

Comparative periodontal status of human immunodeficiency virus-positive patients and controls in a dedicated human immunodeficiency virus clinic in Nigeria

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Abstract

Background: There are diverse reports on the prevalence and severity of chronic periodontitis in human immunodeficiency virus (HIV) positive persons. Few studies have been carried out in developing countries in Sub-Saharan Africa. This study was aimed at comparing the prevalence and severity of chronic periodontitis of HIV-seropositive patients with that of HIV-seronegative persons using the community periodontal index (CPI).

Methodology: This was a comparative study of the periodontal status of 110 HIV-positive subjects and 110 age and gender-matched HIV-negative controls attending a dedicated HIV Clinic in a Teaching Hospital in Lagos, Nigeria. The CPI and simplified oral hygiene index score were used in the periodontal examination. Highest CPI scores and percentages of CPI sextants assessed the prevalence and severity of chronic periodontitis respectively. Logistic regression was used in adjusting demographic differences in the study population. $P \leq 0.05$ was considered as significant.

Results: A significant proportion of the HIV-positive patients 61 (55.5%) and the HIV-negative controls 53 (48.7%) had shallow pockets (4–5 mm) (CPI code 3). The prevalence of deep pockets (≥ 6 mm) (CPI code 4) was higher among HIV-positive patients 9 (8.2%) than the controls 4 (3.5%) ($P = 0.079$). HIV-positive patients had a greater percentage of CPI codes 3, 4 and fewer CPI code 0 sextants than controls ($P = 0.000$). Both groups had comparable oral hygiene status ($P = 0.209$). Using a logistic regression analysis, HIV-positive status and lower education accounted for the greater severity of chronic periodontitis.

Conclusion: HIV-seropositive patients had more severe chronic periodontitis than the HIV-seronegative controls, which was independent of lower education.

Key words: Chronic periodontitis, community periodontal index, human immunodeficiency virus -positive, Nigeria

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Introduction

Exacerbated chronic periodontitis is part of the spectrum of periodontal diseases that has been described in association with the human immunodeficiency virus (HIV) infection. As far back as the early 1990s, studies exploring the possible

influence of HIV infection on conventional chronic periodontitis reported severe gingival inflammation and attachment loss in HIV-seropositive patients^[1,2] compared with HIV-negative controls.^[3] Most of these studies were

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cross-sectional in design, although these findings were refuted in other studies among Caucasian and African HIV-positive individuals respectively.^[4,5] In an earlier longitudinal study, no differences were found in the proportion of sites affected by attachment loss at 1 mm, 2 mm or 3 mm thresholds at either time interval between the 19 HIV positive persons and 17 HIV-negative controls.^[4] The more severe and extensive periodontal attachment loss observed among the HIV-positive group at baseline compared with the HIV-negative controls was attributed to their higher prevalence of smoking and poorer oral hygiene.

More recent well-controlled studies from developed^[6,7] and developing countries^[8] have equally provided conflicting results. The cross-sectional Indian study carried out among HIV-positive patients using the community periodontal index (CPI) of Treatment Needs revealed significant greater periodontal breakdown in the HIV-positive cohort than age-matched controls.^[8] These observations are not surprising considering the deterioration in the immune system of the host. This is hall-marked by the gradual depletion of CD4-T-cells resulting in neutrophil hyperactivity and consequent destruction of the periodontal tissues. It has been suggested that interleukin (IL-18) is elevated in HIV-positive patients and may thus play a role in the degree of periodontitis observed in HIV-positive patients.^[9]

In spite of these reports, other recent studies failed to show differences in the severity of chronic periodontitis between HIV-positive and HIV-negative individuals.^[10] The variation in the prevalence of chronic periodontitis has been attributed to methodological and racial differences.^[4,11] It is interesting to note that most of these studies have been conducted in well-developed countries, with few in Sub-Saharan Africa, which bears the largest burden of the HIV infection epidemic, accounting for over 60% of those affected with HIV.^[12] A South African study did not find any significant differences in clinical parameters such as bleeding on probing, pocket depth or attachment loss measurements between HIV-positive and age-matched HIV-negative controls and the low CD4 + T-cell count did not appear to be a risk factor for increased severity of chronic periodontitis among the HIV-positive subjects.^[13]

It is an irony that Nigeria with the second highest number of people, an estimated 3.2 million living with HIV^[12,14] has a few published reports on the periodontal status of HIV-positive persons. Recently, a Nigerian study reported the prevalence of periodontitis as 63.3% among HIV-positive patients.^[15] Whether this prevalence differs from that of the HIV-uninfected population is not known. The aim of this study was therefore to compare the periodontal status of HIV-infected patients in Nigeria with that of an

HIV-negative control group using the CPI, a tool developed by the World Health Organization for its simplicity and uniformity.^[16]

Methodology

Ethical approval

The study was in accordance with the declaration of Helsinki and was approved by the Health Research and Ethics Committee of the Institution.

Study design

This was a comparative cross-sectional, analytical study carried out at a dedicated HIV-Outpatient clinic in Nigeria. The hospital is a major referral center for most peripheral hospitals in the Lagos Metropolis of South Western Nigeria and serves a catchment population of over 18 million people of diverse ethnicity. The HIV-Outpatient clinic is a clinic dedicated to HIV-positive patients and doubles as a voluntary counseling and testing center.

Sampling and inclusion/exclusion criteria

A convenience sample of new, consecutive, confirmed HIV-seropositive patients was used. The inclusion criteria included being 18 years of age and not yet on anti-retroviral therapy. The control group consisted of age and gender-matched HIV-negative controls attending the same clinic for voluntary counseling and testing. Exclusion criteria were diabetes mellitus, current smoking habit, pregnancy, and periodontal therapy in the preceding 6 months.

Study instrument and assessment of selected periodontal parameters

Semi-structured, self-administered questionnaires were used to obtain information on the sociodemographic characteristics of the participants. This was followed by periodontal examination of the patients while seated comfortably in an upright chair in a well illuminated room. The CPI according to the WHO criteria and the Simplified oral hygiene index were utilized in assessing the periodontal status and oral hygiene status of the participants respectively.^[16,17] A single examiner (the lead author) carried out these assessments thus eliminating inter-examiner variability. The highest CPI score was recorded for each subject and was used to determine the prevalence of chronic periodontitis. The CPI parameters included CPI score 0 representing healthy periodontal status, CPI 1 (bleeding), CPI 2 (calculus), CPI 3 (shallow pocket) and CPI 4 (deep pocket). The number and percentages of CPI sextants were used to assess the severity of chronic periodontitis. Sextant analyses were performed to overcome the limitations of CPI in assessing periodontal status. The values of the CD4 + cell counts determined at the time of periodontal examination were obtained from the patients' hospital record.

Statistical analysis

Data were analyzed using SPSS 17 (SPSS Inc. Chicago, USA) statistical software. Pearson’s Chi-square tests of association, *t*-test and analysis of variance were used to compare qualitative and quantitative variables where appropriate. Logistic regression analysis was used to determine the association between HIV status and severity of periodontitis (CPI sextants with codes 3, 4) while adjusting for significant demographic variables in the bivariate analysis. Analyses were performed at 95% confidence level therefore $P \leq 0.05$ was considered statistically significant.

Results

Socio-demographics

A total of 110 HIV-positive patients and 110 HIV-negative controls were enrolled into the study. Of the HIV-positive patients, 76 (69.1%) were females and 34 (30.9%) were males, giving a female: male ratio of 2.2–1. The mean age (standard deviation) of the HIV-positive patients and HIV-negative controls were 35.4 (± 10.2) years and 34.9 (± 10.5) years respectively ($P = 0.734$). Secondary school education was the level attained by most 53 (48.2%) of the HIV-positive patients while the tertiary level of education was predominant in most 47 (42.7%) of the HIV-negative controls. The association between educational level and HIV status was significant ($P = 0.001$). Unskilled workers constituted the majority occupation in both HIV-positive patients 54 (49.1%) and HIV-negative subjects 35 (31.8%), as shown in Table 1. However, HIV-positive patients had significantly fewer professionals (10%) than the HIV-negative controls (27.3%) ($P = 0.005$) [Table 1].

Oral hygiene status

Most of the HIV-positive patients (52.7%) had a fair oral hygiene, which was comparable to that of the HIV-negative

controls (52.7%). Although, more of the HIV-positive patients (16.4%) had poor oral hygiene compared to the HIV-negative controls (9.1%), the difference was not statistically significant ($P = 0.209$).

Prevalence of chronic periodontitis in the study population

Figure 1 shows the prevalence of chronic periodontitis in the study population. Most (55.5%) of the HIV-positive patients had shallow pockets (CPI 3), followed by calculus (CPI 2) (33.6%). Shallow pockets were also predominant in the HIV-negative controls (48.2%), followed by Calculus in 37.3%. Although, the HIV-infected

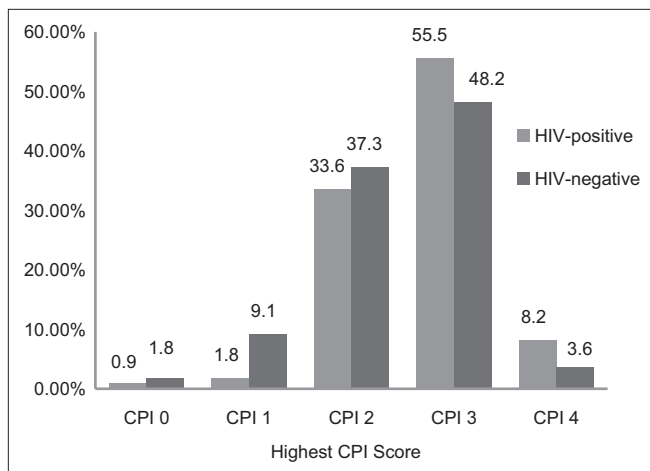


Figure 1: Prevalence of chronic periodontitis in study population

Table 1: Baseline characteristics of study population

Variable	n (%)		P
	HIV-positive	HIV-negative	
Age group (years)			
19-24	14 (12.7)	17 (15.5)	0.846
25-34	45 (40.9)	43 (39.1)	
35-44	35 (31.8)	30 (27.3)	
45-54	16 (14.7)	14 (12.7)	
55 and above	6 (5.5)	6 (5.5)	
Gender			
Female	76 (69.1)	78 (70.9)	0.883
Male	34 (30.9)	32 (29.1)	
Education			
None/primary	35 (23.6)	20 (18.2)	0.001*
Secondary	53 (48.2)	43 (39.1)	
Tertiary	22 (20.0)	47 (42.7)	
Occupation			
Professional	11 (10.0)	30 (27.3)	0.005*
Skilled	27 (24.5)	27 (24.5)	
Unskilled	54 (49.1)	35 (31.8)	
Unemployed	18 (16.4)	18 (16.4)	
Oral hygiene status			
Good	34 (30.9)	42 (38.2)	0.209
Fair	58 (52.7)	58 (52.7)	
Poor	18 (16.4)	10 (9.1)	
Severity of periodontitis by CPI sextants			
0	101 (14.3)	179 (27.1)	0.000*
1	76 (11.5)	73 (11.1)	
2	339 (51.4)	312 (47.3)	
3	130 (19.7)	92 (13.9)	
4	14 (2.1)	4 (0.6)	

*Statistically significant. CPI=Community Periodontal Index

Table 2: Association of CD4+ cell counts with severity of chronic periodontitis

	CPI sextants		P
	0, 1, 2	3, 4	
Mean CD4+ cell count (cells/mm ³) (\pm SD)	246.1 \pm 191.9	268.4 \pm 183.3	0.623

SD=Standard deviation; CPI=Community Periodontal Index

Table 3: Logistic regression of factors associated with severity of chronic periodontitis

Independent variables	B	SE	Wald	Significant	OR	95% CI
HIV status						
Positive/negative	0.968	0.433	4.994	0.025*	2.633	1.126-6.154
Occupation						
Unskilled/professional	0.719	0.491	2.142	0.143	2.052	0.784-5.376
Education						
Tertiary/Secondary or less	0.992	0.462	4.612	0.032*	2.698	1.091-6.674
Constant	-2.900	0.523	30.793	0.000	0.055	

The dependent variable is severe periodontitis. CI=Confidence interval; SE=Standard error; OR=Odds ratio. *Statistically significant

patients had a higher percentage of deep pockets (CPI 4) than the controls (8.2% vs. 3.6% respectively) the difference failed to attain statistical significance ($P = 0.079$).

Severity of chronic periodontitis in the study population

The association between the severity of chronic periodontitis and HIV status was determined using bivariate analysis [Table 1]. The HIV-positive patients had a higher percentage of CPI sextants with codes 3 and 4 (19.7% and 2.1% respectively) compared to the HIV-negative controls (13.9% and 0.6% respectively). Also of note were the fewer percentages of healthy CPI sextants (code 0) in the HIV-positive patients (15.3%) than the HIV-negative controls (27.1%). These associations were statistically significant ($P = 0.000$). Table 2 reveals the relationship between severity of periodontitis and CD4 + cell counts, which did not find any statistically significant association ($P = 0.623$). After adjusting for the effect of education and occupation in the regression model, the independent factors accounting for the greater severity of periodontitis in HIV-positive patients were HIV infection and lower level of education [Table 3].

Discussion

The present study compared the periodontal status of HIV-positive patients against HIV-negative controls in Nigeria. As far as the authors know, this is the first documented study reporting this. This study indicates that HIV-positive patients have the significantly greater severity of chronic periodontitis than age and gender matched, healthy HIV-negative controls. This was reflected by the higher number of CPI sextants with codes 3 and 4 in the HIV-positive patients (21.8%) than the HIV-negative controls (14.5%). It was further supported by the fewer CPI sextants with code 0 among the HIV-positive patients (14.3%) than in the HIV-negative controls (27.1%). This finding is in agreement with the Indian study from another developing country.^[8] The Indian cross-sectional study is similar to the present study in that a comparable periodontal index was used to assess the periodontal status.^[8] They reported the significantly greater number of CPITN sextants with shallow and deep pockets among HIV-positive patients than age-matched presumably

HIV-negative controls with similar socio-economic status. Thus, subjects in the control group had better periodontal health compared with the HIV-positive patients. However, their presumption for the HIV-negative group could affect the reliability of their findings.

In another related study among HIV-infected persons in Poland, more advanced periodontal changes were observed in the HIV-infected subjects such that as HIV infection time increased, there was decrease of the number of healthy CPI sextants, compared to the HIV-negative subjects.^[7] This may be due to the deterioration in their immune system, characterized by a gradual depletion of the CD4 lymphocytes, which compromises the dento-gingival region. Higher levels of potent pro-inflammatory cytokines such as IL-8 have been described in HIV infection and believed to contribute to the etiopathogenesis of periodontitis observed in HIV-positive patients.^[9]

Overall, the prevalence of combined shallow and deep pockets (CPI codes 3, 4) in the present study was 63.7%. This was much higher than that of the HIV-negative controls (51.7%). The higher prevalence figures observed in the present study may be attributable to the poor dental visiting behavior observed among Nigerians generally.^[18,19] These values are considerably high for persons in age groups below 45 years, but are still much lower than the Indian study, which was 78.3% and 58.6% in HIV-positive and presumably HIV-negative respectively.^[8] The generally low socioeconomic status of the Indian subjects could have accounted for this observation. Our findings contrast against a previous study in Tanzanian, which failed to detect any significant difference in bleeding on probing, pocket depth and attachment loss between HIV-seropositive and HIV-seronegative controls.^[5] The current study however, excluded some important confounders for chronic periodontitis such as smoking and diabetes which have been identified as important risk factors in the prevalence and severity of periodontitis. The present study highlighted the effect of lower education on the severity of periodontitis, which has been documented in literature.^[20] HIV-positive status remained an independent risk factor to the severity of periodontitis in this cohort. The present study was cross-sectional by design and

may be limited in actually proving a causal relationship between HIV infection and severity of periodontitis. It has however provided baseline data upon which future longitudinal studies can be conducted. It is noteworthy that there may be difficulties in conducting studies on the natural association between HIV infection and chronic periodontitis for ethical reasons.

Significant education and occupation-related differences were noticed between the HIV-positive and HIV-negative groups in the present study. In spite of these observations, few well controlled studies^[5,13,21] exist on the prevalence and severity of chronic periodontitis in sub-Saharan Africa. The fact that the patients seen in the present study were recruited from outpatient medical clinics, instead of the dental clinics could also explain the lower prevalence of chronic periodontitis in the study. The patients in this study were also mostly seen immediately after HIV diagnosis, at the early stage of the infection, thus implying a lesser time for more severe chronic periodontitis to develop.

Furthermore, higher mean CD4+ cell counts ≥ 200 cells/mm³ may explain the low prevalence of deep pockets (CPI code 4), which is more common among persons with immunosuppression as corroborated by a Finnish report.^[6] The higher prevalence and severity of chronic periodontitis observed among the HIV-positive patients than the HIV-negative subjects in this study underscores the importance of early diagnosis and treatment of chronic periodontitis, which can be achieved through regular maintenance dental recalls. Although, findings from a recent South-African study did not support our observation, the difference may be attributed to the fact that the control group in their study comprised subjects with unconfirmed, presumably HIV-sero-negative.^[13] Some of the controls could have been HIV seropositive, which may have affected the outcome of their findings. Another possible reason for the disparity may be connected with the difference in the criteria used to define chronic periodontitis in their study as they utilized periodontal probing depths and gingival marginal recession.^[13] However, the smaller sample size in their study may have also affected the outcome since a larger sample size was evaluated in the present study.

Although HIV-positive patients had poorer oral hygiene status than controls in the present study, the difference was not statistically significant. Hence, the poorer oral hygiene is unlikely to influence affect the greater severity of periodontitis observed among the HIV-positive patients. Moreover, it has been suggested the relationship of oral hygiene to periodontitis is less straightforward and may not affect the host response.^[22] Unfortunately, few studies are available in the literature to compare and validate these

findings. No doubt, there is an urgent need for well-designed longitudinal studies to clarify the grey areas between the periodontal status of HIV-positive and HIV-negative persons.

Conclusions

Human immunodeficiency virus -positive patients in this study had significantly poorer periodontal status than HIV-negative controls, which was attributed to their HIV infection and lower level of education.

This highlights the need for regular periodontal screening of HIV-positive patients and early treatment of diagnosed periodontitis while working in collaboration with HIV specialists to improve the overall quality of life of the patients.

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