

Oral lesions associated with HIV/AIDS in HIV-seropositive patients attending a counselling and treatment centre in Dar es Salaam

Ibrahim E. A. T. Mwangosi¹ and Jackline Tillya²

¹School of Assistant Dental Officers, Institute of Allied Health Sciences Muhimbili National Hospital, Dar es Salaam, Tanzania; ²Department of Health, Dar es Salaam City Council, Dar es Salaam, Tanzania.

Objectives: To assess the prevalences and patterns of oral lesions occurring in human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS). **Methods:** A cross-sectional study was conducted among 200 people living with HIV/AIDS (PlwHA) who regularly attended a counselling and treatment centre in Dar es Salaam, Tanzania. A questionnaire-guided interview and clinical oral assessment were used. Strict confidentiality and adherence to ethical codes were observed. **Results:** The mean age of participants was 38.91 years (standard deviation: 10.424; mode: 35 years; median: 37.0 years; range: 15–76 years). Most participants (58.5%) were aware of predispositions towards the occurrence of oral lesions such as oral candidiasis (60.0%) in HIV/AIDS and most of these (72.0%) were aware that the lesions are treatable. Some participants reported occurrences of oral thrush (22.5%) and lip ulcerations (28.5%), although only 47.0% of these had sought medical advice. Examinations revealed that 29.0% of participants had at least one oral lesion associated with HIV/AIDS. Prevalences of the various types of lesion were: 11.5% for herpes simplex; 7.5% for oral candidiasis; 4.0% for oral hairy leukoplakia; 3.5% for Kaposi's sarcoma; 1.5% for dry mouth; 0.5% for angular cheilitis, and 0.5% for acute necrotising ulcerative gingivitis. Herpes simplex and Kaposi's sarcoma were more frequently observed in males (56.5% and 71.4%, respectively), whereas oral candidiasis and dry mouth were observed more often in females (86.7% and 66.7%, respectively) ($\chi^2 = 16.692$, $P = 0.016$). **Conclusions:** Prevalences of oral lesions associated with HIV/AIDS in PlwHA and using antiretroviral therapy are persistent, of moderate intensity and vary according to individual immune status. These patients' level of awareness about oral lesions was satisfactory, but formal medicodental lines of management were not prioritised. Contemporary protocol for the management of oral lesions should be understood and disseminated to the general public by dentists.

Key words: HIV/AIDS, HIV-seropositive patients/PlwHA, oral lesions/oral manifestations

Various oral lesions are often strongly associated with longterm immune system depression, estimated according to CD4 cell counts, and are also commonly associated with viral load in plasma. Such lesions may thereby signal levels of human immunodeficiency virus (HIV) viraemia and its progressive impact on the immune system¹ because oral lesions associated with HIV and acquired immune deficiency syndrome (AIDS) very often occur early in the disease process^{2,3}. Prevalences of oral lesions associated with HIV/AIDS are now known to decline with increased use of various combinations of highly active antiretroviral therapy (HAART) and with strategic efforts to control opportunistic infections and diseases in HIV/AIDS⁴.

Previous studies have suggested that many dentists choose to refer patients identified with positive sero-conversion elsewhere, which can make it difficult for

persons with HIV to access dental care⁵. This preference has been attributed to low levels of knowledge among dentists both in practice and within training institutions in which the dental training curriculum does not emphasise the management of people living with HIV/AIDS (PlwHA)^{6–9}. Consequently, oral health care workers have maintained negative attitudes towards PlwHA, resulting in inadequate identification of oral lesions in such patients¹⁰. Older adults among the wider public have also wrongly believed themselves not to be at risk of HIV infection although 10% of PlwHA are aged > 50 years¹¹.

There have been many calls upon dentists to change their practices with regard to the provision of oral care to PlwHA. This has resulted in a revolution in dentistry and brought about the development of a problem-centred curriculum for training students and the

continuous education of oral health care workers of all cadres working at different levels of the profession and within various types of health care unit. These outcomes have contributed towards improvements in the quality of life of PlwHA through the provision of regular and routine oral clinical assessments, and the recording and management of oral lesions^{12–14}. In recent studies, PlwHA have shown high awareness of the general symptoms of HIV/AIDS, but insufficient awareness of oral manifestations, their presentation and management, although patients have demonstrated willingness to learn of contemporary updates¹⁵.

Oral lesions have a profound impact on the daily performance and quality of life of PlwHA. Pain, difficulties in eating, bad breath, altered taste and, occasionally, alterations in appearance predispose patients towards poor nutrition, which ultimately results in difficulties in building the body's defences against opportunistic infections and thereby supports a cycle of deterioration and loss of hope in affected patients¹⁵. Other reported discomforts include a dry mouth, discomfort or pain when brushing teeth, increased salivation and a burning sensation¹⁶. These symptoms affect not only patients, but also their relatives and the community at large because they result in the redirection of scarce resources towards the care of affected patients and thus may jeopardise other socioeconomic development activities¹⁷. The neglect of dietary needs and lack of attention to oral hygiene practices in PlwHA as they focus on HIV infection and the discomfort caused by the opportunistic infections and diseases associated with HIV/AIDS are suggested to result in increased susceptibility to periodontal breakdown and dental caries^{10–20}.

Various studies have identified a number of oral lesions associated with HIV and/or AIDS which occur with very minimal variation across the globe: 20–50% of PlwHA have at least one oral manifestation. The most commonly cited conditions include fungal, viral and bacterial infections^{3,20}. Neoplasms of periodontal disease, salivary gland disease and lesions of uncertain origin are also seen. Oral lesions such as candidiasis of diverse variants, oral hairy leukoplakia, herpetic ulcers and Kaposi's sarcoma often present as the first symptoms of HIV infection^{3,21}. The most predominant opportunistic infections in PlwHA include fungi such as *Candida albican* and viruses belonging to the herpes family, such as herpes simplex, herpes zoster and Epstein-Bar virus infections^{20,22}. The most isolated neoplasms are Kaposi's sarcoma and oral hairy leukoplakia^{23–26}.

Interventions by dentists through the early identification and management of oral lesions result in remarkable improvements and bring great relief to PlwHA^{27,28}. Such findings justify continued clinical screening for oral lesions among HIV/AIDS patients

and continued research in areas in which they lack information on the part of patients, oral health care workers and the public. A study carried out in Brazil demonstrated that, in areas in which access to medico-dental care is unavailable and antiretroviral drugs are scarce, the general, periodontal and dental health status of PlwHA was extremely poor²⁹.

A study carried out by Fabian *et al.*³⁰ in Tanzania reported the overall prevalence of oral manifestations associated with HIV/AIDS to be 45.0% and specific prevalences of candidiasis of 28.9% (mostly of the pseudomembranous type on the lips, mucosa or tongue) and non-tender lymphadenopathy of 11.8%. A study conducted in the municipality of Iringa found that 23.5% of PlwHA had at least one oral lesion associated with HIV/AIDS and reported prevalences of mucosal ulcerations with or without severe periodontal lesions of 7.0%, angular cheilitis of 7.0%, oral thrush of 6.5%, Kaposi's sarcoma of 1.5% and hairy leukoplakia of 1.0%³¹. The wide variations between findings of studies from the same country indicate a need for further investigation; hence this study was conducted.

METHODS

A cross-sectional study was performed in May 2009 among 200 patients previously diagnosed as seropositive for HIV, who regularly attended the Counselling and Treatment Centre (CTC) at Mwananyamala Hospital, Dar es Salaam, Tanzania for routine follow-ups and monthly collection of antiretroviral drugs. This sample size was considered to represent a reasonable proportion of the 400–600 patients who attend the CTC each month.

The relevant ethical research approvals were obtained from the Muhimbili University of Health and Allied Sciences and the Ministry of Health through the School of Assistant Dental Officers. Local permission to conduct the study was obtained from the Kinondoni Municipal Council, the Medical Officer-in-Charge for Mwananyamala District Hospital, the head of the CTC and all individual participants. Each patient attending the CTC who agreed to participate in the study was registered on each day of data collection for 3 weeks.

The study was conducted in full accordance with the World Medical Association Declaration of Helsinki. Verbal and written consent was sought from all participants and the confidentiality of responses was maximised. Any potential conflict of interest among the present researchers in relation to this work was entirely avoided.

Socioeducational status (age, educational level, gender) was recorded. Participants were asked to report any frequent manifestation of any oral symptom they considered to affect PlwHA. Participants were also

asked to recall and name any oral manifestation they had experienced at any time in the past. This interview was followed by a short clinical assessment of the participant's oral health status in which all soft and hard tissue lesions were noted, along with details of the site involved, according to the criteria defined elsewhere by Mwangosi and Majenge³¹. Participants who were not willing to join the study were excluded; the number of these was negligible ($n = 2$).

Analysis was performed using SPSS Version 11 (SPSS, Inc., Chicago, IL, USA). The individual was considered to represent a unit of analysis. Cross-tabulations and frequency distributions were deliberated across two age groups (15–39 years, ≥ 40 years), three educational levels (informal, primary, secondary and college) and gender (female, male). The chi-squared statistic was computed against a critical P -value of ≤ 0.05 for comparisons of significance.

RESULTS

The mean \pm standard deviation (SD) age of participants was 38.91 ± 10.424 years (mode: 35 years; median: 37.0 years; range: 15–76 years). Details are shown in Table 1. Table 2 shows that most participants (58.5%) were aware that HIV and AIDS predispose towards the occurrence of oral lesions such as oral candidiasis (60.0%); most of them (72.0%) were aware that these oral lesions are treatable. Some participants reported having had oral thrush (22.5%) and lip ulcerations (28.5%), but fewer than half of them (47.0%) had taken the correct measures and sought medical opinion.

Table 3 shows that 29.0% of the participants demonstrated the presence of at least one oral lesion

Table 1 Sociodemographic distribution of participants ($n = 200$)

Status	%	<i>n</i>
Age, years		
15–37	51.5	103
38–76	48.5	97
Gender		
Male	32.5	65
Female	67.5	135
Marital status		
Married	40.5	81
Single	36.5	73
Divorced	7.0	14
Widowed	16.0	32
Residence		
Urban	93.5	187
Rural	6.5	13
Educational status		
Informal (below grade 7)	19.5	39
Primary education	64.0	128
Secondary education	16.5	33

Most participants were female, from urban areas, with primary education, married and aged ≤ 37 years.

Table 2 Frequency distributions of positive responses to items on self-reported awareness, past experience and measures taken for oral lesions in people living with HIV/AIDS ($n = 200$)

Statement	Yes responses	
	%	<i>n</i>
General awareness of oral lesions in HIV/AIDS		
HIV and AIDS predispose to oral lesions	58.5	117
Oral thrush is an example of an oral lesion in HIV/AIDS	60.0	120
Lip ulceration can occur in people with HIV/AIDS	24.0	48
Haemorrhagic ulcerations can occur in people with HIV/AIDS	15.0	30
Oral lesions in HIV/AIDS are treatable	72.0	144
Past experience of the following oral lesions		
Oral thrush	22.5	45
Lip ulcerations	28.5	57
Haemorrhagic ulcerations	1.0	2
Measures taken in experiences of oral lesions in the past		
Correct measures taken (medical consultation at a hospital)	47.0	94

associated with HIV/AIDS and that more male than female participants were affected. The most frequently observed oral lesion was herpes simplex (11.5%, $n = 23$), followed by oral candidiasis (7.5%, $n = 15$), oral hairy leukoplakia (4.0%, $n = 8$), Kaposi's sarcoma (3.5%, $n = 7$), dry mouth (1.5%, $n = 3$), angular cheilitis (0.5%, $n = 1$) and acute necrotising ulcerative gingivitis (ANUG) (0.5%, $n = 1$).

Patterns of occurrence of oral lesions showed that herpes simplex and Kaposi's sarcoma were more frequently observed in males (56.5% and 71.4%, respectively) than in females (43.5% and 28.6%, respectively), whereas candidiasis and dry mouth were more frequently observed in females (86.7% and 66.7%, respectively) than in males (13.3% and 33.3%, respectively); these differences were statistically significant ($\chi^2 = 16.692$, $P = 0.016$). Variations in patterns of oral lesions according to educational status, marital status, residence and age were not statistically significant, although dry mouth was more common in patients with an informal educational status, and herpes simplex was more marked in patients with primary educational status. Cheilitis and Kaposi's sarcoma were only observed in patients with secondary educational status.

Table 4 shows that the lips (10.0%, $n = 20$) and tongue (8.0%, $n = 16$) were the most frequent sites of oral lesions observed in patients, most of whom had primary educational status (75.0% and 56.3%, respectively). Other affected sites included the palate (soft and hard) and oral commissures (3.0%, $n = 6$ each), the floor of the mouth (2.0%, $n = 4$), the whole oral cavity (1.5%, $n = 3$) and the buccal mucosa (1.0%, $n = 2$).

Table 3 Frequency distributions of oral lesions observed during examinations of people living with HIV/AIDS ($n = 200$) by gender and educational status

Lesions observed on clinical examination	Gender* ($\chi^2 = 16.692, P = 0.016$)				Level of education ($\chi^2 = 23.055, P = 0.059$)						Total	
	Male		Female		Informal		Primary education		Secondary education			
	%	<i>n</i>	%	<i>n</i>	%	<i>N</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
No abnormality	28.2	40	71.8	102	14.8	21	68.3	97	16.9	24	71.0	142
Kaposi's sarcoma	71.4	5	28.6	2	14.3	1	71.4	5	14.3	1	3.5	7
Oral candidiasis	13.3	2	86.7	13	33.3	5	53.3	8	13.3	2	7.5	15
Oral hairy leukoplakia	50.0	4	50.0	4	25.0	2	50.0	4	35.0	2	4.0	8
Herpes simplex	56.5	13	43.5	10	34.8	8	56.5	13	8.7	2	11.5	23
Dry mouth	33.3	1	66.7	2	66.7	2	33.3	1	0	0	1.5	3
Angular cheilitis	0	0	100	1	0	0	0	0	100	1	0.5	1
ANUG	0	0	100	1	0	0	0	0	100	1	0.5	1

* $P < 0.05$.

ANUG, acute necrotising ulcerative gingivitis.

Table 4 Frequency distributions of sites of oral lesions observed in people living with HIV/AIDS ($n = 200$) by educational status

Site of oral lesions in HIV/AIDS-seropositive patients	Level of education* ($\chi^2 = 29.718, P = 0.008$)						Total	
	Under Grade 7		Primary education		Secondary education			
	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
None	14.8	21	68.3	97	16.9	24	71.0	142
Floor of the mouth	75.0	3	0	0	25.0	1	2.0	4
Buccal mucosa	100	2	0	0	0	0	1.0	2
Hard and soft palate	33.3	2	50.0	3	16.7	1	3.0	6
Lips	20.0	4	75.0	15	5.0	1	10.0	20
Tongue	18.8	3	56.3	9	25.0	4	8.0	16
Oral commissures	33.3	2	50.0	3	16.7	1	3.0	6
Whole oral cavity	66.7	2	0	0	33.3	1	1.5	3

* $P < 0.05$.**Table 5** Frequency distributions of measures taken by people living with HIV/AIDS who self-identified the presence of oral lesions, by gender and age group

Measures taken	Gender* ($\chi^2 = 6.087, P = 0.048$)				Age group* ($\chi^2 = 6.526, P = 0.038$)				Total	
	Male		Female		15–37 years		38–76 years			
	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
Used traditional medicine	66.7	2	33.3	1	33.3	1	66.7	2	1.5	3
Went to hospital	39.4	37	60.6	57	43.6	40	57.4	54	47.0	94
Did nothing	25.2	26	74.4	77	60.2	62	39.8	41	51.5	103
Total	32.5	65	67.5	135	51.5	103	48.5	97	100	200

* $P < 0.05$.

Table 5 shows details of the measures taken by patients who had self-identified the presence of an oral lesion. Only 47.0% ($n = 94$) of patients had proceeded to consult medical opinion. Further probing to establish the measures taken by those who did not seek medical opinion found that most of them did nothing (51.5%, $n = 103$). Of the patients who took no action, larger proportions were female (74.4%) and aged 15–37 years (60.2%). In addition, a small proportion consulted traditional healers (1.5%, $n = 3$).

DISCUSSION

This cross-sectional study used a convenient hospital-based sample of patients attending the CTC who willingly agreed to participate. A negligible proportion of patients were exempted from participation for various reasons, but this could not have jeopardised the outcomes because the total number of participants represented between a third and half of all patients attending the CTC on a monthly basis. However, the

conclusions of this study should be transferred across centres with caution in view of the probable variations across centres in the sociodemographic status of individuals, the types of treatment provided for oral manifestations, and regimens of antiretroviral therapies.

The overall prevalence of oral lesions associated with HIV/AIDS was 29.0%. Specific prevalences were 11.5% for herpes simplex, 7.5% for oral candidiasis, 4.0% for oral hairy leukoplakia, 3.5% for Kaposi's sarcoma, 1.5% for dry mouth, 0.5% for angular cheilitis and 0.5% for ANUG. This overall prevalence is lower than the 45.0% reported by Fabian *et al.*³⁰, but higher than the 23.5% reported in Iringa by Mwangosi *et al.*³¹ Some of the many possible explanations for these differences refer to the levels of ART available, the specific management regimen offered to each individual with oral lesions, which is personalised to each patient, and to differences in practices at various CTCs²⁶.

Many studies have reported oral candidiasis, especially the pseudomembranous type, to be the most frequent oral lesion associated with HIV/AIDS^{17,22,30,32,33}. However, the present study identified herpes simplex as the most frequently observed oral lesion (11.5%), followed by oral candidiasis (7.5%). One of several possible explanations for this variation in the prevalences of different oral lesions in HIV/AIDS may be linked to the staging of HIV/AIDS²³ and the patient's CD4 count³⁴. Some oral lesions occur early in HIV infection, whereas others occur later, and thus the manifestation of lesions signifies the progress of HIV/AIDS with or without treatment³⁵. Patients attending the CTC represent a mixed pool of patients and are not stratified according to stage of disease or duration of therapy.

Studies by Pinheiro *et al.*²⁹ and Bendick *et al.*³⁶ have demonstrated that in the absence of medicodental treatment, the oral and general health status of HIV-seropositive patients is poor. Similarly, a study by Greenwood *et al.*³⁷ showed that whereas patients taking ART over time experienced a fall in the prevalence of oral manifestations of HIV/AIDS from 1992 to 1998, patients who were not taking such drugs maintained a relatively constant prevalence of mucosal lesions. The outcomes of this paucity of care of oral lesions in PlwHA supports an increased emphasis on the clinical practice guidance imposed by some governments that stipulates the examination of oral mucosal surfaces at least twice per year¹⁸, even in resource-constrained contexts, especially in developing countries¹².

However, it should be noted that although oral lesions can be attributed to the side-effects of some antiretroviral drugs⁴, the ongoing discovery of new knowledge on the science of HIV/AIDS and the development of opportunistic disease management strategies may succeed in containing these problems because strong relationships among patients, doctors

and wider society, as advocated by the World Health Organisation's Global Oral Health Programme^{12,13}, strengthen the collective armamentarium in the fight against disease.

In a study by Agbelusi *et al.*¹⁵ among PlwHA in Nigeria, educational status was not found to correlate to individual levels of awareness of oral lesions in HIV/AIDS. By contrast, the current study found that participants with informal education accounted for 66.7%, 75.0% and 100% of those reporting the occurrence of lesions in the whole mouth, the floor of the mouth and the buccal mucosa, respectively. Moreover, although no statistically significant differences in levels of awareness of oral lesions associated with HIV/AIDS emerged among participants of different educational status, participants with primary-level education more frequently suffered lesions on the lips, tongue, oral commissures and palate. This is consistent with findings by Fabian *et al.*³⁰, who reported that the lips, mucosa and tongue were generally the most frequent sites of oral candidiasis, the predominant oral lesion in their study.

Differences in the frequencies of lesions by site, in which the floor of the mouth, the buccal mucosa and the whole mouth are affected more often in informally educated participants, may raise queries on variations in oral hygiene practices across educational levels. Johnson²⁰ argued that oral lesions are likely to increase in frequency because patients with HIV/AIDS neglect their dietary and oral hygiene needs. Tironwe *et al.*¹⁶ associated this increase in frequency with discomfort during tooth brushing, chewing and swallowing. Furthermore, the current study found that participants with informal education were most affected by dry mouth, whereas patients with primary education were most affected with herpes simplex, and Kaposi's sarcoma was observed only in patients with secondary education.

Whereas some studies have shown that occurrences of some oral lesions, such as oral hairy leukoplakia, are positively associated with a patient age of < 35 years³⁸, this study did not show any statistically significant differences by age. In addition, both genders showed similar overall rates of occurrence and differences by educational status were not significant. By contrast, Kaposi's sarcoma was found mostly in males (71.4%) and those with primary education (71.4%) and no immediate explanation for this was found. In a study by Josephine *et al.*³⁴, Kaposi's sarcoma and parasitic lesions similar to those of crusted scabies were associated with lower counts of CD4 cells.

In conclusion, prevalences of oral lesions associated with HIV/AIDS in PlwHA on ART remain persistent but are of moderate intensity and their patterns of occurrence probably vary according to the immune status of the individual. Patient awareness of oral lesions is satisfactory but most patients do not seek

formal medicodental management advice. It is recommended that all health cadres are trained in contemporary strategies for the management of oral lesions and are encouraged to disseminate this information to the wider public.

Conflicts of interest

None declared.

REFERENCES

1. Patton LL. Sensitivity, specificity, and positive predictive value of oral opportunistic infections in adults with HIV/AIDS as markers of immune suppression and viral burden. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2000 90: 182–188.
2. Areotiba JT, Arowojulu MO, Fasola AO *et al.* Oral manifestation of HIV/AIDS. *Afr J Med Med Sci* 2006 35(Suppl): 13–18.
3. Gennaro S, Naidoo S, Berthold P. Oral health and HIV/AIDS. *MCN Am J Matern Child Nurs* 2008 33: 50–57.
4. Flint SR, Tappuni A, Leigh J *et al.* (B3) Markers of immunodeficiency and mechanisms of HAART therapy on oral lesions. *Adv Dent Res* 2006 19: 146–151.
5. Terry SD, Jones JE, Brown RH. Dental care experiences of people living with HIV/AIDS in Aotearoa, New Zealand. *N Z Dent J* 1994 90: 49–55.
6. Darling M, Arendorf T, Samaranayake LP. Oral care of HIV-infected patients: the knowledge and attitudes of South African dentists. *J Dent Assoc S Afr* 1992 47: 399–402.
7. Hartshorne JE, Carstens IL, Engelbrecht D. Dental and oral hygiene students' knowledge of HIV infection and AIDS. *J Dent Assoc S Afr* 1994 49: 161–167.
8. Oliveira ER, Narendran S, Falcão A. Brazilian dental students' knowledge and attitude towards HIV infection. *AIDS Care* 2002 14: 569–576.
9. Erasmus S, Luiters S, Brijlal P. Oral hygiene and dental students' knowledge, attitude and behaviour in managing HIV/AIDS pattern. *Int J Dent Hyg* 2005 3: 213–217.
10. Tillis TS, Vojir CP. Identification of HIV/AIDS-associated oral lesions. *J Dent Hyg* 1993 67: 30–36.
11. Wooten-Bielski K. HIV and AIDS in older adults. *Geriatr Nurs* 1999 20: 268–272.
12. Petersen PE, Bourgeois D, Ogawa H *et al.* The global burden of oral disease and risks to oral health. *Bull World Health Organ* 2005 83: 661–669.
13. Petersen PE. Policy for prevention of oral manifestations in HIV/AIDS: the approach of the WHO Global Oral Health Programme. *Adv Dent Res* 2006 19: 17–20.
14. Kaste LM, Bednarsh H. The third decade of HIV/AIDS: a brief epidemiologic update for dentistry. *J Can Dent Assoc* 2007 73: 941–944.
15. Agbelusi GA, Adeola HA, Ameh PO. Knowledge and attitude of PLWHA concerning oral lesions of HIV/AIDS among patients of PEPFAR clinic in Lagos University Teaching Hospital (LUTH) Lagos, Nigeria. *Niger Postgrad Med J* 2011 18: 120–125.
16. Tironwe JF, Rwenyonyi CM, Muwazi LM *et al.* Oral manifestations of HIV/AIDS in clients attending TASO clinics in Uganda. *Clin Oral Investig* 2007 11: 289–292.
17. Umadevi KR, Blignaut E, Glick M *et al.* Social aspects of HIV and their relationship to craniofacial problems: workshop 4C. *Adv Dent Res* 2011 23: 117–121.
18. Patton LL, Van der Horst C. Oral infections and other manifestations of HIV disease. *Infect Dis Clin North Am* 1999 13: 879–900.
19. Khanna S. Immunological and biochemical markers in oral carcinogenesis: the public health perspective. *Int J Environ Res Public Health* 2008 5: 418–422.
20. Johnson NW. The mouth in HIV/AIDS: markers of disease status and management challenges for the dental profession. *Aust Dent J* 2010 55 (Suppl): 85–102.
21. Shobhana A, Guha SK, Neogi DK. Mucocutaneous manifestations of HIV infection. *Indian J Dermatol Venereol Leprol* 2004 70: 82–86.
22. Adedigba MA, Ogunbodede EO, Jeboda SO *et al.* Pattern of oral manifestation of HIV/AIDS among 225 Nigerian patients. *Oral Dis* 2008 14: 341–346.
23. Taiwo OO, Okeke EN, Otoh EC *et al.* Prevalence of oral lesions in Nigerian women. *Niger J Med* 2005 14: 132–136.
24. Agbelusi GA, Wright AA. Oral lesions as indicators of HIV infection among routine dental patients in Lagos, Nigeria. *Oral Dis* 2005 11: 370–373.
25. Ogunbodede EO, Folayan MO, Adedigba MA. Oral health care workers and HIV infection control practices in Nigeria. *Trop Doct* 2005 35: 147–150.
26. Taiwo OO, Okeke EN, Jalo PH *et al.* Oral manifestation of HIV/AIDS in Plateau state indigenes, Nigeria. *West Afr J Med* 2006 25: 32–37.
27. Lloyd A. Infection and AIDS. *P N G Med J* 1996 39: 174–180.
28. Jordan RA, Gängler P, Jöhren HP. Clinical treatment outcomes of periodontal therapy in HIV-seropositive patients undergoing highly active antiretroviral therapy. *Eur J Med Res* 2006 11: 232–235.
29. Pinheiro A, Marcenés W, Zekrzeska JM *et al.* Dental and oral lesions in HIV-infected patients: a study in Brazil. *Int Dent J* 2004 54: 131–137.
30. Fabian FM, Kahabuka FK, Petersen PE *et al.* Oral manifestations among people living with HIV/AIDS in Tanzania. *Int Dent J* 2009 59: 187–191.
31. Mwangosi IEAT, Majenge JM. Prevalence and awareness of oral manifestations among people living with HIV/AIDS attending counselling and treatment centres in Iringa Municipality, Tanzania. *Tanz J Health Res* 2011 13: 205–213.
32. Badie P, Alborzi A, Davarpanah MA *et al.* Distributions and antifungal susceptibility of *Candida* species from mucosal sites in HIV positive patients. *Arch Iran Med* 2010 13: 282–287.
33. Zhang X, Reichart PA, Song Y. Oral manifestations of HIV/AIDS in China. A review. *Oral Maxillofac Surg* 2009 13: 63–68.
34. Josephine M, Issac E, George A *et al.* Patterns of skin manifestations and their relationships with CD4 counts among HIV/AIDS patients in Cameroon. *Int J Dermatol* 2006 45: 280–284.
35. Okoje VN, Obiechina AE, Aken'Ova YA. Orofacial lesions in 126 newly diagnosed HIV/AIDS patients seen at the University College Hospital, Ibadan. *Afr J Med Med Sci* 2006 35: 97–101.
36. Bendick C, Scheifele C, Reichart PA. Oral manifestations in 101 Cambodians with HIV and AIDS. *J Oral Pathol Med* 2002 31: 1–4.
37. Greenwood I, Zakrzeska JM, Robinson PG. Changes in the prevalence of HIV-associated mucosal disease at a dedicated clinic over 7 years. *Oral Dis* 2002 8: 90–94.
38. Sharma G, Pai KM, Subhas S *et al.* Oral manifestations in HIV/AIDS infected patients from India. *Oral Dis* 2006 12: 537–542.

Correspondence to:

Dr Ibrahim E. A. T. Mwangosi,
Muhimbili School of Assistant Dental Officers,
Institute of Allied Health Sciences Muhimbili,
PO Box 66521,
Dar es Salaam,
Tanzania.
Email: ieatmwangosi@yahoo.com

Copyright of International Dental Journal is the property of Wiley-Blackwell and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.