Xerostomy, Dental Caries and Periodontal Disease in HIV+ Patients

Julio César Cavasin Filho and Élcio Magdalena Giovani
Universidade Paulista (UNIP); São Paulo, SP, Brazil

We studied xerostomy and its correlation with periodontal and dental cavity diseases in HIV patients, through measurement of salivary flow and through variables such as saliva buffer capacity, salivary pH, periodontal index, MDF index, dental carie risk and risk of periodontal disease. One hundred patients were analyzed. They were distributed into two groups: Group I (test) – 50 patients evidently HIV+, from whom information was collected and analyzed regarding age, gender, skin color, habits, general and oral diseases, levels of T-CD4 lymphocytes, viral load and highly active antiretroviral therapy (HAART); and Group II – (control) 50 HIV- patients, from whom information was collected and analyzed regarding age, gender, skin color, habits, general and oral diseases. In both groups, measurement of salivary flow, pH and buffer capacity was made. Group I presented high MDF, bacteria plaque and bleeding, with a greater susceptibility to the risks of oral cavities and periodontal disease. The salivary flow and the buffering capacity of the saliva were low, indicating a high level of xerostomy. Two important modifying factors influence these pathologies in an incisive way: one is immunossuppression and the other is HAART therapy. The control exhibited results that are closer to normality; it had better oral-health conditions.
Key Words: Acquired Immune Deficiency Syndrome, HIV, salivary flow, xerostomy, dental cavity, periodontal disease.

The acquired immunodeficiency syndrome (AIDS) was and still is one of the pathologies of greatest interest for the international scientific community; consequently, information about it has greatly advanced in a relatively short time. Besides developments in medical research, the AIDS epidemic has provoked considerable changes in behavior, attitudes, and prejudice, and it has generated an intense mobilization to raise the consciousness of the population in relation to the disease and to the current scientific achievements, with the advent of antiretroviral therapies and other aspects of treatment made available for patients living with HIV (human immunodeficiency virus).

AIDS incidence and mortality rate has become reduced in some countries. After the introduction of HAART (highly active antiretroviral therapy), undesirable adverse effects related to the therapy itself became noticeable, many of which occur in the oral cavity. Among the many adverse effects, we have identified xerostomy, which is present in most patients living with HIV, and has been attributed to HIV contamination itself and/or due to immunossuppression as well as because of treatment with HAART [1].

It is known that partial or complete reduction of salivary flow and alterations in salivary composition can be a consequence of dental caries and periodontal diseases, considering that from an immunological point of view saliva helps the organism to protect itself against other diseases. A great difference was observed in HIV patients, when salivary flow is reduced or lacking, which makes alterations in saliva an important cofactor in oral manifestations of disease [2].

The etiology of periodontal disease is dental plaque. Factors of the host such as immunossuppression can accelerate disease progression, affecting local factors, including quantity and type of microbiota. Dental plaque allows the damaging influences of cavity bacteria to be concentrated at specific locations on the tooth surface, making the proliferation of these bacteria and solubility of dental tissues easier.

The development of a dental cavity depends on various factors, such as the host condition, microbiota, time and diet. Microbiologically, the dental cavity may be defined as the interrelation between the oral cavity, bacteria and dental tissues; chemically, the process of the cavity is described interrelating pH and mineral flow and solubility on the tooth-saliva interface.

We analyzed xerostomy, risk of cavities and risk of periodontal diseases (PD) in HIV patients, through the measurement of the following variables: salivary flow (SF), buffer capacity (BC), periodontal levels (PL) and MDF index. We compared them with the control group of HIV- patients, with the objective of determining if there is an increase in these rates, the possible causes for such changes in HIV+ patients, and to develop adequate clinical procedures for the treatment of these pathologies.

Material and Methods

One hundred individuals, of both genders, from 20 to 70 years old, were chosen at random, 50 of presented a diagnosis of HIV infection, while the other 50 were HIV-, respecting the order of arrival for the beginning of treatment, during a period of one year from March 2007 to March 2008.

The test group (TG) was composed of patients with positive HIV serology undergoing odontological treatment at the Centro de Atendimento a Pacientes Especiais, of the Faculdade de Odontologia, of the Universidade Paulista de São Paulo. The information on age, gender, skin color, habits, general and oral diseases, levels of T-CD4 lymphocytes, viral

load and HAART was collected in the anamnesis and in the clinical examination of the patients. Among the oral and general manifestations, the ones that we considered were the damage at the time of the clinical examination and those reported in the anamnesis or that were manifested during the odontological treatment, without ignoring the previous reports of the patients. The oral exams were made by the researcher himself, after training and calibration by the supervisor, which consisted of standardization of the methodology applied in the collection of data, such as detection of oral cavity diseases, evaluation of bacterial plaque, examination of the depth of periodontal problems and measurement of the salivary flow through the collection of saliva and application of the Dental Buff® kit, using personal protection equipment (PPE), preconized by international biosecurity norms. When necessary, the clinical exam was complemented with radiographic exams, exfoliative cytology or biopsy, according to the orientation in each case.

The control group (CG) was composed of patients undergoing odontological treatment at our teaching clinic in the Disciplina de Clinica Integrada da Faculdade de Odontologia, da Universidade Paulista de São Paulo. Information was collected and analyzed regarding age, gender, skin color, habits, general and oral diseases.

In both groups, the MDF index, plaque index, cavity index and PL rates were determined. Measurement of the SF and BC was done by collecting stimulated saliva for five minutes, according to the the salivary test methods for DentoBuff® (Inodon, Porto Alegre, RS, Brazil).

For collecting the salivary sample, the individual should be fasting for a period of two hours, in a relaxing and sitting position, chewing a basic gum tablet, which comes with the kit, with the objective of stimulating salivation. All the saliva accumulated in the first 30 seconds was discarded (swallowed or expelled). From this moment on, a new timing was started for five minutes; during this time the patient continued to chew the gum. All the secreted saliva was collected in a graduated cup, at frequent intervals. When five minutes had passed, the patient stopped chewing the gum and the last portion of stimulated saliva was collected. Through the graduation of the cup, the quantity of saliva collected in the last five minutes could be registered and the salivary flow calculated (secretion speed demonstrated in milliliters per minute). The salivary bulk was divided by the collection time and compared with the flow evaluation chart. Example: 5 mL collected in 5 minutes = 1 mL/min.

The normal SF was estimated to be between 1.6 and 2.3 mL/min, an intermediate salivary flow (moderate) between 1.0 and 1.5 mL/min and a (severely) low salivary flow - less than 1.0 mL/min.

Using the same sample of collected saliva, 1.5 mL. was taken from the graduated cup with a disposable syringe; 1.0 mL. of this saliva was added to a flask, together with the acid solution, which was already in the flask. Also, four drops of the indicator that was located in a brown glass in the kit were added, using a medicine dropper and the mixture shaken for 10 seconds. A comparison with the color scale was made, evaluating the buffering capacity (BC) of the saliva with a chart. Low BC was pH lower than 4.5, intermediate BC- pH between 4.5 and 5.5, normal BC - pH higher than 5.5 (varying from 5.6 to 7.0, with an average of 6.6).

Prophylaxis of the dental elements was done with a Robinson brush and a rubber cup with pumice stone. After that the patient was oriented to rinse his mouth with water. Clinical exams of the dental elements were made with relative isolation, mirror and an exploratory probe, using artificial lightning. Lack of teeth, presence of cavities, and restored teeth were evaluated. These rates were registered in the teeth records of the CAPE patients and in the records of the patients of the Disciplina de Clínica Integrada da UNIP.

The plaque rate was measured through the apparent plaque (erythrosine). This material was introduced into the oral cavity, producing a red color wherever there was bacterial plaque. The result of this test was registered in the plaque rate and evaluated through the Ainamo and Bay test (1975), considering the presence or absence of the plaque in a binomial pattern (dicotomic counting). Visible plaque was marked "1", while no visible plaque was marked "0".

The bleeding rate was calculated by examining the visible bleeding points, until 15 seconds after the poll. The number of bleeding tooth faces was divided by the total number of tooth faces, obtaining the bleeding rate. The result of this test was registered and evaluated with the Ainamo and Bay test [3], as was the plaque rate.

A clinical exam of the periodontal condition was done using relative isolation, using a 1 to 10 mm probe and artificial lightning. The probe was introduced into the marginal gingival area and inserted into each dental element.

The data was first analyzed descriptively. In this phase, averages, percentages and standard deviations were obtained. In a second stage, the inferential statistical analysis of the data was done. χ^2 tests of homogeneity and comparison tests were applied.

Results

The average age of the TG was 38 years old. There were 58% females and 42% males. Among the CG, the average age was 41 years old, with 56% females and 44% males. In the recording of skin color in the CG, 78% were black and 22% white; in the TG 50% were black 48% white and 2% yellow. Most of the HIV+ patients of our sample had a low viral load (VL). Fifty percent of them had an undetectable VL and the remaining 25 presented values less than or equal to 2,408 copies/mL of blood. Seventy-eight presented VL under 5,000 copies, 12% between 5,000 and 10,000 copies and only 10% had ≥ 10,000 copies/mL of blood. In the analysis of defense cells, 56% presented T-CD4 lymphocytes ≥ 500 /mm³, 36% between 200 and 500 /mm³ and only 8% presented T-CD4 under 200 /mm³; which would mean a low risk of opportunistic infection.

We found that 21 HIV+ patients, 42% of the TG, presented some form of oral candidiasis, which was the most common oral manifestation found in the TG. Other oral manifestations were also found, such as HPV in seven patients (14%) and oral hairy leukoplakia (OHL) in four cases (8%) of the TG. Among the other non-oral pathologies, the most common ones were pneumonia in 11 cases (22%), herpes Zoster in eight patients (16%) and pulmonary tuberculosis in four patients (8%) of the TG. Seven patients (14%) of the TG did not present oral or general manifestations. The CG presented lower numbers of oral manifestations, candidiasis being the most frequent, with six cases (12%), followed by labial herpes with five cases (10%). Among the general manifestations, the CG had eight cases (16%) of cardiopathy and diabetes, followed by hepatitis, which affected three patients (6%). In the analysis of DP, our TG had 12 cases (24%) of type P3 (severe), which is the most severe form of the disease before P4 (extraction indicated), while the CG presented only three cases (6%) of P3.

In order to evaluate the salivary flow, when altered, we divided it into three different categories: normal salivary flow, between 1.6 and 2.3 mL/min, intermediate (moderate) salivary flow, between 1.0 and 1.5 mL/min, and low (severe) salivary flow, under 1.0 mL/min. The TG had 50% with low SF, while the CG had 18%. Normal SF, was found in 24% of the TG and in 62% of the CG; what these differences were significant (p ≤ 0.003).

Table 1. Distribution of frequencies of salivary flow categories in HIV and control patients (percentages in parentheses).

	Salivary Flow			
Group	**Low**	**Intermediate**	**Normal**	**Total**
Control	9 (18.0)	10 (20.0)	31 (62.0)	50 (100.00)
HIV	25 (50.0)	13 (26.0)	12 (24.0)	50 (100.00)
Total	34 (34.0)	23 (23.0)	43 (43.0)	100 (100.00)

p= 0.003.

There were significant differences (p ≤ 0.033), in tooth cavities, tooth loss and tooth restoration (MDF). The mean MDF rate observed in the TG was 20 and in the CG it was 16 per patient.

Table 2. Patient age and tooth conditions in control and HIV patients.

Variable	**Group**	**Average**	**S.D.**	**p**
Age	Control	41.4	12.4	0.213
	HIV	38.5	10.1	
MDF	Control	16.04	6.50	0.033
	HIV	20.80	7.37	
Bleeding rate	Control	36.0	26.6	0.033
	HIV	46.6	30.2	
Plaque rate	Control	52.7	28.6	0.027
	HIV	63.7	27.6	

Fifty percent of the TG patients had low BC, while only 4% of the CG had low BC. Intermediate CT was found in 22% of the TG and in 34% of the CG. Normal BC, in only 28% of the TG, while in the CG most of the patients (62%) presented normal BC; the difference between the groups was significant. The TG had the worst rates of CPO and BC.

Table 3. Distribution of buffering capacity of the control and HIV patient salivas (perentages in parentheses).

Group	**Low**	**Intermediate**	**Normal**	**Total**
Control	2 (4.0)	17 (34.0)	31 (62.0)	50 (100.00)
HIV	25 (50.0)	11 (22.0)	14 (28.0)	50 (100.00)
Total	27 (27.0)	28 (28.0)	45 (45.0)	100 (100.00)

p = 0.003.

Two important factors were observed regarding bad habits: 16% used to smoke and 12% used to smoke and drink alcohol frequently, which 52% of the TG did not have these habits. In the group that did not have these habits, nine patients (18%) were found with normal CT. In the group that revealed bad habits, such as smoking, three patients (6%) had normal CT; in the group that smoked and drank alcohol two patients (4%) had normal CT.

In the analysis of PD, the TG had a much more severe disease situation than did CG; 12 TG patients (24%) had P3, that is severe PD; the CG had only three patients (6%) with P3. Those who smoked and drank alcohol had the same percentages of severe PD in both groups.

We observed a significant difference (p≤0.03) in the average bleeding rate for the groups; it was higher in the HIV+ group when compared to the CG. An average of 46% of the TG group had bleeding, compared to 36% of the CG. The TG had 63% medium plaque rate and the CG 52%.

In our sample, the TG had a much more advanced DP than the CG, not being compatible with the rates of plaque formation found. The severity of DP was twice as high in TG, which had 32% with PD-P1 (light). The CG had 62% light PD, while severe PD-P3 was found in 24% of the TG and 6% of the GC.

Discussion

Saliva is an aqueous, translucent fluid, with neutral pH, secreted by the salivary glands into the oral cavity. Its production reaches one half to one liter per day. Salivary flow is inconstant, reduced in the morning, higher during the afternoon, and almost inexistent during sleep. The main component of saliva is water (99%), the rest is formed by organic components and minerals secreted by the large and small salivary glands. Saliva is one of the most complex, versatile and important fluids of the human body; it includes products of bucal metabolism, bacterial cells, epithelial cells and gingival secretion, which attend to a large spectrum of physiological needs. The presence of structural (mucin, estaterrin, agglutinin,

Table 4. Distribution of the rate of Periodontal Diseases (percentages are in parentheses). P1 is least severe, P4 is most severe.

	Periodontal Diseases					
Group	P1	P2	P3	P4	S/D	Total
Control	31 (62.0)	15 (30.0)	3 (6.0)	0 (0.0)	1 (2.0)	50 (100.00)
HIV	16 (32.0)	19 (38.0)	12 (24.0)	1 (2.0)	2 (4.0)	50 (100.00)
Total	47 (47.0)	34 (34.0)	15 (15.0)	1 (1.0)	3 (3.0)	100 (100.00)

p = 0.003.

lactoferrin) and immunological (immunoglobulin, salivary IgA or secretor immunoglobulin: SgA) proteins in the composition of saliva are determining factors for its properties, being essential for the oral cavity, oropharinge and gastrointestinal epithelium protection [1,4-14].

Mulligan et al. [2] and Greenspan et al. [15] describe that what is most damaged in HIV+ patients is their immune response, through which the host interacts with the etiological agent of the disease. According to these authors, few studies examine the effectiveness of HAART in the reduction of the incidence of oral damage.

In our sample we demonstrated in the TG cases, a higher frequency of damage, such as HPV (human papillomavirus), not observed in the CG.

Confirming what we found, Alpagot et al., Brown et al., Caridade et al., Cobb et al., and Lindhe et al. [16-21], affirm that the HIV leads to more severe PD disease, which is associated with a deficiency in the response of the host, as the bacterial groups found in the HIV+ patients are the same found in HIV- patients. Besides PD, the number of cavities in TG was higher, which occurred because of the reduction of SF and BC of the saliva.

Our findings are similar to what was found by Giovani et al. [1], who reported that the SF was low in HIV+ patients, and the pH of these patients was altered when compared to HIV- patients; the MDF and dental plaque rates were also higher in the HIV+ group. The SF was low, which associated with the low BF and the high plaque rate, enhances the risk of cavities in HIV+ patients.

When the BC is low, the probability of the patient developing a tooth cavity disease is much higher, as cavities involve demineralization of the enamel. When the pH of the saliva is low (acid), demineralization of the enamel will occur faster, facilitating the development of microorganisms that produce the tooth cavities. The incidence of cavities can also be influenced by the anti-retroviral product rich in sucrose, pointing to the necessity of working with on oral health. These drugs favor the reduction of the many estomatological manifestations, so it would not be possible to suspend this therapy. In our samples, 82% of the HIV+ patients used HAART [22-27].

Different from what we found, Bretz et al., Brunelle et al., Chen et al. and Phelan et al. [28-31], observed that patients who used HAART had a much lower occurrence of dental cavities than patients who did not use this therapy. According to those authors, systemic medication of HAART for the patient with HIV does not have any significant damaging effect on their teeth.

Conclusions

Patients living with the HIV had a higher rate of salivary flow reduction, consequently a higher rate of xerostomy, and a lower salivary buffering capacity than the control group. The HIV+ group manifested a larger number of severe periodontal diseases, which did not follow the bacterial plaque and MDF index numbers. Although the HIV+ group, in general, did not have high viral loads or low numbers of T-CD4 lymphocytes, though a higher risk of periodontal diseases, dental cavities and xerostomy was evident. This reveals the necessity of more rigorous clinical control with higher periodicity to avoid these manifestations in the HIV patient.

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