

Sales-Peres SHC*, Costa AH, Mapengo MA, Yamashita JM, Xavier CN and Sales-Peres A

Department of Pediatric Dentistry, Orthodontics and Public Health, Bauru School of Dentistry, University of São Paulo, Avenue Octávio Pinheiro Brisolla, 9-75. Bauru-SP, Brazil

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***Corresponding author:** Sílvia Helena de Carvalho Sales Peres, Department of Pediatric Dentistry, Orthodontics and Public Health, Bauru School of Dentistry, University of São Paulo. Avenue Octávio Pinheiro Brisolla, 9-75. Bauru-SP 17012-901 Brazil, Tel: + 55 14 32358260; Fax :+ 55 14 32358260; E-mail: shcperes@usp.br

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Research Article

Oral Health Status and Anthropometric Conditions among HIV Infected Adolescents on Antiretroviral Therapy in Mozambique

Abstract

Background: Malnutrition and weight loss are important characteristics in HIV/AIDS patients. The association between this type of pathology and oral health in HIV/AIDS patients maintains unclear in the literature.

Objective: The aim of this study was to assess the oral health status and anthropometric conditions in adolescents treated and non-treated with HIV infection in Maputo-MZ.

Design: Cross-sectional analytical study conducted in the Maputo city, Mozambique in 2012.

Methods: The random sample was composed of 143 adolescents from 15-19 years of age, attended to at the Medical Center Hospital and Pediatric Unit of Maputo Hospital. The adolescents were divided into two groups: HIV Group (HIVG) - adolescents with AIDS; Control Group (CG) - adolescents without HIV infection. The oral health conditions were collected by means of the DMFT index, the community periodontal index (CPI) and soft tissue, according to the criteria proposed by the World Health Organization (WHO), by a calibrated researcher. Student's t-Test and Spearman correlation were used for statistical analysis ($p < 0.05$).

Results: The HIV group presented a higher degree of dental caries ($OR = 5.902$; $95\%CI = 2.859-12.188$; $p = 0.000$), a trend to less periodontal diseases ($OR = 1.318$; $95\%CI = 0.662-2.624$; $p = 0.540$), higher alterations in the soft tissue ($OR = 0.216$; $95\%CI = 0.057-0.811$; $p = 0.030$) and higher normal BMI ($OR = 0.498$; $95\%CI = 0.252-0.987$; $p = 0.066$) than the CG group.

Conclusion: HIV/AIDS patients are at major risk for dental caries or alterations of soft tissue and minor risk for periodontal diseases, even when on antiretroviral therapy.

Introduction

Acquired Immune Deficiency Syndrome (HIV infection) is considered an important public health problem in developed and developing countries. Worldwide, there are approximately 33 million people living with HIV/AIDS and in Mozambique (2009), it was estimated that 11.5% among adults aged 15–49 years were affected [1,2]. According to the National Strategic HIV and AIDS Response Plan 2010–2014, multiple sexual partners alone with a low condom usage are the main causes of HIV infection in Mozambique and contribute to approximately 24% to 29% of all new HIV infections in the country [3]. The oral lesions associated with HIV that may occur in over half of HIV/AIDS patients are well established. Among these lesions the most common are HIV gingivitis and periodontitis [4–6], fungal and other opportunistic infections and Kaposi's sarcoma.

The goal of antiretroviral therapy (ART) is the suppression of viral replication. The evidence supports the use of three ART agent combination therapies is optimal way to achieve this goal [7]. The combination ART has shown a reduction in the prevalence of some oral conditions, however, the presence of HIV-related periodontal

disease still occurs and appears to be more often associated with failure or cessation of HIV treatments [8].

The treatment of human immunodeficiency virus (HIV) infection such as anti-retroviral medicines has resulted in an increase in the life expectancy of HIV patients. On the other hand, this therapy may interfere in the oral conditions, such as dental caries and xerostomy. Saliva has important roles in oral health and prevention of dental caries including clearance effects, buffering capacity, balancing de/remineralization, antimicrobial properties and production of antibodies [9].

The highly active antiretroviral therapy could interfere on the dental caries prevalence in HIV-infected patients [10]. However, there is insufficient data showing the relation between the rate dental caries, and taking highly active antiretroviral therapies (HAART).

Moreover, the spread of the HIV pandemic in Africa and its impact on the nutritional status of sick children have triggered a secondary epidemic of severe malnutrition. The pathophysiology among severely sick malnourished children with AIDS and their

clinical response to the accepted WHO therapeutic guidelines, which may be different from those of children with primary severe malnutrition secondary to food shortage rather than HIV infection [11].

Nevertheless, the effect of HIV treatment type, oral health status and body mass index were not investigated up to now. Thus, the null hypothesis is that there is no difference in the oral health status (OHS) or anthropometric conditions (BMI) between adolescents with or without HIV infection ("Treated by different antiretroviral therapies"). Therefore, the aim of this study was to assess the oral health status and anthropometric conditions in adolescents treated and non-treated of HIV infection, in Maputo-MZ. In addition, the type of HIV treatment may not interfere in OHS or BMI.

Material and Methods

Study design

This is a quantitative exploratory cross-sectional and analytical study carried out in the public health service offered to adolescents with HIV/AIDS at the Medical Center Hospital of Maputo which attends AIDS patients.

Study location

This study was conducted in the Maputo, MZ, with adolescents from 15 to 19 years-old, who under the care at the Pediatric Need Unit at the Maputo Medical Center Hospital between March and December 2012.

Maputo is the capital of Mozambique and it is located in Sub-Saharan Africa. Mozambique is considered one of the 20th poorest countries in the world and it is 172 numbered of the 182 countries of the Human Development Index. More than half the children of Mozambique live below the poverty threshold.

Sample

The sample size (n) was calculated to assess the difference between groups for the DMFT index at a confidence level of 95% and test power 80% ($\beta=20\%$). Each group (with or without HIV infection) should be composed of at least 64 subjects. Considering that a possible loss may occur, in our sample, 68 subjects with HIV and 75 without HIV were included. The sample selection was carried out by simple random sampling the patients, for each examination until the sample was completed. Furthermore, we did not extend our comparison past this 6-month window, which would have confounded our analysis.

The first set of data was collected following an oral examination of 143 adolescents. The subjects were divided into two groups: HIV Group (HIVG)- adolescents participants in the AIDS consultation; Control Group (CG)- adolescents attended to at the Pediatric Unit of Maputo Hospital without HIV infection. The HIVG patients had been treated under two therapeutic protocols: HIVG1- received 2 NRTI (d4t+3TC) + 1 NNRTI (NVP); and HIVG2- NRTI (ABC+3TC+TDF) and 1 PI (LPV/r), as stated previously. The patients with confirmed the diagnosis of HIV infection 12 to 19 years old and who agreed participate in the study were included in the random selection.

Inclusion and exclusion criteria

The criteria for exclusion in the study were difficulties with communication, or neuromotor problems and patients hospitalized. Individuals who did not agree to participate in the study and those absent in the days of the exam were excluded from the sample.

Data collection

The collection of data was performed in 10 months, after a pilot study in which the variables were tested. The patients that participate of pilot study were not included in the present study.

Clinical examinations

In the second set, the oral examinations were conducted by a calibrated examiner for dental caries (Kappa=0.91) and periodontal disease (Kappa=0.84). Condition of the teeth, gums and soft tissues were evaluated according to the codes and criteria for epidemiological survey of the World Health Organization [12,13]. The average number of decayed, missing or filled teeth was used (DMFT). The periodontal status was verified by the Community Periodontal Index (CPI), which evaluated the presence of bleeding, calculus and periodontal pockets. The soft tissues were evaluated by the codes: 0- No abnormal condition, 1- malignant tumor (oral cancer), 2- leukoplasia, 3-lichen planus, 4- ulcerations (for thrush, herpes, traumatic), 5-Necrotizing ulcerative gingivitis (NUG), 6- candidiasis. 7-abscess, 8- another condition and 9-no information [12,13].

Anthropometric evaluation

The anthropometric measurements were assessed for all patients. Participants were weighed while barefoot, wearing light clothes, on a scale that measured to the nearest 0.1 kg. Height was measured at baseline using a stadiometer (rank, 0.7–2.05m). Participants were positioned upright and relaxed with the head in the Frankfurt plane. Both height and weight measurements were collected at the same time. The classification of nutritional status was divided according to gender and age [14].

Patient medical file data

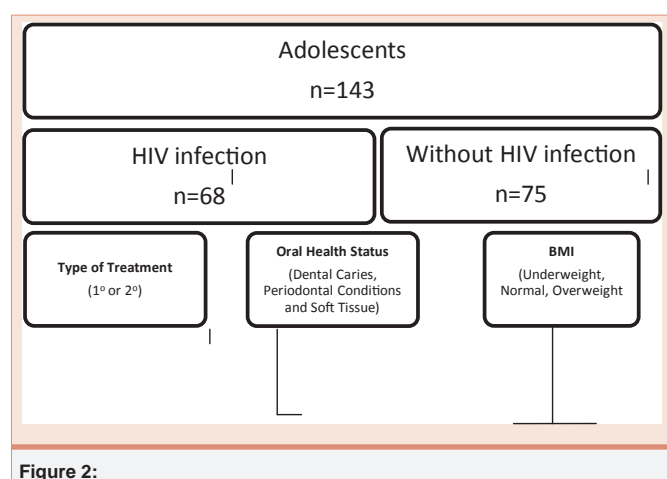
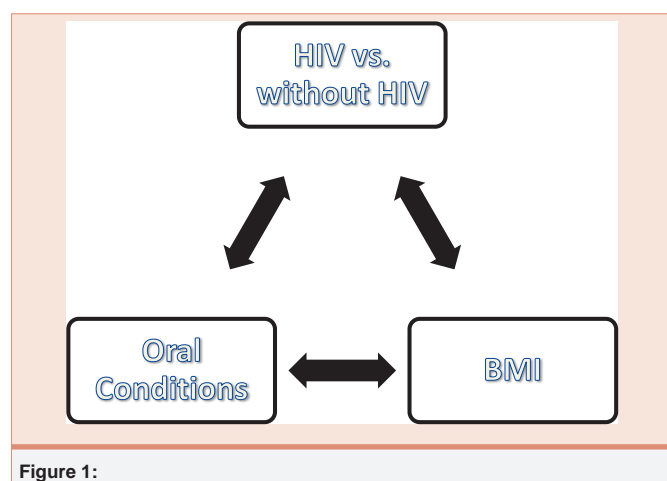
The quantification of CD4 lymphocytes was obtained from the patient's medical files. CD4 lymphocyte count under 200 cel/mm³ is the level related with HIV infection and oral lesions appearance.

Statistical Analysis

Descriptive analyses were performed for participants' individual characteristics through the measures of central tendency (simple frequencies and mean) and measures of dispersion (standard deviation). The Kolmogorov-Smirnov test was performed to analyze the normality of the variables. The data were analyzed using the Student's t-Test (Statistica Version 7) and Odds ratio. Spearman correlation was used to correlate the oral conditions and CD4 lymphocytes. The significance level was set at $P<0.05$.

Hypothesized model

To test our hypothesis, we developed two structural models in which adolescents with or without HIV infection was expected to somewhat mediate the effects of oral condition and therapy on HIV/AIDS patients (Figures 1 and 2).



Hypothesized model

In the arena of HIV/AIDS prevention in sub-Saharan Africa, both oral conditions and BMI play important roles.

Ethical approval

Ethical approval was obtained from the Bioethics National Committee for health of Mozambique (Protocol n° 365/CNBS/11). The written informed consent of parents or those responsible for the adolescents was obtained prior to the clinical examination and self-administered questionnaire.

Results

A total of 143 patients included in this research including 68 with HIV infection and 75 without HIV infection. Of all individuals, 42 (29.3%) were male and among them 37 were HIV infection and 5 without disease. The female gender were composed of 101 (70.6%) and among them 31 were HIV infection and 70 were without disease. The average of age in the sample was 16.5 ± 2.26 years ranging between 12 and 19 years old. In HIVG was 15.04 ± 2.30 and in CG 18.2 ± 1.7 years old.

Regarding HIV transmission, the most study participants identified vertical transmission as the major route through which

they were infected while 5 patients were unable to identify how they were infected.

Evaluation of CD4 lymphocyte count

The CD4 lymphocyte count was collected from patient medical file of adolescents with HIV infection. Sixty six patients had this information and the mean of CD4 lymphocyte count was 627 cel/mm^3 , whereas the framework to include in the therapy antiretroviral is 200 cel/mm^3 or more. Only 4 patients (5.88%) presented CD4 lymphocyte count less than 200 cells. The blood collection and oral exam were realized in the same time. Adolescents infected were on antiretroviral therapy. The medication was prescribed according to the severity of the disease and the self-report was type 1 (29%), type 2 (58%) and 18% have no idea about the type of therapy.

Anthropometric evaluation

In CG the underweight was more prevalent ($n=33$; 48.5%) followed by normal ($n=31$; 45.5%), overweight ($n=3$; 4.4%) and obesity ($n=1$; 1.47%). In HIVG the normal was more prevalent ($n=49$; 65.3%) and followed by underweight ($n=26$; 34.6%) and there were no overweight or obesity. Table 1 present the mean and standard deviation according to BMI.

The BMI in AIDS patients presented values considered as normal and patients without HIV/AIDS presented malnutrition.

Evaluation of Oral Conditions

Soft tissue alterations

Seventeen adolescents showed alterations of soft tissue:

Soft tissue alterations were found in 17 of adolescents: HIVG=14, of whom 10 presented with candidiasis and 4 with aphthous ulcerations. CG=3, who presented with aphthous ulcerations. There was no significant difference between groups ($p>0.05$).

Periodontal diseases

Eight hundred and fifty eight teeth were examined, of which 408 teeth belong to HIV infected patients and 450 teeth belong to those without infection. The periodontal condition most found was healthy (HIVG=67.6% and CG=61.3%) and there was no significant difference between the groups ($p>0.05$) (Tables 2 and 3).

Dental caries

DMFT mean of the sample was 2.90 ± 2.78 , in HIVG was 3.06 ± 2.63 and in CG was 2.76 ± 2.91 ($P>0.05$). In relation of the caries free, 22.67% ($n=17$) and 32.35% ($n=22$) in the HIVG and CG. The Significant Caries Index (SIC index) was 6.12 ± 2.04 (HIVG= 6.17 ± 3.05 ; CG= 6.08 ± 2.76). The table 4 showed the distribution of DMFT according to components (Decay, Missing and Filled per Tooth).

Table 1: Mean and standard deviation of BMI of study groups.

	Underweight Mean \pm SD	Normal Mean \pm SD	Overweight Mean \pm SD	Obesity Mean \pm SD
CG	19.14 \pm 1.19	23.50 \pm 2.09	-	-
HIVG	17.92 \pm 1.89	21.75 \pm 1.94	27.65 \pm 1.87	30.7 \pm 0.00

Table 2: Frequency of periodontal conditions distribution in the adolescents.

	Healthy n (%)		Bleeding n (%)		Calculus n (%)	
HIVG	46	67.6 %	2	2.9%	20	29.4%
CG	46	61.3%	9	12.0%	20	26.6%
TOTAL	92	64.3%	11	7.6%	40	27.9%

Table 3: Periodontal condition according to Community Periodontal Index by sextant.

	HIVG			CG		
	H	B	C	H	B	C
16/17	58	4	6	64	7	3
11	64	3	1	74	0	1
26/27	57	1	10	61	3	11
47/46	66	1	1	71	2	2
31	56	2	10	59	4	12
36/37	58	1	9	68	2	5
Total	359	12	37	397	18	34

Table 4: Mean and standard deviation of DMFT components in the groups.

	Decay	Missing	Filled	DMFT
HIVG	2.76±2.46	0.00±0.00	0.29±0.69	3.06±2.63
CG	2.52±2.71	0.05±0.22	0.19±0.48	2.76±2.91
TOTAL	2.64±2.60	0.03±0.16	0.24±0.59	2.90±2.78

Table 5: Univariate analysis of groups by health conditions.

Variables		Groups		Univariate analysis		
		HIVG	CG	Odds ratio	95% CI	p
Dental Caries	Yes	51	50	5.902	2.859-12.188	0.000*
	No	24	18			
Periodontal Disease	Yes	29	22	1.318	0.662-2.624	0.540
	No	46	46			
Soft tissue alteration	Yes	14	03	0.216	0.057-0.811	0.030
	No	54	72			
Normal BMI	Yes	49	31	0.498	0.252-0.987	0.066
	No	26	33			

The type 1 was 39.71% and type 2 was 58.82% of therapy, and one of them said that he have no idea about the received therapy. There was no significant difference between the two treatment types (1^a or 2^a line) and DMFT ($p>0.05$).

In the Univariate analysis, the groups were compared by variables analyzed. In relation to risk of develop a periodontal disease there were not significantly difference between groups ($p>0.05$).

* $p<0.05$

In the Spearman Correlation, there were positive correlation between DMFT and CPI ($r=0.185$; $p<0.05$). DMFT and CD4 lymphocytes showed negative correlation between them($r=-0.0037$; $p<0.05$). There were no correlations between periodontal conditions and TCD4 lymphocytes ($r=-0.07$; $p>0.05$). Soft tissue and CD4 lymphocytes there were no correlations ($r=-0.098$; $p>0.05$) and between BMI and CD4 lymphocyte ($r=0.012$ $p>0.05$).

Discussion

In a previous study, we identified that the candidiasis is the most common lesion in infected children of Maputo-MZ [15]. In this research, candidiasis was the most common lesion in infectedadolescents, reinforcing the hypothesis that this disease requires care in patients with HIV/AIDS. It has become necessary to understand and identify factors of the epidemiological situation found, which may influence the occurrence of this disease.

In the present study, the sampling units were infected mostlyvia vertical transmission (from mother to child) and some adolescents were unaware that they were HIV/AIDS carriers and they believed that they only were having a chronic illness. This fact made it difficult to collect the information for the research. However, the researchers used data from medical records to confirm the information in an attempt to reduce this bias.

This is the first study to assess the prevalence of dental caries, periodontal disease and soft tissue alterations in HIV infected adolescents. The results of this study showed that the oral health status of the participants was worse, independent of group, than the DMFT of adolescent 12 years old in Maputo, which was 0.9 [16]. The present study showed that the SiC of the whole sample was 6.12 (HIVG=6.70±3.05 and CG=6.08±2.76) and in the Mapengo et al. [16] investigation, it was 2.78. On the other hand, the caries free was 22.67% and 60.06% in both studies, respectively. In the adolescents' assessment, there was an increasein oral problemsprevalent with increased age.Between the groups analyzed, the results showed that the patients of control group presented a 5.9 chance to present dental caries ($p<0.000$).

These results highlight that between the ages evaluated in these researches, a huge difference was present and several teeth can be exposed for high risk of dental caries. Nevertheless, in the WHO report, the rate of caries in Africa remained low and stable [17]. These data suggest that interventions were aimed at primary prevention of dental caries, especially, from 12 to 19 years of age, in Mozambique. Several strategies of public health should be afforded for children to prevent these situations in adolescents and adults.

The prevalence of periodontal diseases in HIV-infected individuals remains a controversial issue.It is known that the development of periodontal disease depends on the interaction between the host response and the resident oral microbiota, which constitutes a complex dynamic biofilm of multiple microbial communities. Considering that it is a microbial community disease, a distinct microbial profile in these patients, if identified, could assist our understanding of the aetiopathological mechanisms [18].

Factors which influence the prevalence of periodontal disease such as age, immune system competence, smoking habits, oral hygiene level are not always taken into consideration [4,19]. In this study, the periodontal health status was better in HIV infection adolescents and the bleeding was four times worse in the CG than the HIVG. This can be observed by the results of the oral health, as well as others performed with HIV/AIDS, where the adequate treatment of HIV infection was reported.

The introduction of highly active antiretroviral therapies (ART) has significantly modified the course of HIV disease into a manageable chronic disease with longer survival and improved quality of life in HIV-infected subjects. The findings from relevant studies also vary and cannot be compared, partly because of the different types of therapy received by participating patients [8]. In our investigation the patients received two types of ART therapy HIVG1 (58%) received 2 NRTI (d4t+3TC) + 1 NNRTI (NVP); and HIVG2 (28%) NRTI (ABC+3TC+TDF) and 1 PI (LPV/r), which in turn may partly explain the low prevalence of alterations in soft tissue.

Oral lesions are among the clinical manifestations whose prevalence, severity and progress have been improved by this treatment. Our results are in concordance with a study conducted in South Africa, assessing 56 children that have taken active antiretroviral therapy and their mucosa lesions. The authors showed a negative correlation between the CD4 lymphocyte count, viral load and oral lesions [20].

These patients have a life of duplicity, because only a few people from their neighborhood are chosen to know about their HIV status [21]. This concern even affects the demand for health care because these patients stop going or look for the dentist too late for fear of having to report that they have the HIV virus and may suffer prejudice due to the professional unpreparedness. This makes these patients prone to having major problems related to oral health [22]. Although oral candidiasis appears to be the infection more significantly decreased after the introduction of ART, the current literature suggests that the prevalence and course of periodontal lesions have also been modified. However, our results do not support the hypothesis of different severities of periodontal disease between HIV vs non-HIV infected adolescents. Additional research is required regarding biological issues, such as the role of oral immune factors and periodontal disease in the persistency of HIV infection, the possibility of oral transmission and the re-emerging of HIV infection. The underlying mechanism is not fully understood and may be multifactorial.

Adequate nutrition in patients with AIDS directly affects the immune status, improves the effectiveness of the treatment, reduces side effects and increases the quality of life [23]. In this study, the malnutrition condition was approximately 41.2% similar to the results found by Mapengo et al. [24]. Malnutrition is the combination factors that involved the access and availability of foods (FAO, 2008). The HIV group showed better nutritional condition and the CG presented higher malnutrition condition. These findings may be attributed to strategies offered to HIV/AIDS patients in Public Health Program, which included nutritional counseling and the use of nutritional supplements. A Cohort study was conducted in Maputo with

AIDS patients analyzed the influence of food supplementation and nutrition education [25]. During the follow-up, the BMI increased and there was an association between the BMI and quality of life. Future investigations using clinical trial models should be conducted to better explain these benefits.

This research is cross-sectional, which precludes causal inferences. Despite this limitation, the study shows that there are many factors that influence the HIV/AIDS patients and the type of therapy and inadequate oral health negatively influence the life of these individuals. Another limitation was the length of antiretroviral therapy that it was not available. Because to the limitations, which also includes the duration of the infection, receiving the treatment of HIV infection for varies period and no opportunity for radiographic study, more researches on this topic is highly recommended.

The construction of strategies to prevent and educate adolescents about their oral conditions is development. In addition, qualified professionals working in hospitals should be reinforced in order to enhance the value of current techniques to assess the dental status in HIV/AIDS patients.

Conclusion

There were differences between adolescents with HIV/AIDS and those without the disease for the health conditions evaluated. Adolescents with HIV/AIDS presented a higher prevalence of dental caries and alterations in soft tissues and, lower occurrence of periodontal disease. Most of the adolescents with HIV/AIDS presented BMI considered as normal and those without the disease showed malnutrition. The CD4 lymphocyte count negatively interferes in the oral health conditions, especially dental caries and periodontal diseases.

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