DMFT index and oral mucosal lesions associated with HIV infection: cross-sectional study in Porto Velho, Amazonian Region – Brazil

ABSTRACT

We evaluated the DMFT (decayed, missing and filled teeth) index and the prevalence of candidiasis, linear gingival erythema, oral hairy leukoplakia, herpes simplex, aphthous ulcers, Kaposi's sarcoma and lymphoma, as well as the association with TCD4 count, viral load (VL) and antiretroviral therapy (ART) in 140 HIV-infected adult individuals. A standardized examination to determine the DMFT index and the presence of oral lesions was conducted. Demographic data, TCD4 count and use of ART were obtained from medical records. A high number of decayed teeth detected among patients undergoing ART resulted in a mean DMFT of 16.9 teeth. It was observed that 24.2% of the individuals had at least one oral lesion. Candidiasis was the most frequent lesion and was associated with the TCD4 count. Oral hairy leukoplakia was associated with an increased VL. Regular use of ART was inversely associated with the occurrence of lesions. Overall, the studied population showed low prevalence of oral lesions and high DMFT index. The use of ART seems to reduce the occurrence of these lesions. Higher TCD4 count and a lower VL were associated with an improved oral health status in HIV+ individuals.

Keywords: oral mucosal lesions, DMFT index, tooth decay, HIV infection.

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INTRODUCTION

Between 1980 and 2007, 474,237 cases of acquired immunodeficiency syndrome (AIDS) were notified in Brazil, with the Southeast region being the one presenting the highest number of cases (289,074). The Northern region had 16,103 cases, with 1,862 in the state of Rondônia. Additionally, during a similar period of time (1980 – 2006), 192,709 deaths due to AIDS were notified in Brazil, with 549 in the state of Rondônia.[1]

The initial infection by the human immunodeficiency virus (HIV) is accompanied by unspecific symptoms, such as fever and malaise. Subsequently, the lymphadenopathy proceeds to a chronic and asymptomatic phase, as viral replication is, partially controlled by the immune system. Duration of this stage varies to factors such as viral phenotype, host's immune response, and use of antiretroviral therapy (ART). If it is not controlled by medication, viral replication continues and other symptoms, such as diarrhea, weight loss and oral candidiasis, appear and full-blown AIDS is established, which consists of a large number of acquired or reactivated diseases due to immunosuppression. Opportunistic diseases caused by viruses, bacteria, protozoa, and fungi and, together with some related neoplasias,[2] indicate a severely immunocompromised state.[3]

Around 1% of HIV-infected individuals, so called non-progressors, can maintain normal TCD4 lymphocyte levels and low viral load (VL) for periods as long as 10 to 20 years.[4] Specifically, in the oral environment the lesions associated with HIV infection include candidiasis, herpes simplex, oral hairy leukoplakia (OHL), cytomegalovirus (CMV) infection, varicella-zoster virus infection, papilloma virus infection, linear gingival erythema (LGE), gingivitis and necrotizing ulcerative periodontitis, Kaposi's sarcoma, and aphthous ulcers, which are acknowledged as important markers of AIDS clinical stages.[5-9]

Tooth decay is an infectious disease that affects all populations worldwide. In HIV-infected children, as the degree of immuno-

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suppression increases, so does the incidence of caries.[10,11] Phelan *et al.*[12] observed a higher incidence of caries and a lower number of teeth present in the oral cavity of HIV-infected adult women. However, in Brazil, the DMFT data in HIV-infected populations are scarce. Awareness of the magnitude of this problem in Brazil may allow for comparison with other countries and might highlight the need to implement or intensify preventive programs aimed at this group of individuals and at professionals working in this area. Such actions could guarantee a better quality of life through adequate care for the ones in need.

The treatment of the HIV infection/AIDS aims at limiting viral replication and, consequently, preventing and controlling opportunistic infections. To monitor disease progression, TCD4 cell count and VL[13] must be monitored throughout treatment. TCD4 counts < 200 cells/mm^3 indicate higher probability of developing opportunistic infections, whereas VL > 50,000 to 100,000 copies/mL can result in a rapidly compromised immune system.[3] In Brazil, ART is recommended for all symptomatic individuals infected by HIV, and asymptomatic individuals with a TCD4 count < 350 cells/mm^3.[3,14]

Therefore, the objective of the present cross-sectional study was to assess the DMFT index in association with oral mucosal lesions HIV-infected individuals living in the city of Porto Velho, state of Rondônia, Brazil. Moreover, a possible association between the oral health status and TCD4 count, VL quantification, and ART use was investigated.

METHODS

Sample calculation

Of 970 medical records of individuals registered at the Reference Outpatient Service (ROS), receiving care at Policlínica Municipal Dr. Rafael Vaz e Silva, a sample of 130 participants was chosen, to provide a power of 80% and an α error of 0.05. For the sample calculation, we considered the mean prevalence observed in the literature of oral candidiasis, linear gingival erythema, oral hairy leukoplakia, aphthous ulcers, Kaposi's sarcoma, herpes simplex and lymphoma.

Inclusion and exclusion criteria

The convenience sample consisted of patients that came to Policlínica for medical, dental or psychological care, or to collect ART medication during the period of August 2007 to January 2008. HIV-infected men and women, aged 18 years or older, registered and followed at the ROS were evaluated. Only individuals that agreed to participate in the study and signed the Free and Informed Consent Form were kept in the study (protocol of approval by the Ethics Committee in Research #121/07). Former smokers who had quit smoking less than three years before enrollment, and individuals that did not follow the outpatient clinic treatment were excluded.

Data collection

Participants underwent an oral assessment by a single examiner at the dental office of the clinic, under artificial light, according to the appropriate biosafety guidelines and with the help of a clinical dental mirror #5 (Duflex, SS White, Rio de Janeiro, RJ, Brazil), a dental probe #5 (Duflex, SS White, Rio de Janeiro, RJ, Brazil), a blunt-tip probe (Duflex, SS White, Rio de Janeiro, RJ, Brasil), a wooden spatula and sterilized gauze pads.

The examiner was trained to identify the following oral mucosal lesions: candidiasis (erythematous, pseudomembranous and angular cheilitis), linear gingival erythema, oral hairy leukoplakia, aphthous ulcers, herpes simplex, Kaposi's sarcoma and lymphoma, which were photographed (Sony DSC-H2, San Diego, CA, USA). Following a standardized oral exam, a single examiner assessed all present teeth, except for the third molars, in order to determine the DMFT (decayed, missing and filled teeth) index, according to the criteria established by the World Health Organization (WHO).[15] Each tooth was classified as Decayed: D (decayed teeth and filled teeth with caries or temporary filling material), Missing – subdivided in two categories; Extracted: E (teeth lost due to caries or other reasons) or Extraction indicated: Ei (extensive tooth decay that prevented tooth restoration procedures), or Filled: F (teeth that had been filled with permanent filling material and with no caries). According to the Brazilian Ministry of Health,[16] an examiner is adequately trained when his intra-examiner index reaches a reproducibility rate of 97.5%. The information on age, gender, laboratory data, smoking habit, and time of ART use were collected from medical records. TCD4 lymphocyte counts and VL quantifications obtained up to three months before or after the oral clinical assessment were considered in the study, as the VL tends to stabilize with the beginning of the humoral response.[17]

As the use of ART depends on symptomatology and the TCD4 cell count,[14] patients that had used ART regularly for at least twelve months were considered users. All data were entered in a form especially created for the present study.

Participants were advised on the importance of follow-up and regular use of the antiretroviral therapy, as well as the importance of oral hygiene. Those who presented with oral mucosal lesions received adequate treatment. Those who needed dental treatment were scheduled to receive it. Only cases that needed endodontic treatment and/or prosthesis were referred to the Dental Clinic of Faculdade São Lucas and the Dental Specialization Centers – DSCs.

Statistical analysis

Data were stored in Excel™ spreadsheets and the individual was considered the analysis unit. The statistical analysis was carried out with BioEstat 4.0 and SPSS 16.2

software, and the level of significance was set at 5% ($p < 0.05$). The normality of data was initially evaluated by Kolmogorov-Smirnov test (Lilliefors Test).

The Chi-square test was used for the comparative analyses regarding the occurrence of oral mucosal lesions, as well as their presence according to smoking status. The Mann-Whitney test was used for the intra-group analysis of the association between these lesions and TCD4 counts, VL quantification and use of ART, whereas ANOVA was used to verify the differences between the number of decayed teeth and TCD4 counts, VL quantification and use of ART.

The individual DMFT was obtained by adding the teeth included in any of criteria (D, E, Ei or F) and the mean DMFT was obtained by calculating the simple arithmetic mean of the DMFT index of all participants.

RESULTS

To reach a sample size of 140 eligible participants (39 ± 10.7 years), 238 individuals were invited to participate. Two participants were excluded as they did not meet the age criterion. A high number of subjects refused to participate (96) due to the need to undergo the intra-oral clinical assessment.

The study sample consisted of 66 men (40.8 ± 11.5 years), 74 women (37.5 ± 9.8 years); 37 were smokers. There were 2.9% participants in the age-range between 14 and 19 years, 15% between 20 and 29 years, 37.9% between 30 and 39 years, 25.0% between 40 and 49 years, and 19.2% were older than 50 years.

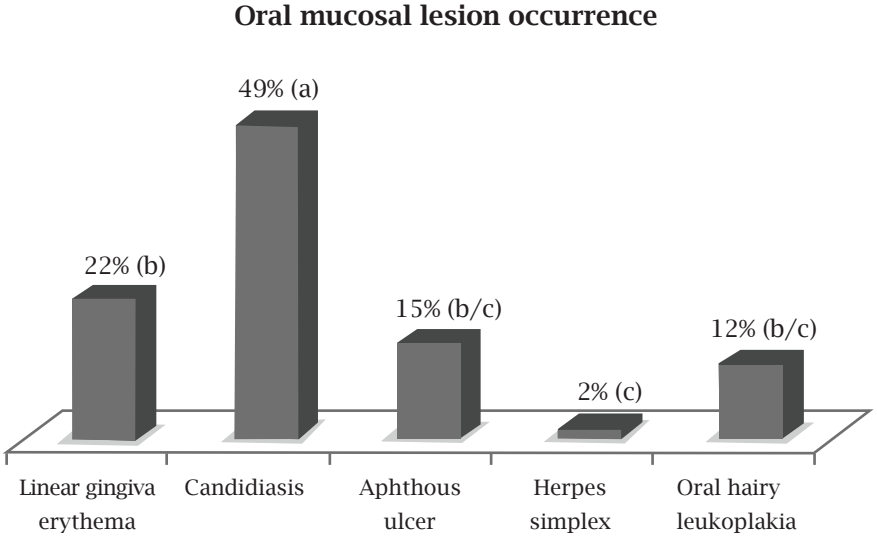
The mean TCD4 count was of 380 cells/mm^3. Of the 140 participants, 58% had intermediate counts of TCD4 (between 200-500 cells/mm^3), 23% presented more than 500 cells/mm^3, 14% presented 50-200 cells/mm^3 and only 5% had fewer than 50 lymphocytes/ mm^3.

Regarding ART use, 68% of the individuals reported using a combination of three antiretroviral drugs for a mean time of 45.4 months (± 37.5 months).

Fifty-three percent of individuals had undetectable HIV VL, 23% had < 10,000 copies/mL, 16% had between 10,000 and 100,000 copies/mL, and only 8% of the participants had more than 100,000 copies/mL.

Out of the total, 75.8% (106/140) disclosed no oral mucosal lesion. In the remaining 34 patients only one oral lesion was present in 82.4% (28/34). whereas 14,7% (5/34) had two lesions, and only one patient (2.9%) had simultaneously three different lesions (linear gingival erythema, candidiasis and aphthous ulcer). The most frequently identified oral mucosal lesion was candidiasis (20 patients) (Figure 1), with erythematous candidiasis being observed in 16 cases, followed by angular cheilitis in three cases, and pseudomembranous candidiasis in two patients. There were no cases of Kaposi's sarcoma or lymphoma. Additionally, aphthous ulcers was present in six patients, herpes simplex in one, and oral hairy leukoplakia in five patients. Smoking, reported by 37 participants, was not associated with the occurrence of oral mucosal lesions ($p = 0.99$).

Figure 1: Oral lesion types. Different small letters between parenthesis indicate significant statistical difference (Chi-square test, $p < 0.05$) between the occurrence of lesions.



The presence of lesions was inversely proportional to the TCD4 count, i.e., the higher the number of cells, the lower the occurrence of lesions (Figure 2). As for the VL, as its levels increased, so did the occurrence of lesions.

There was a trend towards the association of an increasing number of oral mucosal lesions and being without ART, albeit without statistical significance.

Among the 64 individuals who had an undetectable VL, 96.8% (62) was on regular use of ART, and 82.8% (53) had a TCD4 count > 200 cells/mm^3. Only one patient with undetectable VL had TCD4 count < 50 cells/mm^3.

The group with TCD4 count > 500 cells/mm^3 showed a lower prevalence of candidiasis, when compared to the group with TCD4 count between 200-500 cells/mm^3 (p = 0.0238) and to the group with TCD4 count < 50 cells/mm3 (p = 0.0254). Oral hairy leukoplakia was more prevalent among patients with VL > 100,000 copies/mL than among those with undetectable VL and with < 10,000 copies/mL (p < 0.05). These data are shown in Table 1.

Figure 2: Percentage of individuals with a positive diagnosis for at least one of the oral mucosal lesions, evaluated comparatively to those that did not exhibit any lesions at the moment of the intra-oral assessment. * Statistically significant difference at the intra-group analysis (p < 0.05; Mann-Whitney).

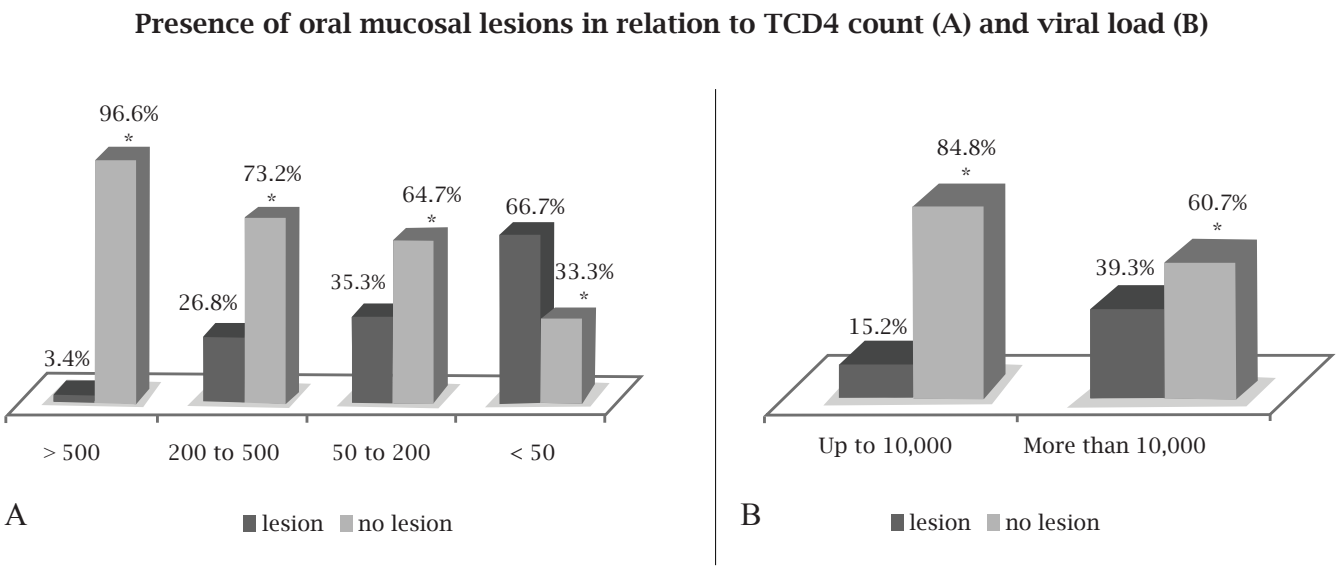


Table 1. Presence of oral lesions according to TCD4 count, viral load (VL) and use of ART

Oral lesions		Candidiasis n (%)	Linear gingival erythema n (%)	Herpes simplex n (%)	Oral hairy leukoplakia n (%)	Aphthous ulcers n (%)
TCD4$^+$	> 500	$0^{(b)}$ (0.0%)	$1^{(a)}$ (3.4%)	$0^{(a)}$ (0.0%)	$0^{(a)}$ (0.0%)	$0^{(a)}$ (0.0%)
	200 to 500	$14^{(a)}$(19.7%)	$4^{(a)}$ (5.9%)	$1^{(a)}$ (1.4%)	$1^{(a)}$ (1.4%)	$5^{(a)}$ (7.0%)
	50 to 200	$3^{(a/b)}$ (17.6%)	$2^{(a)}$ (11.8%)	$0^{(a)}$ (0.0%)	$1^{(a)}$ (5.9%)	$0^{(a)}$ (0.0%)
	< 50	$2^{(a)}$ (25.0%)	$1^{(a)}$ (16.7%)	$0^{(a)}$ (0.0%)	$2^{(a)}$ (25.0%)	$0^{(a)}$ (0.0%)
Viral load VL	Undetectable	$11^{(a)}$ (17.2%)	$4^{(a)}$ (6.3%)	$1^{(a)}$ (1.6%)	$0^{(b)}$ (0.0%)	$3^{(a)}$ (4.7%)
	< 10,000	$3^{(a)}$ (10.7%)	$3^{(a)}$ (10.7%)	$0^{(a)}$ (0.0%)	$0^{(b/c)}$ (0.0%)	$1^{(a)}$ (3.6%)
	10,000 to 100,000	$2^{(a)}$ (10.5%)	$1^{(a)}$ (5.3%)	$0^{(a)}$ (0.0%)	$1^{(a/b)}$ (5.3%)	$0^{(a)}$ (0.0%)
	> 100,000	$3^{(a)}$ (33.3%)	$0^{(a)}$ (0.0%)	$0^{(a)}$ (0.0%)	$3^{(a)}$ (33.3%)	$0^{(a)}$ (0.0%)
ART	+ (68%)	$15^{(a)}$ (15.8%)	$7^{(a)}$ (7.4%)	$1^{(a)}$ (1.1%)	$0^{(a)}$ (0.0%)	$3^{(a)}$ (3.2%)
	- (32%)	$5^{(a)}$ (11.1%)	$2^{(a)}$ (4.4%)	$0^{(a)}$ (0.0%)	$5^{(b)}$ (11.1%)	$3^{(a)}$ (6.7%)

Different small letters in the same column indicate significant statistical difference (p < 0.05) between the subgroups of TCD4, viral load and ART use.
+, user; -, non-user.

Figure 3 shows the means of decayed – D, extracted – E, extraction indicated – Ei and filled teeth – F (restored), as well as the general mean DMFT index. There was no statistically significant difference when the DMFT index was correlated with TCD4 cell counts (ANOVA), or when each criterion (D, E, Ei and F) were compared among the individuals with different VL counts (ANOVA).

However, higher number of decayed teeth – D was observed among patients who were not on ART (p = 0.004; t-Test) (ANOVA) (Table 2).

Figure 3: Mean DMFT Index: D, decayed; Missing: E, extracted; Ei, extraction indicated; F, filled (restored).

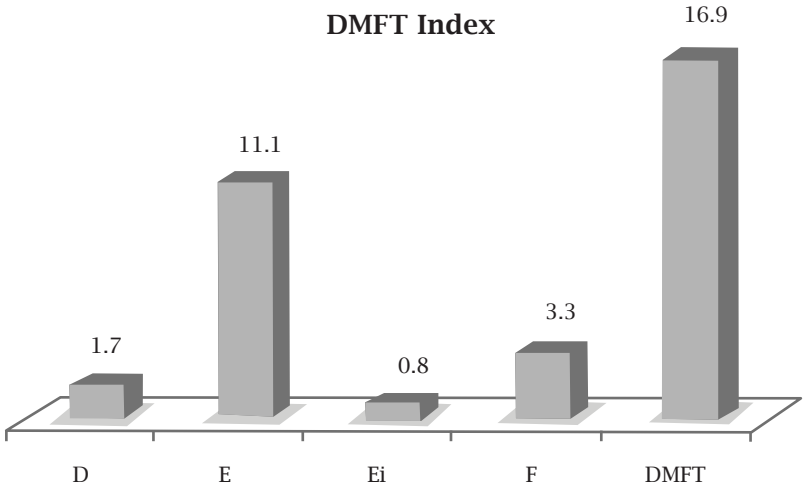


Table 2. Association between the DMFT index and the use of ART

		Decayed (D) n (Mean)	Extracted (E) n (Mean)	Extraction indicated (Ei) n (Mean)	Filled (F) n (Mean)	DMFT n (Mean)
ART	+ (n = 95)	120 (1.3)[(a)]	1094 (11.6)[(a)]	79 (0.8)[(a)]	343 (3.6)[(a)]	1636(17.4)[(a)]
	- (n = 45)	123 (2.7)[(b)]	454 (9.9)[(a)]	37 (0.8)[(a)]	117 (2.5)[(a)]	731 (15.9)[(a)]

Different small letters in the same column indicate significant statistical difference (p < 0.05) between the participants who were users (+) or non-users (-) of ART.

DISCUSSION

In the state of Rondônia, Amazonian region, Brazil, there are only six healthcare centers providing specialized care for patients with HIV/AIDS, and two of them are located in the capital city, Porto Velho. Of these, only ROS offers dental care, which was the setting of the present study. The main objective of the present study was to determine the DMFT index and the prevalence of oral mucosal lesions in HIV-infected patients and its association with TCD4 count, viral load (VL) quantification, and antiretroviral therapy (ART) use.

These data represents important information on which to base the planning of more effective actions to copy with the studied health problem. The results of the present study confirmed two trends of the AIDS epidemics: the aging of the infected population due to higher survival rates[9,18,19] and the feminization.[20,21]

Availability of ART at the Brazilian Public Healthcare System (SUS) was established by Federal Law # 9313, of December 1996, and guaranteed the broad and free distribution of ART to the Brazilian population.[22] According to Hammer *et al.*,[23] combination ART therapy is more efficient than monotherapy, as it results in an increase in TCD4 count and concomitant decrease

in VL, which, in turn, results in a decrease in the rate of oral mucosal lesions.[24-26] This low prevalence of lesions was confirmed by the present study. Moreover, the combination therapy has shown to be effective in improving/restoring the quality of life and increasing survival rates of infected patients.[27]

The type of candidiasis most frequently observed was the erythematous type, in accordance with Noce *et al.*,[9] but in disagreement with other authors, such as Souza *et al.*,[11] Mattos, Santos and Ferreira,[28] Ranganathan and Hemelatha,[29] and Ranganathan *et al.*,[30] who reported that pseudomebranous candidiasis was the most common type. These authors also mentioned the presence of angular cheilitis as a frequent fungal infection, a manifestation also observed in this study, albeit with a low incidence (2%).

Linear gingival erythema represented 6% of the cases, a value that was similar to that of several studies involving Brazilian populations[7,17,28,31] (Fabro *et al.*[7] – 2%; Grando *et al.*[17] – 5.9%; Mattos, Santos and Ferreira[28] – 4.3%; and Ferreira *et al.*[31] – 2.5%).

Aphthous ulcers represented 4% of the cases in the present study. The literature presents an assorted prevalence of these alterations. Ulcers are reported by studies carried out in Brazil as ranging from 0.9%[32] up to 23.5%,[5] with most of studies showing a prevalence of approximately 3%.

Oral hairy leukoplakia (OHL) has also been reported with prevalences varying from 2.1% through 6%.[9,11,17,30,33] It is noteworthy that several authors described OHL as a marker of HIV infection progression.[13,34,35] Thus, the relatively low frequency of this lesion in the population of the present study suggests an indicator of HIV control as a result of combination ART. Patton *et al.*[36] reported that HIV-infected patients who present OHL only among those with VL > 20,000 copies/mL, regardless of the TCD4 count. In contrast, there were five patients with OHL identified in the present study.

Kaposi's Sarcoma and lymphoma were not seen in this study. According to Girotto *et al.*,[37] the decrease in the prevalence of these lesions is associated with the use of combination ART. In Porto Velho, since the ROS started treating patients, there have never been any report of lymphoma in the oral cavity.

Candiani *et al.*[38] reported a significant decrease in opportunistic infections, hospitalizations and death in HIV-infected patients following the introduction of highly-active antiretroviral therapy (HAART), a combination of three antiretroviral drugs. Birnbaum *et al.*,[24] Greenwood, Zakrzewska and Robinson,[26] Ferreira *et al.*,[31] and Coogan, Greenspan and Challacombe[39] reported changes in the prevalence of oral mucosal lesions following the introduction of ART, including the reduction of the incidence of candidiasis, OHL and KS. A low prevalence of KS was also associated with the use of ART, as reported by Greenspan *et al.*[25] In the present study, 68% of the patients used combination ART for a mean period of 45 months (SD: 37.5 months). In approximately 20% (95) of the patients on regular use of ART, some type of oral mucosal lesion was identified, whereas in the group without ART therapy, approximately 31% (45) presented lesions. Greenspan *et al.*[40] reported that after the start of HAART therapy, a significant decrease in the quantification of VL occurs, as well as an increase in TCD4 count. The results obtained in the present study show a decrease in the prevalence of lesions in the oral mucosa among those on HAART, thus suggesting that, in fact, the combined HAART maintains or restores the immune response and, additionally, decreases the VL, resulting in a better quality of life and longer survival rates.

According to Mattos, Santos and Ferreira,[28] most of the patients with oral mucosal lesions had TCD4 counts between 200 and 399 cells/mm^3, whereas in patients with VL up to 10,000 copies/mL fewer lesions were identified. Birnbaum *et al.*[24] and Patton *et al.*[36] showed that the increase in VL is also characterized by the increase in the prevalence of lesions in the oral mucosa.

Similarly, in the present study, patients with VL values > 10,000 copies/mL had higher prevalence of lesions. Miziara, Lima and Cortina[35] demonstrated that patients with candidiasis or OHL had lower TCD4 lymphocyte counts and higher VL values, when compared to patients that did not express these manifestations clinically. A study carried out by Ferreira *et al.*[31] demonstrated a higher prevalence of lesions in the oral mucosal lesions in patients with TCD4 count < 200 cells/mm^3 and a higher prevalence of these lesions in patients with high VL values. In agreement, in the present study, the increase in the TCD4 count was associated with the decrease in the occurrence of oral mucosal lesions.

In Brazil, few studies have reported their experience on dental caries and HIV infection, and most of them were carried out with HIV-infected children.[10,12,32,41] The differences between the prevalence and the incidence of caries in individuals with and without HIV infection have yet to be elucidated. However, by recognizing that dental caries is an infectious disease, and knowing that several side effects of ART therapy can contribute to an inadequate oral hygiene, as well as to an inappropriate diet, the HIV infection seems to function as a risk factor for caries.

Bretz *et al.*[41] observed a high prevalence of caries (mean of 42.9 surfaces) in an HIV-infected population from Houston, Texas. A study carried out by Phelan *et al.*[12] showed a comparison of prevalence of caries between the HIV-infected and uninfected women. These authors observed higher rate of coronal and radicular caries, in addition to a lower number of permanent teeth in the oral cavity of HIV-infected women, concluding that the occurrence of caries was higher in individuals with decreased TCD4 count. In Brazil, Silveira and Rangel[32] observed a high prevalence of caries with a mean DMFT = 23 (D = 12; E = 7.5; Ei =1.5; F = 2) in 123 adult patients of both sexes.

In agreement with other studies, this study also showed a high prevalence of caries. The mean DMFT index of the participants was of 16.9; the number of decayed teeth and

teeth with extraction indicated was low (1.7 and 0.8, respectively) and the number of extracted teeth was high (11.1). It can be observed that these numbers are far from the targets proposed by the WHO for the year 2010, such as: the presence of 20 or more teeth in the oral cavity for 96% of the individuals at the age range of 35 to 44 years and no lost teeth at the age of 18 years.[42] In the present study, at the age range of 35 to 44 years, 49 individuals were assessed. Of these, 23 individuals (47%) had fewer than 20 teeth in the oral cavity, that is, less than half of the target number proposed by the WHO; there were only two participants who were 18 years old, and both had at least two missing teeth.

The SB Brazil epidemiological surveillance, carried out by the Ministry of Health in 2002, indicated that, at the age range 35 to 44 years, the mean of missing teeth was of 14.77 for the Northern region, whereas in the present study, the mean was of 12.12 for HIV-infected individuals. Regarding the decayed and filled teeth criteria, the results demonstrated better oral health status for HIV-infected patients (D = 1.41; F = 4.0), when compared to the general population of the Northern region (D = 2,97; F = 1.89).[43] Therefore, the comparison of these data suggest a better access to dental care services for the studied population, confirming the importance of the surgeon-dentist in reference services providing care for HIV/AIDS patients.

The results from the present study reflect the importance of adequate care given to HIV/AIDS patients, as the correct management provides a better quality of life to the patient, which was demonstrated here through the low prevalence of oral mucosal lesions. It should also be pointed out the importance of creating/implementing oral rehabilitation programs (dental prosthesis), considering the large number of missing teeth, as well as the creation of more reference centers with multiprofessional teams, so that a new effective management and follow-up of HIV-infected patients can be accomplished.

CONCLUSIONS

The studied population, which consisted primarily of individuals with intermediate TCD4 counts and undetectable VL, showed low prevalence of oral mucosal lesions and a high DMFT index, with the high number of extracted teeth contributing the most for this high index.

The most frequently observed lesion was candidiasis, which was related to TCD4 count, whereas the increase in the VL was associated with the occurrence of OHL. The DMFT index was not associated with VL, TCD4 count or ART use. Only the criterion Decayed tooth, when analyzed separately, was higher in the group that was not on ART use.

Individuals with higher counts of TCD4 lymphocytes and lower counts of VL tended to present fewer oral mucosal lesions associated with HIV infection. Additionally, the use of antiretroviral therapy showed an association with lower prevalence of lesions, especially OHL.

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