± 4.0
PlI	1.24 ± 0.51
GI	1.39 ± 0.43
PPDall (mm)	3.12 ± 0.70[14]
Number of teeth affected	13.0 (8.0 - 19.0)*
Number of missing teeth	4.0 (1.0 - 5.0)*
Number of mobile teeth	6.0 (2.0 - 9.0)*
OHI-S	2.20 (1.67 -3.0)*
PPDx (mm)	5.18 (4.69 - 5.76)*
GR (mm)	2.60 (2.0 - 3.67)*
CAL (mm)	3.29 (2.43 – 4.83)*
Number of bleeding sites	33.0 (16.0 – 54.0)*
Number of sites with periodontitis	39.0 (17.0 -58.0)*
Oral Hygiene Index	
Poor	16 (38.1%)
Fair	21 (50.0%)
Good	5 (11.9%)
Severity of periodontitis	
Mild	16 (38.1%)
Moderate	22 (52.4%)
Severe	4 (9.5%)
Extent of periodontitis	
Localised	22 (52.4%)
Generalised	20 (47.6%)

SD = Standard deviation, OHI-S = Simplified Oral Hygiene Index, PlI = Plaque Index, GI = Gingival Index, PPDall = Periodontal probing depth of all sites, PPDx = Periodontal probing depth of diseased sites, CAL = Clinical attachment loss, GR = Gingival recession, * = Median (interquartile range)

Table 3: Association of demographics, oral hygiene practice and, oral health behaviour of patients with severity of periodontitis (n = 42)

Variable	Mild/Moderate periodontitis	Severe periodontitis	n (%)	P value*
Age (years)				
< 50	1 (100.0)	0 (0.0)	1 (100.0)	1.000
≥ 50	37 (90.2)	4 (9.8)	41 (100.0)	
Gender				
Male	21 (84.0)	4 (16.0)	25 (100.0)	0.134
Female	17 (100.0)	0 (0.0)	17 (100.0)	
BMI				
< 25.0 (kg/m²)	14 (93.3)	1 (6.7)	15 (100.0)	1.000
≥ 25.0 (kg/m²)	24 (88.9	3 (11.1)	27 (100.0)	
Education				
< Secondary	15 (88.2)	2 (11.8)	17 (100.0)	1.000
≥ Secondary	23 (92.0)	2 (8.0)	25 (100.0)	
Frequency of toothbrushing				
Once daily	26 (86.7)	4 (13.3)	30 (100.0)	0.308
Twice or more daily	12 (54.5)	0 (0.0)	12 (100.0)	
Technique of toothbrushing				
Up and down	14 (93.3)	1 (6.7)	15 (100.0)	1.000
Others	24 (88.9)	3 (11.1)	27 (100.0)	
Last dental visit				
Ever	27 (83.1)	2 (6.9)	29 (100.0)	0.576
Never	11 (84.6)	2 (15.4)	13 (100.0)	
Last scaling and polishing				
Ever	19 (90.5)	2 (9.5)	21 (100.0)	1.000
Never	19 (90.5)	2 (9.5)	21 (100.0)	
Previous diagnosis of periodontitis				
Yes	12 (92.3)	1 (7.7)	13 (100.0)	1.000
No	26 (89.7)	3 (10.3)	29 (100.0)	
Previous treatment for periodontitis				
Yes	3 (100.0)	0 (0.0)	3 (100.0)	1.000
No	35 (89.7)	4 (10.3)	39 (100.0)	
Oral hygiene index				
Poor/Fair	33 (89.2)	4 (10.8)	37 (100.0	0.134
Good	5 (100.0)	0 (0.0)	5 (100.0)	

P value* = Fisher's exact test

Table 4: Association of periodontopathogens with severity of periodontitis (n = 42)

Bacteria		Severity of Periodontitis		n (%)	P value*
		Mild/ Moderate n (%)	Severe n (%)		
AA	NEG	36 (90.0)	4 (10.0)	40(100.0)	1.000
	POS	2 (100.0)	0 (0.0)	2 (100.0)	
PG	NEG	24 (96.0)	1(4.0)	25(100.0)	0.285
	POS	14 (82.4)	3 (17.6)	17(100.0)	
PI	NEG	20 (90.9)	2 (9.1)	22(100.0)	1.000
	POS	18 (90.0)	2 (10.0)	20(100.0)	
FN	NEG	19 (86.4)	3 (13.6)	22(100.0)	0.608
	POS	19 (95.0)	1 (5.0)	20 (1.00)	
TF	NEG	36 (90.0)	4 (10.0)	40(100.0)	1.000
	POS	2 (100.0)	0 (0.0)	2 (100.0)	
TD	NEG	37 (90.2)	4 (9.8)	41(100.0)	1.000
	POS	1 (100.0)	0 (0.0)	1 (100.0)	

AA = A. actinomycetemcomitans, PG = P. gingivalis, FN = F. nucleatum, PI = P. intermedia, TF = T. forsythia, TD = T. denticola, NEG = Negative, POS = Positive, P value* = Fisher's exact test

Microbiological features

The occurrence of *Aggregatibacter actinomycetemcomitans, Porphyromonas gingivalis, Prevotella intermedia, Fusobacterium nucleatum, Tannerella forsythia* and *Treponema denticola* in the subgingival plaque of the participants, are described in a previous article.[16] A combination of culture and PCR detected the presence of at least one of the six periodontal pathogens in 73.8% of the participants, with *P. intermedia* being the overall most prevalent at 54.8%.[16] *P. intermedia* and *F. nucleatum* were equally prevalent in the sites of periodontitis i.e. PPD >3mm (Table 4). None of the periodontopathogens was statistically significantly associated with the severity of periodontitis. Table 4 shows the association of the presence of the bacteria with the severity of periodontitis.

DISCUSSION

Although not statistically significant, the higher number of males than females with periodontitis in this study compares with other reports.[17,21] However, a study among a Nigerian population, has reported a higher female preponderance.[9] A higher male preponderance observed in another report, posits that the higher occurrence of periodontitis in men compared to women could be attributed to the inter-
ference of sex biology with gender social and behavioural constructs which eventually affects the disease clinical phenotype.[22] It is therefore not surprising to find that the higher frequency of periodontitis in males than females has been related to poorer oral hygiene, less positive attitudes

towards oral health and poorer dental-visit behavior among males.[17,21]

The peak age of prevalence of periodontitis in this study were in the middle-ages and it collaborates with what has been previously reported, where most adults with periodontitis are 40 years and over.[7,15] The higher occurrence with increasing age is not unexpected and has been attributed to the cumulative effects of plaque bacteria and its pathologic potentials over time.[20] Furthermore, in this environment, irregular or poor dental clinic attendance by most individuals is common practice. The frequent reason for dental visits among Nigerians is problem based.[23] This results in late clinical presentation in their later years when features of the disease might have begun to interfere with their daily activities, especially mastication. The problems of low awareness of oral health, poor education and low socioeconomic status as well as poor access to and inadequate oral healthcare facilities may play a role in the late presentation particularly as patients get older.[12,13] The findings of the present study also underscores this point of late presentation or irregular visits as about a third had never attended a dental clinic beforehand while half had attended well over 12 months ago.

The body mass index (BMI) has been associated with periodontitis.[24] Modulation of the host immune response by obesity is known to cause an increased susceptibility to infections.[25] Adipocytes trigger a systemic proinflammatory state by the release of inflammatory mediators and this may interfere with host response to the microbial challenge of periodontitis.[25] In a systematic review by Suvan and his colleagues, following the meta-analysis it was concluded that independent of traditional risk factors, obesity and overweight/obesity together are 1.8 times and 2.3 times respectively, more likely to place individuals at risk of periodontitis compared to normal-weight.[24] However, in the present study, BMI was not found to be significantly associated with severity of periodontitis.

The educational status and occupation were not significantly associated with the severity of periodontitis in the present study. This is despite the fact that direct relationships between low socioeconomic status and low educational level and the presence and severity of periodontal diseases have been described.[26] It has been pointed out that socioeconomic conditions can influence patterns of health behaviour and health-related beliefs and thus low socioeconomic status has been associated with the presence of severe periodontitis.[17] Periodontitis has been reported to inflict an especially higher burden on older, disadvantaged population with lower socioeconomic status and shown to considerably impact on the individual and community in terms of pain, suffering, loss of function and reduced quality of life.[8] Our finding is however supported by a study conducted among Nigerians which did not observe a positive association between low socioeconomic status and periodontal disease.[27] This may be due to the rather small sample size and the location of the study in a cosmopolitan city where the participants may have more access to oral health related information.

Poor oral hygiene practice can increase bacterial plaque accumulation and lead to a microbial flora predisposed to a dysbiotic pathogenic state but does not seem to influence the host immune response.[21] Rather, poor oral hygiene and plaque accumulation have been found to have minimal link with the severity of periodontitis.[21] Nevertheless meticulous oral hygiene is paramount to preventing periodontitis and improving treatment outcome.[15]

The few numbers of participants with a previous diagnosis of periodontitis and had not received treatment prior to the study further underscore the poor attitude to oral health. This may be due to ignorance and the insidious, chronic and painless course of periodontitis until the onset of complications. Interference with daily activities such as mastication, prompts the individual to seek professional care.

The low number of patients with severe periodontitis is in consonance with reported findings.[7] About 5-20% of the adult population globally, have severe periodontitis which leads to tooth loss.[5] Also, systemic conditions such as cardiovascular disease, diabetes, and rheumatoid arthritis are conditions which may arise as complications of severe periodontitis.[4,6] Above 65 years, the occurrence of severe periodontitis remains constant at less than 15%.[17] This seemed to play out in this study, as only 6.67% of the participants above 60 years had severe periodontitis. This may be attributed to the reduced number of teeth in the mouth following tooth loss in older persons. Assessment of tooth loss is a prominent feature of the current classification of the severity of periodontitis, where loss of 5 teeth or more is included in the Stage IV category (as well as CAL of ≥5mm and radiorapic bone loss extending to te mid-tird of the root and beyond.[1]

A. actinomycetemcomitans, P. gingivalis, P. intermedia, F. nucleatum, T. forsythia and, *T. denticola* are gram-negative facultative or strict anaerobes that have been implicated in destructive periodontal disease.[28] *P. gingivalis*, *T. forsythia* and

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T. denticola are considered to be the most important periodontal pathogens and make up the red complex in subgingival bacterial plaque.[2] *P. intermedia* was the most prevalent of the six periodontopathogens among the participants.[16] Likewise, *P. gingivalis,* considered a "keystone" pathogen, was more prevalent in sites of severe periodontitis.[2,3] There was no co-occurrence of the components of the red complex in any of the periodontal sites sampled.[16] This study found the severity of periodontitis to be independent of the detected six periodontopathogens. It has been pointed out that diet, culture, and genetic background, may influence the presence of periodontopathogens in subgingival plaque.[29] Also, the sample size, sample selection, subgingival plaque sampling technique, culture and, the molecular techniques utilized, may affect the detection of specific bacteria in subgingival plaque samples.[29] The findings in this study may be attributed to low rate of detections of the periodontopathogens in the subgingival plaque as well as the small number of patients sampled.

CONCLUSION

In this study, periodontitis was more frequent in males and the middle-aged. Oral hygiene practices and oral hygiene were poor. Severe periodontitis was not a common feature of periodontitis. Majority of the periodontopathogens were detected in mild/moderate periodontitis. The age, gender, educational qualification, BMI, oral hygiene and the periodontopathogens detected did not have any significant association with the severity of the disease in this population.

We recommend that early and regular dental visits among Nigerians needs to be promoted to detect periodontitis in its initial and mild stages to improve treatment outcome and prevent the attendant oral and systemic effects. Proper patient education and motivation, lifestyle changes (involving enhanced oral hygiene practices and oral health behavior) and long-term supportive periodontal therapy are critical to positive treatment outcome and the subsequent maintenance of periodontal health.[15]

A limitation of this study was the small sample size, with an almost ethnically homogenous population. A better generalization of findings will require further studies involving multiple tertiary health centers with larger and more diverse population of adult Nigerians with periodontitis.

Conflicts of interest

The authors declare no conflict of interest

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