ORAL DISEASES

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ORIGINAL ARTICLE

Dental status of Portuguese HIV+ patients and related variables: a multivariate analysis

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OBJECTIVE: The aim of this cross-sectional study was to evaluate the dental status of 101 Portuguese HIV+ subjects aged 22–71 years (mean = 39) and its association with clinical, socioeconomic, and behavioral variables.

MATERIALS AND METHODS: A calibrated dentist performed clinical examination and collected data on dental caries, periodontal status, dental plaque levels, prosthetic conditions, and need. The volunteers completed questionnaires on socioeconomic and behavioral variables as well as the Oral Health Impact Profile (OHIP-14) questionnaire. Univariate and multiple logistic regression (MLR) analyses were performed.

RESULTS: The mean number of decayed, missing or filled teeth index (DMFT index) was 16.44, standard deviation (s.d.) = 8.42. MLR demonstrated that salaried employee and those with OHIP-14 \leq 4.22, or any/no dental plaque were less prone to have DMFT > median (=17). As regards prosthetic status, 28.8% of the examined individuals used dental prosthesis. MLR demonstrated that HIV+ with DMFT >17 or those who knew they were HIV-positive for longer than 5 years were more prone to need dental prostheses. The mean OHIP-14 index was 5.83 (s.d. = 7.79).

CONCLUSIONS: The dental health status of HIV-infected Portuguese patients was unsatisfactory and related to clinical, socioeconomic, and behavioral variables. Oral Diseases (2010) 16, 176–184

Keywords: AIDS; HIV; DMFT index; CPI index

Introduction

Human Immunodeficiency Virus (HIV) infection and the Acquired Immunodeficiency Syndrome (AIDS) account for tens of millions infections and deaths, thousands of newly infected individuals each day, and millions of children orphaned. In some countries, they contribute greatly to a reduced life expectancy (Antunes, 2004).

Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome are considered important public health problems both in developed and developing countries (WHO, 2009). The morbidity and mortality associated with HIV infection are affected by prophylaxis to prevent opportunistic infections, antiretroviral therapy, and social condition (Paixão, 2004). While in Europe, Portugal, Spain, and France the high AIDS incidence rates are associated with virus transmission by drug use and sexual contact among heterosexuals, and in the northern European countries, virus transmission by homosexual relations is predominant (Sousa and Victorino, 2004).

According to the national commission for the fight against AIDS ('Comissão Nacional de Luta contra a AIDS'), since the beginning of the AIDS epidemic, Portugal has been one of the countries with the highest proportion of injecting drug users (IDUs) living with HIV and/or with AIDS, within the European Union. Among the dependent drug users, a total of 49.5% present AIDS and 5.8% are asymptomatic HIV-infected individuals.

The drug dependence is the most risk behavior, because drug users have difficulty in adhering to drug treatment, and in general, have a negligent attitude towards health (WHO, 1990). An active drug dependent individual rarely adheres to the health care needs that HIV infection requires. Therefore, the clinical course is marked by abandonment of antiretroviral treatment leading to successive stays in hospital and consequently reduced life expectancy (EuroHIV, 2003). Generally, illicit drug use dependents present high rates of dental caries and periodontal disease, resulting from poor oral health and malnutrition (Fazzi *et al*, 1999).

As regards HIV-associated oral lesions, there are seven cardinal lesions indicators of HIV infection: oral candidiasis, hairy leukoplakia, Kaposi sarcoma, linear gingival erythema, necrotizing ulcerative gingivitis, necrotizing ulcerative periodontitis, and non-Hodgkin

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lymphoma (Coogan *et al*, 2005). In relation to oral lesions distribution worldwide, Ranganathan and Hemalatha (2006) published an overview on oral lesions in HIV infection in developing countries. They found that oral candidiasis was the commonest opportunistic infection. Kaposi's sarcoma, as well as histoplasmosis and penicilliosis, has been reported in patients from Africa and Latin America, and from Thailand, respectively. Gingivitis and periodontal disease were predominant in Africa and India, due to malnutrition and poor oral hygiene. According to the authors, high rates of salivary gland disease have been noted in Latin America. Such diseases may harm the patient's quality of life.

Moreover, reduction in salivary flow rate may increase caries risk (Petersen, 2006). In a study of Phelan *et al* (2004), higher coronal caries prevalence was detected in HIV+ women compared with HIVwomen. According to Eldridge and Gallagher (2000), HIV+ children should be treated as high caries risk individuals and receive appropriate dental care. As regards periodontal diseases, prevalence of HIV-associated periodontal diseases has been estimated to be about 5% to 12%. They can cause pain, severe discomfort, and negatively affect the quality of life (Schmidt, 1999).

There are very few complete studies on the dental status of HIV-infected subjects. In Portugal, there is no report on the subject. Therefore, the aim of this cross-sectional study was to evaluate the dental status of 101 Portuguese HIV+ subjects aged 22–71 years and its association with clinical, socioeconomic, and behavioral variables.

Materials and methods

Ethical aspects

All ethical aspects related to the research development were fulfilled. The study was undertaken with the understanding and written consent of each subject and according to the principles of the World Medical Association Declaration of Helsinki. The study has been independently reviewed and approved by the Ethics Council of the School of Dental Medicine, University of Lisbon.

Study design

This was a cross-sectional study in which a calibrated dentist performed the clinical examination and the volunteers completed questionnaires. Clinical examination included assessment of dental caries levels, periodontal, oral hygiene, and dental prosthetic status. Questionnaires included questions on socioeconomic, demographic, behavioral, and medical variables as well as on oral health impact profile (OHIP).

The study was conducted in Cascais County, a region near Lisbon with a population of about 200 000 inhabitants.

Sample

The sample was composed of 101 (32 women and 69 men) 22-71-year-old HIV+ adult (mean age = 39.1 years;

standard deviation = 9.2 years) patients enrolled at the Immunodeficiency Unit (IU) of Cascais Hospital Center who received regular medical care and signed the Informed Consent Form. The sample size calculation considered the significance level of 5%, power of the test = 0.80, and χ^2 = 7. Sample selection was carried out by randomly contacting 20% of the patients, in each examination day, until we completed contacting the 101 subjects. Among the contacted patients, only one refused to be enrolled in the study (response rate = 99%).

Data collection

Data collection was conducted within four months, after a pilot study on all dental variables searched. On an average, the volunteers have spent 15 min to undergo clinical examination and fill out the questionnaire.

Clinical examination. Clinical examination was con-

ducted by a calibrated dentist (kappa > 0.81 for all collected variables) in a hospital room, under the supervision of a physician. The examiner used Community Periodontal Index (CPI) probes, flat mouth mirrors, natural light and was seated in front of the volunteer. Dentition status, treatment needs, periodontal, and prosthetic status were assessed in accordance with the World Health Organization codes and criteria (WHO, 1997).

Dentition status was evaluated by the mean number of Decayed, Missing or Filled teeth index (DMFT index). Treatment needs were recorded as follows: 0-no treatment, 1-one surface filling, 2-two or more surface fillings, 3-crowns for any reason, 4-veneer or laminate, 5-pulp care and restoration, 6-extraction, 7-incipient lesion remineralization, 8-fissure sealant, and 9-not recorded.

Periodontal status was evaluated by the Community Periodontal Index using a CPI probe with a 0.5 mm ball tip, with a black band between 3.5 and 5.5 mm and rings at 8.5 and 11.5 mm from the ball tip. Teeth 17, 16, 11, 26, 27, 37, 36, 31, 46, 47 were assessed. The presence of bleeding, calculus, and periodontal pockets was determined using the CPI probe with a sensing force of not more than 20 g to determine the pocket depth and to detect subgingival calculus and bleeding response. The codes were: 0-healthy; 1-bleeding observed after probing; 2-Calculus detected during probing, but the entire black band on the probe visible; 3-pocket 4–5 mm; 4-pocket 6 mm or more; X- excluded sextant (<2 teeth); 9-not recorded.

The dental prosthetic status was recorded for each jaw as follows: 0-no dental prosthesis, 1-bridge, 2-more than one bridge, 3-partial denture, 4-both bridge(s) and partial denture(s), 5-full removable denture, 9-not recorded. The dental prosthetic need was also assessed in each jaw, according to the codes: 0-no prosthesis needed, 1-need for one-unit prosthesis, 2-need for multi-unit prosthesis, 3-need for a combination of one- and/or multi-unit prostheses, 4-need for full prosthesis, 9-not recorded.

Visible dental plaque was assessed on the labial surface of teeth 16, 26, 41, and 21; and lingual surface

of teeth 36 and 46, according to Greene and Vermillion (1960).

Questionnaire. A structured pretested questionnaire with 16 closed questions with regard to socioeconomic status, demographic variables, knowledge of HIV-positive status, drug use, smoking habits, and perception of dental treatment need was applied.

Oral health impact profile (OHIP) questionnaire. The Oral Health Impact Profile (OHIP), a 49-item self-administered questionnaire, was developed by Slade and Spencer (1994) to assess the individuals' perceptions of the impact of oral conditions on their well-being. The aim of the instrument is to measure seven conceptually formulated dimensions of physical pain, functional limitation, physical and social disabilities, psychological discomfort, psychological disability, and handicap. A short-term version (OHIP-14) was later developed with two questions for each of the seven dimensions and validated by Slade (1997) who stated that OHIP-14 has good reliability, validity, and precision. For each question, the HIV+ patients were asked how frequently they had experienced the impact in the last 12 months. Responses were based on a Likert-type scale as follows: 0-never, 1-hardly ever, 2-occasionally, 3-fairly often, 4-very often. Responses 'occasionally', 'fairly often', and 'very often' were pooled together to indicate the prevalence of people who had at least some impact.

Data analysis

Univariate analyses were performed using chi-square or Fisher tests. Dependent variables were either dichotomized by median as follows: DMFT index > 17; Decayed Teeth >3; Periodontal Community Index >2; OHIP-14 >4.22, oral hygiene (score 0-3: little or no plaque; score >3: much plaque). Dental prosthetic need (ves; no) was also dichotomized. Those with P < 0.15 were selected for the multiple logistic regression (MLR) to eliminate those that would make little contribution to the model. The Stepwise selection was the method of variable selection and the best-fit model was estimated by means of the Akaike information criterion (AIC) and the likelihood ratio test. After adjusting the regression model, the values of Odds Ratio (OR), their 95% confidence interval (CI), and P-values were estimated. All the statistical tests were performed using the SPSS for Windows Version: 13.0.1 (SPSS Inc., Chicago, IL, USA 1999).

Results

Most of HIV+ patients examined were men (68%), 22–44 years old (75%), who used illicit drugs intravenously (56%) and/or smoked (63%). As regards the socioeconomic variables, most of them were employed (56%), received wages from 251 to 1000 Euros (55%), and had attended school for 9 years at least (57%). With regard to oral health care, most had visited a dentist in the last 2 years (63%).

Oral Diseases

The HIV+ patients showed a mean 16.44 DMFT (standard deviation, s.d. = 8.42) (5.28 Decayed teeth, s.d. = 6.00; 9.25 missed teeth, s.d. = 8.60 and 1.91 Filled teeth, s.d. = 2.68). Grouping patients by age. mean DMFT (standard deviation) was 16.39 (7.96), 15.79 (8.32), and 17.08 (9.57) for 22-34, 35-44, and 45-71 year olds, respectively. Mean decayed teeth was 7.73 (7.32), 4.72 (5.36), and 3.00 (3.96) for 22-34, 35-44, and 45-71 year olds, respectively. Mean missing teeth was 6.97 (7.27), 8.65 (7.92), and 13.28 (10.32) for 22-34, 35-44, and 45-71 year olds, respectively. Mean filled teeth was 1.73 (2.73), 2.67 (2.78), and 0.84 (2.08) for 22-34, 35-44, and 45-71 year olds, respectively. Among all decayed teeth, on average 4.17 teeth needed dental extraction/restorative/endodontic care and 1.1 needed remineralization/sealant. Almost all the subjects (95%) presented DMFT >0; 20% needed dental treatment and on average they had 18.75 teeth.

With DMFT > 17 as dependent variable, the univariate analysis showed that professional status, educational level, intravenous illicit drug use, smoking habits, and all dental variables were associated with dependent variable at P < 0.05 (Table 1). The results of MLR analysis, which included all independent variables at P < 0.15, demonstrated that salaried employee, or those with OHIP-14 \leq 4.22, or none/some dental plaque were less prone to have DMFT > 17 (Table 2). When decayed teeth >3 was used as dependent variable, univariate analysis showed age, monthly income, intravenous drug use, perception of need to visit dentist, OHIP-14 and several dental variables were associated at P < 0.05 (Table 1). The multivariate model indicated that those with self-perception about visiting the dentist, with OHIP-14 > 4.22 or those with mandibular prosthetic need were at risk of having more than three decayed teeth (Table 2).

Periodontal status showed that only 6.9% of HIV + patients presented periodontal health. Among a total of 77.2%, at least 4–5 mm deep pockets were detected. Table 3 shows results of univariate analysis for dental plaque or CPI index as dependent variables. Age, educational level, time since last dental visit, CPI index and prosthetic need were associated with dental plaque at P < 0.05 (Table 3). Among them, education level, smoking habits, and CPI index were risk indicators for the presence of a great deal of plaque (Table 4). Considering CPI index as dependent variable, DMFT and prosthetic need were associated at P < 0.05(Table 3). No variable in the MLR model remained at the level of significance (P < 0.05).

Regarding dental prosthetic status, 28.8% of the examined individuals wore dental prosthesis. Among them, 20.8% used partial denture, 5% full removable denture, 2% full and partial denture, and 1% used bridge. Regarding prosthetic need, 51.5% needed dentures in the maxilla and 49.5% in the mandible. Table 5 shows the knowledge of HIV-positivity, drug use, smoking habits, and DMFT as variables associated with dental prosthetic need at P < 0.05. The MLR demonstrated that HIV+ with DMFT>17 (OR = 4.53; CI = 1.65–12.42; P < 0.0001) or those who had

Table 1 Univariate analyses with decayed, missing or filled teeth (DMFT) or decayed component as dependent variables

	DMFT			Decayed component			
Independent variable	≤ <i>17</i> n (%)	>17 n (%)	P-value	≤3 n (%)	>3 n (%)	P-value	
Age (years)							
22–34	15 (45.5)	18 (54.5)	0.2968	11 (33.3)	22 (66.7)	0.0141	
35–44	26 (60.5)	17 (39.5)		22 (51.2)	21 (48.8)		
45-71	11 (44.0)	14 (56.0)		18 (72.0)	7 (28.0)		
Gender							
Female	15 (46.9)	17 (53.1)	0.5278	14 (43.5)	18 (56.5)	0.3558	
Male	37 (53.6)	32 (46.4)		37 (53.6)	32 (46.4)		
Professional status	× /						
Employed	38 (66.7)	19 (33.3)	0.0009	27 (47.4)	30 (52.6)	0.0880	
Unemployed	9 (42.9)	12 (57.1)		8 (38.1)	13 (61.9)		
Other	5 (21.7)	18 (78.3)		16 (69.6)	7 (30.4)		
Monthly income (Euros)	- ()	(,,,,,)			. ()		
No income	6 (42.9)	8 (57 1)	0.2855	3 (21.4)	11 (78.6)	0.0213	
1-250	8 (36.4)	14 (63.6)	0.2000	16(727)	6(27.3)	0.0215	
251-500	15 (53.6)	13(464)		14(50.0)	14(50.0)		
501-1000	16(57.1)	12(42.9)		11(30.3)	17(60.7)		
1001 1500	10 (57.1)	2(33.3)		11 (5).5)	2(333)		
1501 2000	4(00.7)	2(33.3)		4(00.7)	2(33.3)		
Educational laval	5 (100.0)	0 (0.0)		3 (100.0)	0 (100.0)		
	17(20.5)	2((0,5))	0.0295	24(55.9)	10 (44.2)	0 2572	
interate, < 9 years of schooling	17 (39.3)	20 (00.5)	0.0385	24 (55.8)	19 (44.2)	0.3373	
≥9 years of schooling	35 (60.3)	23 (39.7)		27 (46.5)	31 (53.5)		
Knowledge of HIV-positive status							
≤5 years	30 (58.8)	21 (41.2)	0.1361	28 (54.9)	23 (45.1)	0.3710	
> 5 years	22 (44.0)	28 (56.0)		23 (46.0)	27 (54.0)		
Intravenous illicit drugs use							
No	30 (68.2)	14 (31.8)	0.0032	30 (68.2)	14 (31.8)	0.0018	
Yes	22 (38.6)	35 (61.4)		21 (36.8)	36 (63.2)		
Smoking habits							
No	26 (70.3)	11 (29.7)	0.0041	22 (59.5)	15 (40.5)	0.1707	
Yes	26 (40.6)	38 (59.4)		29 (45.3)	35 (54.7)		
Time since last dental visit							
< 2 years	34 (53.1)	30 (46.9)	0.5994	38 (59.4)	26 (40.6)	0.0839	
3–5 years	5 (35.7)	9 (64.3)		5 (35.7)	9 (64.3)		
6–10 vears	8 (53.3)	7 (46.7)		4 (26.7)	11 (73.3)		
> 11 years	5 (62.5)	3 (37.5)		4 (50.0)	4 (50.0)		
Self-perception of need for dental visit	- ()	- ()		. ()	(((((((((((((((((((((((((((((((((((((((
No	9 (50 0)	9 (50 0)	0 8894	17 (94 4)	1 (5 6)	< 0.0001	
Ves	43 (51.8)	40 (48 9)	0.0001	34(407)	19 (59 0)	0.0001	
CPL index	45 (51.0)	40 (40.5)		54 (40.7)	17 (35.0)		
<2	16 (88 0)	2(111)	0.0028	12 (66 7)	6 (33 3)	0.0306	
≥ 2	10(00.9) 26(40.2)	2(11.1) 27(507)	0.0028	12(00.7)	0(33.3)	0.0390	
Pontal plaqua amount	30 (49.3)	57 (50.7)		29 (39.7)	44 (00.3)		
	25 (20.1)	20 ((0,0))	0.0010	20(42,2)	25 (54 7)	0 1707	
Large amount	25 (39.1)	39 (60.9) 10 (27.0)	0.0010	29 (43.3)	33 (34.7) 15 (40.5)	0.1707	
None/some	27 (73.0)	10 (27.0)		22 (59.5)	15 (40.5)		
OHIP-14 index	24 (((7)	17 (22.2)	0.0000	24 (((7)	17 (22.2)	0.0010	
≤4.22	34 (66.7)	17 (33.3)	0.0020	34 (66.7)	17 (33.3)	0.0010	
> 4.22	18 (36.0)	32 (64.0)		17 (34.0)	33 (66.0)		
Maxillary prosthetic status							
No prosthesis	44 (62.0)	27 (38.0)	0.0019	31 (43.7)	40 (56.3)	0.0925	
Fixed denture	1 (100.0)	0(0.0)		1 (100.0)	0(0.0)		
Removable partial denture	7 (31.8)	15 (68.2)		13 (59.1)	9 (40.9)		
Full denture	0(0.0)	7 (100.0)		6 (85.7)	1 (14.3)		
Maxillary prosthetic status (yes/no)							
No prosthesis	44 (62.0)	27 (38.0)	0.0012	31 (43.7)	40 (56.3)	0.0346	
With prosthesis	8 (26.7)	22 (73.3)		20 (66.7)	10 (33.3)		
Maxillary prosthetic need							
No denture needed	31 (63.3)	18 (36.7)	0.0009	0 (0.0)	49 (100.0)	0.0151	
One-unit prosthesis	6 (85.7)	1 (14.3)		1 (14.3)	6 (85.7)		
Multi-unit prosthesis	7 (23.3)	23 (76.7)		4 (13.3)	26 (86.7)		
One- and/or multi-unit prostheses	8 (88 9)	1 (11.1)		2 (22.2)	7 (77.8)		
Full denture	0 (0 0)	6 (100 0)		0(00)	6 (100 0)		
Maxillary prosthetic need	0 (0.0)	0 (100.0)		0 (0.0)	0 (100.0)		
No	31 (63 3)	18 (36 7)	0.0215	33 (67 5)	16 (32 5)	0.0010	
Ves	21 (40.4)	31 (59.6)	0.0210	18 (34.6)	34 (65 4)	0.0010	
1 V0	21 (TU.T)	51 (57.0)		10 (0.7.0)	JT (0J.T)		

Table 1 (Continued)

Independent variable	DMFT			Decayed component		
	≤17 n (%)	>17 n (%)	P-value	≤3 n (%)	>3 n (%)	P-value
Mandibular prosthetic status						
No prosthesis	49 (62.0)	30 (37.7)	0.0002	34 (43.0)	45 (57.0)	0.0091
Fixed denture	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Removable partial denture	3 (17.5)	14 (82.5)		12 (70.6)	5 (29.4)	
Full denture	0 (0.0)	5 (100.0)		5 (100.0)	0 (0.0)	
Mandibular prosthetic status (yes/no)	()					
No prosthesis	49 (62.0)	30 (38.0)	< 0.0001	34 (43.0)	45 (57.0)	0.0045
With prosthesis	3 (13.6)	19 (86.4)		17 (77.3)	5 (22.7)	
Mandibular prosthetic need	- ()					
No denture needed	32 (62.8)	19 (37.2)	0.0009	3 (5.8)	48 (94.2)	0.7814
One-unit prosthesis	5 (100.0)	0 (0.0)		0 (0.0)	5 (100.0)	
Multi-unit prosthesis	11 (29.0)	27 (71.0)		4 (10.5)	34 (89.5)	
One- and/or multi-unit prostheses	4 (80.0)	1 (20.0)		0 (0.0)	5 (100.0)	
Full denture	0 (0.0)	2(100.0)		0 (0.0)	2 (100.0)	
Mandibular prosthetic need	• (••••)	- ()		. ()	- ()	
No	32 (62.8)	19 (37.2)	0.022	28 (54.9)	23 (45.1)	0.3710
Yes	20 (40.0)	30 (60.0)		23 (46.0)	27 (54.0)	

CPI, community periodontal index; OHIP, oral health impact profile.

 Table 2
 Multiple logistic regressions with decayed, missing or filled teeth (DMFT) or decayed component as dependent variables

Independent variable	<i>DMFT</i> >17 n (%)	Odds ratio (OR)	Confidence interval	P-value
Professional statu	S			
Employed	19 (33.3)	0.145	0.0026-0.824	0.0165
Unemployed	12 (57.1)	0.644	0.092-4.484	0.5196
Other	18 (78.3)	1.00		
OHIP-14				
≤4.22	17 (33.3)	0.121	0.029-0.503	< 0.0001
>4.22	32 (64.0)	1.00		
Dental plaque am	ount			
Large amount	39 (60.9)	11.628	2.625-52.631	0.0008
None/some	10 (27.0)	1.00		
Decayed compone	nt > 3 n (%)			
Self-perception of	need for dent	al visit		
No	1 (5.6)	1.00		< 0.0001
Yes	19 (59.0)	14.32	1.76-116.65	
OHIP				
≤4.22	17 (33.3)	1.00		0.0130
> 4.22	33 (66.0)	2.78	1.12-6.94	
CPI index				
≤2	6 (33.6)	1.00		0.0456
>2	44 (60.3)	3.26	0.99–10.73	

CPI, community periodontal index; OHIP, oral health impact profile.

knowledge of their HIV-Positive Status for more than 5 years (OR = 3.17; CI = 1.17-8.61; P = 0.0075) were more prone to need dental prostheses.

The mean OHIP-14 index was 5.83 (scale from 0 to 28; s.d. 7.79). On an average, each component of impact ranged from 0.17 to 1.83 (maximum value = 4), indicating a mild impact of oral health problems. Most participants experienced several impacts affecting their well-being in the last six months: trouble with pronouncing words (26.7%), worsened sense of taste (31.7%), painful aching in mouth (38.6%), discomfort when eating any foods (58.4%), self-conscious because of their teeth, mouth or dentures (45.5%), felt tense because of

problems with their teeth, mouth or dentures (34.7%), unsatisfactory diet (24.8%), interruption of meals (26.7%), difficulty to relax due to oral problems (32.7%), embarrassed because of oral problems (38.6%), irritable with other people because of oral problems (28.7%), felt that life in general was less satisfying (32.7%), and totally unable to function (32.7%). The prevalence of difficulty doing usual jobs had the lowest impact (13.9%).

Discussion

This is the first Portuguese study on the dental status of HIV + patients. The proper sample design, calibration and training of examiner, use of pretested questionnaire, accomplishment of pilot study, control of confounding variables, and taking into account the hierarchical relationships between the independent variables in data analysis were strategies used to ensure study's validity and data's reliability.

As regards dental caries, on average, HIV+ patients presented 16.4 decayed, missing or filled teeth. Comparing this result with those of similar age group, such as a sample of Turkish health adults, aged 18–74 years, which the mean DMFT was 11.4 (Namal et al, 2008), one may verify the worse dental status of the HIV+ Portuguese patients. Although there is no report on dental caries in Portuguese HIV+ patients, the last national epidemiological survey conducted in the 1990s showed that DMFT for 35-44 year-old adults was 10.9, with 2.9 decayed, 6.7 missing, and 1.4 filled teeth (Almeida et al, 1991). These data corroborate the poor dentition status of Portuguese HIV + patients compared with general dental patients. In fact, HIV + patients had about five decayed teeth, demonstrating that the sample had approximately over 500 teeth needing care. Moreover, more than nine teeth, on an average, were missing. On the other hand, the DMFT found in this study was

Table 3 Univariate analyses with dental plaque or CPI index as dependent variables

		Dental plaque	CPI index (periodontal status)			
Independent variable	Large amount n (%)	None/some n (%)	P-value	≤2 n (%)	>2 n (%)	P-value
Age (years)						
22-34	26 (78.8)	7 (21.2)	0.0233	2 (6.5)	29 (93.5)	0.0537
35-44	21 (48.8)	22 (51.2)		11 (28.2)	28 (71.8)	
45-/1 Conden	17 (68.0)	8 (32.0)		5 (23.8)	16 (76.2)	
Female	11 (63.8)	25 (36 2)	0.9021	13 (21.0)	49 (79.0)	0.6775
Male	20 (62 5)	12(37.5)	0.9021	5(172)	24 (82.8)	0.0775
Professional status	20 (02.5)	12 (57.5)		5 (17.2)	24 (02.0)	
Employed	36 (63.2)	21 (36.8)	0.9625	11 (19.6)	45 (80.4)	1.0000
Unemployed	14 (66.7)	7 (33.3)		4 (19.0)	17 (81.0)	
Other	14 (60.9)	9 (39.1)		3 (21.4)	11 (78.6)	
Monthly income (Euros)						
No income	9 (64.3)	5 (35.7)	0.7922	2 (14.3)	12 (85.7)	0.6299
1-250	13 (59.1)	9 (40.9)		10 (24.4)	31 (75.6)	
251-500	18 (64.3)	10 (35.7)		5 (18.5)	22 (81.5)	
501-1000	18 (64.3)	10 (35.7)		0(0.0)	6 (100.0)	
1001-1500	5(83.3)	1(10.7)		1 (33.3)	2 (66.7)	
1301–2000 Educational level	1 (33.3)	2 (00.7)				
Educational level $(0, 0)$ where of schooling	34 (70.1)	0(200)	0.0048	6 (167)	30 (83.3)	0 5463
>9 years of schooling	30(517)	28(483)	0.0048	12(21.8)	43 (78.2)	0.5405
Knowledge of HIV-positive status	50 (51.7)	20 (40.5)		12 (21.0)	45 (70.2)	
≤5 vears	33 (64.7)	18 (35.3)	0.7778	7 (15.2)	39 (84.8)	0.2693
> 5 years	31 (62.0)	19 (38.0)		11 (24.4)	34 (75.6)	
Intravenous illicit drugs use	× /			· · · ·		
No	26 (59.1)	18 (40.9)	0.4333	10 (23.8)	32 (76.2)	0.3717
Yes	38 (66.7)	19 (33.3)		8 (16.3)	41 (83.7)	
Smoking habits						
No	19 (51.4)	18 (48.6)	0.0567	9 (25.0)	27 (75.0)	0.3119
Yes	45 (70.31)	19 (29.69)		9 (16.4)	46 (83.6)	
Time since last dental visit	24 (52 1)	20(46.0)	0.00242	15(262)	12 (72 7)	0 1926
< 2 years	34(33.1) 12(857)	30(40.9)	0.00245	13(20.3) 1(8.2)	42(75.7)	0.1850
6-10 years	12 (85.7)	2(14.3) 2(13.3)		2(91)	20(90.9)	
> 11 years	5 (62.5)	3(37.5)		2 (9.1)	20 (90.9)	
Self-perception of need for dental visit	- ()					
No	10 (55.6)	8 (44.4)	0.4480	3 (21.4)	11 (78.6)	1.000
Yes	54 (65.1)	29 (34.9)		15 (19.5)	62 (80.52)	
OHIP-14						
≤4.22	31 (60.8)	20 (39.2)	0.5865	11 (25.0)	33 (75.0)	0.2265
> 4.22	33 (66.0)	17 (34.0)		7 (14.9)	40 (85.1)	
CPI index						
≤2	17 (94.4)	1(5.6)	< 0.0001	-	-	—
> 2 Dental plaqua amount	18 (24.7)	55 (62.8)		-	-	
Large amount				1 (1.8)	55 (08.2)	5 475
None/some	_	_		17 (48.6)	18(514)	5.475
DMFT				17 (40.0)	10 (51.4)	
≤17	25 (48.1)	27 (51.9)	0.0010	16 (30.8)	36 (69.2)	0.0028
>17	39 (79.6)	10 (20.4)		2 (5.1)	37 (94.9)	
Maxillary prosthetic status						
No prosthesis	47 (66.2)	24 (33.8)	0.5288	11 (15.7)	59 (84.3)	0.1393
Fixed denture	0 (0.0)	1 (100.0)		0 (0.0)	1 (100.0)	
Removable partial denture	13 (59.1)	9 (40.9)		7 (38.9)	11 (61.1)	
Full denture	4 (57.1)	3 (42.9)		0 (0.0)	2 (100.0)	
Maxillary prosthetic status (yes/no)	47 ((())	24 (22.9)	0.2750	11 (15 7)	50 (04.2)	0.0754
INO PROSENESIS	47 (66.2)	24 (55.8)	0.3759	11(15.7)	59 (84.3) 14 (66.7)	0.0754
with prostnesis	17 (30.0)	15 (43.3)		/ (33.3)	14 (00./)	
No full denture needed	23 (46.9)	26 (53 1)	0.0035	13 (31.0)	29 (69 0)	0.0753
One-unit prosthesis	4 (57 1)	3(42.9)	0.0055	13(31.0) 1 (14 3)	6 (85 7)	0.0755
Multi-unit prosthesis	25 (83.3)	5 (16.7)		2. (6.7)	28 (93.3)	
One- and/or multi-unit prostheses	6 (66.7)	3 (33.3)		1(11.1)	8 (88.9)	
Full denture	6 (100.0)	0 (0.0)		1 (33.3)	2 (66.7)	

Table 3 (Continued)

	Dental plaque			CPI index (periodontal status)		
Independent variable	Large amount n (%)	None/some n (%)	P-value	≤2 n (%)	>2 n (%)	P-value
Maxillary prosthetic need						
No	23 (46.9)	26 (53.1)	0.0009	13 (30.9)	29 (69.1)	0.0132
Yes	41 (78.9)	11 (21.1)		5 (10.2)	44 (89.8)	
Mandibular prosthetic status					× /	
No prosthesis	49 (62.0)	30 (38.0)	0.7152	15 (19.2)	63 (80.8)	0.7160
Fixed denture	0 (0.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Removable partial denture	11 (64.7)	6 (35.3)		0 (0.0)	0 (0.0)	
Full denture	4 (80.0)	1 (20.0)		3 (23.1)	10 (76.9)	
Mandibular prosthetic status (yes/no)						
No prosthesis	49 (62.0)	30 (38.0)	0.5961	15 (19.2)	63 (80.8)	0.7160
With prosthesis	15 (68.2)	7 (31.8)		3 (23.1)	10 (76.9)	
Mandibular prosthetic need				. ,	× /	
No full denture needed	32 (62.8)	19 (37.2)	0.0002	9 (20.5)	35 (79.6)	0.0343
One-unit prosthesis	0 (0.0)	5 (100.0)		3 (60.0)	2 (40.0)	
Multi-unit prosthesis	30 (79.0)	8 (21.0)		4 (10.8)	33 (89.2)	
One- and/or multi-unit prostheses	0 (0.0)	5 (100.0)		2 (40.0)	3 (60.0)	
Full denture	2 (100.0)	0 (0.0)		0 (0.0)	0 (0.0)	
Mandibular prosthetic need				. ,		
No	32 (62.7)	19 (37.3)	0.8959	9 (20.5)	35 (79.6)	0.8758
Yes	32 (64.0)	18 (36.0)		9 (19.2)	38 (80.9)	

^aFor CPI index as dependent variable, the classes were: <2 years; 3–5 years; >6 years

Table 4	Multiple	logistic	regressions	with	dental	plaque	as depende	nt
variable								

Independent variable	Large amount of dental plaque n (%)	Odds ratio (OR)	Confidence interval	P-value
Educational level				
Illiterate, <9 years of schooling	34 (79.1)	4.11	1.36-12.43	0.009
≥9 years of schooling	30 (51.7)	1.00		
CPI index				
≤2	17 (94.4)	142.2	9.0-500.0	< 0.0001
> 2	18 (24.7)	1.00		
Smoking habits				
No	19 (51.4)	1.00		0.0402
Yes	45 (70.3)	4.42	0.13-38.46	

lower than the values found by Pinheiro *et al* (2004). The authors assessed oral health of 161 HIV + Brazilians, aged 19–53 years, and found a DMFT of 18.8 with 78.9% of examined individuals needing dental care. Nevertheless, the HIV + patients of this study need dental care and should receive attention from the national oral health system.

The results showed that socioeconomic variables were able to identify HIV + patients with poor dentition status and poor oral hygiene (Tables 2 and 4). Those who were salaried employees or who had at least 9 years of schooling were less prone to have high DMFT or a great deal of dental plaque. Several studies have shown that socioeconomic factors may play an important role in determining the dental caries process in the general adult population (Miura *et al*, 1997; Jovino-Silveira *et al*, 2005; Krustrup and Petersen, 2007; Roberts-Thomson and Stewart, 2008; Skudutyte-Rysstad *et al*, 2009). In general, good socioeconomic status is an important determinant in health because it may improve access to information and health care.

Another risk indicator for dental caries was OHIP-14 (Table 2). Considering the mean OHIP-14 as 5.83, one may consider that the oral health problems of HIV+ patients caused a mild impact on their wellbeing. The literature has shown that mean OHIP-14 among adults and elderly ranged from 5.6 to 9.2 (Reed et al, 2006; Lawrence et al, 2008; Mariño et al, 2008), a datum close to that of this study. As regards risk, those with OHIP-14 > 4.22 were more prone to have DMFT > 17 and/or decayed teeth > 3. These results are consistent with others. Biazevic et al (2008) in a cross-sectional study assessed the dental status and its relationship with quality of life among Brazilian adolescents. They found positive and statistically significant correlation between the highest score in the OHIP and decayed teeth. McGrath (2002) evaluated the impact of oral diseases on the quality of life of 60 + aged Chinese prisoners and found that the impact was associated with dental status (DMFT and prosthetic need), among other socioeconomic and behavioral variables. Other investigators have also found association between OHIP-14 and DMFT and/or decayed teeth (Kushnir et al. 2004).

Self-perception of dental visit was also risk indicator for decayed teeth >3 (Table 2). Those with cavities probably feel pain and know they need to visit the dentist. In fact, in a study of caries experience among Australian 45–54 year olds, the results showed that the last dental visit for pain relief was related to more decayed teeth (Brennan *et al*, 2007).

Table 5 Univariate analyses with prosthetic need as dependent variable

		Prosthetic need	
	Yes n (%)	<i>No</i> n (%)	P-value
Age (years)			
22–34	20 (60.6)	13 (39.4)	0.8413
35–44	27 (62.8)	16 (37.2)	
45-71	17 (68.0)	8 (32.0)	
Gender	~ /		
Female	19 (59.4)	13 (40.6)	0.5707
Male	45 (65.2)	24 (34.8)	
Professional status			
Employed	34 (59.7)	23 (40.3)	0.2360
Unemployed	12 (57.1)	9 (42.9)	
Other	18 (78.3)	5 (21.7)	
Monthly income (Euros)			
No income	7 (50.0)	7 (50.0)	0.5075
1-250	17 (77.0)	5 (23.0)	
251-500	17 (60.7)	11(39.3)	
501-1000	18 (64.3)	10 (35.7)	
1001-1500	4 (66 7)	2(33.3)	
1501-2000	1(33.3)	$\frac{2}{2}(66.7)$	
Educational level	1 (0010)	2 (0017)	
Illiterate, <9 years of schooling	28 (65.1)	15 (34.9)	0.7533
>9 years of schooling	36 (62 1)	22 (37.9)	
Knowledge of HIV-positive	status	22 (37.5)	
<5 years	25 (49 0)	26 (51.0)	0.0025
> 5 years	39 (78.0)	11(220)	0.0025
Intravenous illicit drugs use		11 (22.0)	
No	22 (50.0)	22 (50.0)	0.0143
Ves	42(737)	15(263)	0.0145
Smoking habits	42 (13.1)	15 (20.5)	
No	16 (43.2)	21 (56.8)	0.0014
Ves	10(43.2)	16(250)	0.0014
Time since last dental visit	48 (75.0)	10 (25.0)	
< 2 years	43 (67.2)	21 (32.8)	0 2905
3 5 years	10(714)	4 (28.6)	0.2703
6 10 years	8 (53 3)	7(46.7)	
> 11 years	3(37.5)	5 (62.5)	
Solf parametian of nood for	dontal visit	5 (02.5)	
No	12(667)	6 (33 3)	0.7485
NO	12(00.7)	0(33.3)	0.7465
	32 (02.7)	51 (57.5)	
0HIP-14	29(540)	22(451)	0.0746
≤4.22 > 4.22	28 (34.9)	23(43.1)	0.0746
>4.22	30 (72.0)	14 (28.0)	
Dental plaque amount	41 (64.1)	22 (25 0)	0.0405
Large amount	41 (64.1)	23 (33.9)	0.8485
None/some	23 (62.2)	14 (37.8)	
	22 (44 2)	20 (55 0)	< 0.0001
$\geq 1/$	25 (44.2)	29 (55.8)	< 0.0001
> 1 /	41 (83.7)	8 (16.3)	

OHIP, oral health impact profile; DMFT, decayed, missing or filled teeth.

HIV + smokers presented a larger amount of plaque when compared with non-smokers (Table 4). Some studies on the effects of smoking on plaque formation have found no significant difference in the extent of plaque levels in smokers compared with non-smokers (Bastiaan and Waite, 1978; Swenson, 1979; Bergström, 1981; Macgregor *et al*, 1985). However, in a more recent study, Müller and Stadermann (2006) tested the influence of heavy smoking on the amount of supragingival plaque and gingival bleeding on probing. They evaluated healthy adults, 33 heavy smokers and 32 were nonsmokers. According to the results, adult smokers showed a significantly higher average plaque index. It seems that further studies on the subject are needed to provide scientific evidence.

With regard to periodontal status, 93% of subjects showed no periodontal health. Most of them presented pockets at least 4–5 mm deep. Studies on oral health manifestation include periodontal disease as a common disease in HIV + patients (McKaig *et al*, 2000; Goddard *et al*, 2005; Gennaro *et al*, 2008).

Finally, those who had known of their HIV infection for over 5 years were at risk for needing dentures. Choromańska and Waszkiel (2006) assessed prosthetic need, among other variables, in HIV-infected individuals aged 19–52 years. According to the authors, the loss of teeth in HIV-infected subjects for a longer period of time resulted in an increased prosthetic need. On the other hand, Engeland *et al* (2008) studying HIV infection and tooth loss in 193 HIV+ patients and 192 controls matched for age, race, gender, and smoking status, found no association between tooth loss and disease progression. They concluded that in the period of highly active antiretroviral therapy, HIV-infected people do not appear to be at risk for tooth loss.

In conclusion, the dental health status of HIVinfected Portuguese patients was unsatisfactory and related to clinical, socioeconomic, and behavioral variables. Consequences of dental caries are present in most HIV+ subjects. The number of decayed and missing teeth, periodontal condition and prosthetic needs characterizes the sample as a group highly in need of dental services. The authors believe these results are the consequence of ineffective preventive care strategies offered to HIV+ patients by the National Health System. Therefore, it is recommended that Portuguese HIV+ patients should be a target population for oral health care, to improve their oral health and quality of life.

Author contributions

Antonio C Pereira designed the study. Ana Espírito Santo collected the data. Gláucia MB Ambrosano performed the statistical analysis and discussed the results. Elaine PS Taglia-ferro and Marcelo C Meneghim reviewed the data and wrote the text. All authors contributed to the editing of the manuscript and presentation of the data.

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