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Oral health status among hospitalized patients

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Abstract: Aim: To investigate into oral health status and its association with health status in hospitalized patients. Methods: A total of 82 patients were examined and 49 (59.7%) patients were men. The patients answered a survey and oral examinations to detect the number of teeth, oral hygiene index, prostheses hygiene, oral lesions, caries, dental plaque index (DPI), gingival inflammation index (GI), gingival bleeding index, periodontitis and periodontal index. Results: Oral hygiene was associated with age, but it was not related to physical disability. Difficulty eating was mainly associated with age and tooth loss. All full and partially dentate patients presented dental plaque, 38 (69%) poor oral hygiene, 58 (98.1%) gingival inflammation, 41 (74.5%) periodontal disease and 33 (60%) caries. Oral lesions were detected in 30 (36.5%) and candidiasis (n = 16, 19.6%) was the most frequent mucous lesion. Caries were associated with smoking and poor oral hygiene. Hospital length of stay and age were associated with increased DPI and GI. Conclusions: The majority of hospitalized patients did not present satisfactory oral hygiene. Caries and periodontal diseases are associated with health behaviours. Increased time length at hospital could increase gingival inflammation and dental plaque accumulation.

Key words: dental plaque; hospital; oral hygiene; oral lesion; periodontal disease

Introduction

Many studies have demonstrated a remarkable association between oral infections and systemic diseases or health complications, such as cardiovascular diseases, arthritis, diabetes and HIV infection (1–7). Periodontal infection may be implicated in adverse pregnancy outcomes and preeclampsia (8–10). Many of these serious health problems may present complications, such as stroke, generalized infection and abortion, and they often lead to patient hospitalization. Epidemiological studies reported poor oral hygiene and high prevalence of edentulousness, mucosal oral lesions and periodontal inflammation in psychiatric and aged hospitalized population (11–15). Poorer oral health may be associated with negative effects for systemic health status, including chronic inflammatory stimulus and increased risk of malnutrition because of masticatory dysfunctions (16–18). Oral infections foci (ulcers, caries, periodontal pockets) could disseminate microorganisms to organs and tissues, especially in immune compromised patients and are related to worse systemic health status in hospitalized patients (16, 17, 19).

The information about oral conditions of hospitalized population was mainly focused in specific hospital sectors or elderly patients (11–15, 20–22). The aim of this work was to investigate the oral findings in relation to health conditions among hospitalized patients at the Northern Paraná Regional Hospital of the State University of Londrina (HURNP). This pilot study was conducted to identify the main oral health problems, especially oral infectious foci, and oral treatment necessities among those patients. The patient's main complaints about oral health problems were also investigated. The information was necessary to identify oral conditions that may be ameliorated by means of oral health care and planning oral interventions in hospitalized patients.

Study population and methodology

Study population

This is a cross-sectional study conducted in hospitalized patients at the men ward, women ward, haemodialysis sector, infectious diseases sector and maternity ward of HUNRP at State University of Londrina, Brazil. The study was carried out from September to December 2004. HURNP has 289 beds. From these, 177 (61.2%) were selected for this study. The minimum number of observations for 95% confidence interval (CI) and 80% statistical power was 103 observations, considering a prevalence of 30% periodontal disease in adult population. Beds that are not used for hospitalization, as well as the ones used for Intense Care Therapy (it was not suitable to perform all procedures) and Paediatrics sector were excluded. Patients were excluded if (1) they were non-conscious, (2) absent during examiner visits, (3) the oral exams could not be performed or (4) they did not agree with their participation in the study. Total sample presented 90% CI and 82 patients. The selected patients were aware of their treatment and have volunteered themselves and all the procedures were performed after the written consent of patients or their legal responsible. All procedures were approved by the Ethics Committee of Human Research at the State University of Londrina.

Interview

The beds were consecutively visited once. The interview and examination were performed by a single calibrated observer. All patients answered a survey that comprised several questions about demographics, health behaviours and oral conditions. Demographics and health behaviours included age, gender, smoking, alcohol intake and physical disability. Physical disability was defined as difficulties in personal care because of mobility problems (walking or to be moved) (15). Self-reported oral conditions included length of time of actual partial or full denture wearing, self-reported oral hygiene, oral pain or toothache and eating difficulty. Oral health status variables included self-reported oral conditions, oral hygiene, number of teeth, edentulousness, presence of oral lesions, presence of caries and periodontal indexes (PI).

The event that motivated the hospitalization and general health status of patients were accessed from medical handbooks. General health status was recorded as number of diagnoses, number of daily home medications and time of staying at the hospital.

Oral hygiene index (OHI), mucous oral lesions and caries investigation

The oral hygiene was assessed by OHI (23). Vestibular and lingual surfaces of molars and incisors were examined and the presence of dental plaque was ranked from zero to three. Zero was attributed to absence of dental plaque; 1 = >1/3 of tooth surface covered with dental plaque; 2 = >2/3 of tooth surface covered with dental plaque or presence of intrinsic pigmentation and calculus; 3 = more than 2/3 tooth surface covered with dental plaque and calculus. The OHI was the average scores obtained from the number of surfaces examined. Oral hygiene was graded as good (0.0–1.2), fairly (1.3–3.0) and poor (3.1–6.0).

The oral examination of mucous membranes and teeth was carried out with a clinical mirror, a number five clinical probe, a periodontal probe and a lantern to illuminate mouth cavity. The lips, vestibular mucosa, jugal mucosa, gum, retromolar region, mouth floor, tongue, soft and hard palate, palatine and oropharyngeal tonsils were inspected. Diagnosis of oral lesions was based on medical and dental history and clinical findings. The number of teeth and presence of active carious lesions were determined. Caries were identified as cavitations evidenced by probing or directly visualized by examiner.

Periodontal examination

All teeth with at least one-third of health dental crown were examined. The periodontal examination was performed in accordance with four indexes:

1 Dental Plaque Index (24) (DPI): score ranges from zero to three. Zero score is attributed to absence of dental plaque; 1 = presence of adhered dental pellicle, at cervical regions, detected by probing; 2 = presence of dental plaque visible by naked eye; 3 = presence of abundant dental plaque inside periodontal pockets (or gingival margin) and on teeth surface. The mesial, distal, vestibular and lingual surfaces of all teeth were probed. DPI by tooth was obtained by adding up the obtained scores from each surface and then dividing the result by four. DPI by patient was obtained by adding up all DPI by tooth and dividing them by the number of teeth.

2 Gingival index (GI). The status of marginal gum was analysed by the criteria described by LÖE and SILNESS (24), from 1963, and modified in 1967. The mesiovestibular, distovestibular, vestibular and lingual surfaces of all teeth were examined. The tissue condition scores ranged from zero to three. Zero was attributed to areas without signs of inflammation; 1 = minor areas of gingival inflammation characterized by slight redness and marginal oedema; 2 = moderated inflammation characterized by redness, oedema, hyperplasia, probe bleeding; 3 = severe gingival inflammation characterized by redness, oedema, hyperplasia and spontaneous bleeding. The GI per tooth was the sum of the scores for each tooth divided by four. The individual GI of the patient was obtained adding up all GI scores by tooth and then dividing them by the number of teeth. Inflammation process was graduated in four levels based on patient gingival index: gingival health (score zero); slight gingival inflammation (0.1-1.0); moderate gingival inflammation (1.1-2.0); severe gingival inflammation (2.1-3.0).

3 Gingival Sulcus Bleeding Index (GBI). The gingival inflammation was also characterized by the presence of bleeding from probed gingival sulcus (20). The number of bleeding sites up to 10 s after periodontal probing was observed.

4 Loss of periodontal attachment (PI). The attachment loss and periodontal pockets were determined by probing. All teeth were probed, individually, at six sites: mesiovestibular, mesiolingual, distovestibular, distolingual, vestibular and lingual tooth surface. The PI per patient was obtained by the ratio of the number of sites presenting more than 3 mm of probing depth divided by the number of examined teeth.

Presence of periodontal disease was defined as the presence of more than one tooth with probing depth >3 mm.

Statistical analysis

Statistical analysis of continuous variables was performed by means of parametric (Student's *t*-test, One-way analysis of variance and Tukey–Kramer test) or non-parametric tests (Mann– Whitey test, Kuskal–Wallis test and Dunn test), at a significant level of P < 0.05. Parametric tests were performed when Barlett test did not detect statistical significant differences (P > 0.05) among standard deviations. Multiple logistic regression was performed to detect the association of presence of oral lesions, caries and periodontal diseases with studied variables. Multiple linear regression analysis was performed to detect association of PIs with the studied variables.

Results

Eighty two patients (46.3% of beds) from the 177 selected beds were examined. The 95 remaining beds were not being used, or the patients were excluded from the study. Table 1 shows the number of hospitalized patient per hospital sector, medical treatment and gender. Forty-nine (59.7%) patients were men and 33 (40.3%) were women. Nobody was hospitalized because of oral diseases or oral complications. The mean number of comorbidities per patients, use of daily medications and mean time of stay at hospital were demonstrated in Table 2. Fifty-two (63.4%) patients were hospitalized up to 7 days, 19 (23.2%) between eight and 14 days and eleven (13.4%) for more than 15 days.

Smoking and alcohol intake were more prevalent in men group. The mean cigarette consumption per patient was 15.3 ± 11.1 units per day, for a period of 25.6 ± 17.1 years. The mean alcohol intake period was 14.5 ± 8.5 years. Eighteen (21.9%) patients reported alcohol intake and they were also smokers (Table 2).

Physical disability patients were temporarily unable to walk or they could not be dislocated from their beds. These patients reported difficulties during self oral and personal cares and they needed help in self hygiene or received hygienic care in their own beds (Table 2). The mean age of patients in physical disability was advanced (Student *t*-test, P < 0.01; 51.3 ± 20.7 years) in comparison with that in the non-disability ones (40.5 ± 18.1 years).

Table 1. Frequency of patients at hospital sectors

		Gender			
Hospital sector	n (%)	Men (%)	Women (%)		
Haemodialysis (Nephrology)	7 (8.5)	4 (8.2)	3 (9.1)		
Infectious diseases	11 (13.4)	7 (14.3)	4 (12.1)		
Maternity ward (Obstetric)	5 (11.5)		5 (15.2)		
Men and women wards					
Digestive Surgery	9 (11.0)	3 (6.1)	6 (18.2)		
Medical Clinic	9 (11.0)	8 (16.3)	1 (3.0)		
Gastrology	5 (6.1)	4 (0.8.2)	1 (3.0)		
Pneumology	5 (6.1)	4 (8.2)	1 (3.0)		
Haematology	4 (4.9)	3 (6.1)	1 (3.0)		
Cardiology	3 (3.6)	3 (6.1)	-		
Nephrology	3 (3.6)	1 (6.1)	2 (6.0)		
Neurology	3 (3.6)	3 (6.1)	-		
Vascular surgery	3 (3.6)	2 (4.1)	1 (3.0)		
Urology	3 (3.6)	2 (4.1)	1 (3.0)		
Gynaecology and Obstetric	3 (2.4)	-	3 (9.0)		
Endocrinology	2 (2.4)	-	2 (6.0)		
Orthopaedics	2 (2.4)	2 (4.1)	-		
Surgical Emergency Care	2 (2.4)	2 (4.1)	-		
Ophthalmology	1 (1.2)	-	1 (3.0)		
Otorinolarhyngology	1 (1.2)	1 (2.0)	-		
Plastic Surgery	1 (1.2)	-	1 (3.0)		
Total	82 (100)	49 (59.7)	33 (40.3)		

In relation to oral conditions (Table 3), 27 (32.9%) patients were totally edentulous and 33 (40.2%) patients were partially edentulous (less then 24 teeth). Edentate patients were older (P < 0.001, 60.7 ± 16.7 years) than dentate ones (38.3 ± 17.3 years).

Oral prostheses were investigated in relation to the number of patients (Table 3), quality and hygiene. Nineteen (23.1%) patients wore complete dentures at both arches, eleven (13.4%) had only upper complete dentures, four (4.9%) wore maxillary removable partial denture, two (2.4%) wore remov-

		Gender		
	Total	Men	Women	
Mean ± SD				P-value
Age (<i>n</i> = 82)	45.7 ± 20.1	45.0 ± 21.6	46.6 ± 17.8	P > 0.05
Number of diseases $(n = 82)$	2.0 ± 01.3	1.8 ± 01.2	2.3 ± 01.5	<i>P</i> > 0.05
Number of medications $(n = 11)$	5.6 ± 03.1	2.5 ± 00.7	$6.3 \pm 02.9^{*}$	<i>P</i> < 0.05
Time of hospitalization $(days) (n = 82)$	10.5 ± 04.9	11.2 ± 05.6	9.1 ± 04.2	<i>P</i> > 0.05
Frequency				χ^2 (<i>P</i> -value)
Smokers	35 (42.7)	27 (55.1)	8 (24.2)	<i>P</i> < 0.005
Alcohol intake	23 (28.0)	20 (40.8)	3 (09.1) [†]	P < 0.005
Physical disability	39 (47.6)	27 (55.1)	12 (36.4)	P > 0.05

Values in parentheses are in percentages.

*P < 0.01, Mann-Whitney test.

[†]Yate's correction.

able partial denture in both arches and two (2.4%) presented fixed partial dentures. The quality of oral prosthesis was very poor: 32 (84.2%) patients presented old removable oral prosthesis (more than 6 years of use), 30 (78.9%) patients presented poor prostheses hygiene (dental plaque, food waste, calcified deposits and microorganisms colonies visible by naked eyes). Thirty (78.9%) removable oral prostheses were not adjusted to soft tissues or were broken. The mean age of prostheses wearers (53.2 ± 17.1 years) was advanced (Student *t*-test, P < 0.0001) in comparison with others (39.4 ± 20.3 years).

Oral pain and toothache were reported by few patients (Table 3). Seven (53.8%) patients presented toothache because of caries, one (7.7%) because of tooth mobility and five (38.5%) patients had oral pain because of oral lesions.

Patients reported difficulty when eating (Table 3) because of tooth loss (n = 28, 63.6%), tooth mobility (n = 5, 11.4%), toothache (n = 7, 15.9%), discomfort caused by non-adjusted dentures (n = 2, 4.5%) and two (4.2%) patients had difficulties because of systemic conditions. Thirty-one (37.8%) patients also reported eating difficulty because of hospital food consistence. Patients with eating difficulties were older (P < 0.001, 52.2 ± 19.3 years) than patients who were normally eating (38.0 \pm 18.3 years). Difficult eating was associated with edentulousness (P = 0.03) with an odds ratio (95% CI) of 2.8 (1.1– 8.6). Dentate and partially dentate patients without difficulty eating had significantly more teeth (P < 0.001; 25.5 \pm 2.8) than patients who reported difficulty (16.1 \pm 10.4).

None of the patients reported to receive oral hygiene or instructions during hospitalization. The majority of patients reported self oral hygiene daily (Table 3), including the period at hospital, but none of the (full and partially) dentate patients

Table 2. General health status and health behaviours

Table 3. Oral findings

		Gender		
	Total	Men	Women	
Mean ± SD				P-value
Number of teeth	21.6 ± 09.7	22.0 ± 09.6	20.0 ± 10.1	P > 0.05
Frequency				χ^2 (<i>P</i> -value)
Edentulousness	27 (32.9)	15 (30.6)	12 (36.4)	P > 0.05
Denture wear	37 (45.1)	18 (63.3)	19 (57.6)	P > 0.05
Toothache or oral pain	13 (15.9)	5 (10.2)	8 (24.2)	P > 0.05
Eating difficulty	44 (53.7)	25 (51.0)	19 (57.6)	P > 0.05
Self-reported oral hygiene	58 (70.7)	33 (67.3)	25 (74.8)	P > 0.05
Poor oral hygiene	38 (69.1)	23 (67.6)	15 (71.4)	P > 0.05
Oral lesions	30 (36.6)	18 (36.7)	12 (36.4)	P > 0.05
Caries	33 (40.2)	20 (40.8)	13 (39.4)	P > 0.05
Periodontal disease	34 (41.5)	21 (42.9)	13 (39.4)	P > 0.05

Values in parentheses are in percentages.

was using dental floss. Oral hygiene was considered fair in 17 (30.9%) dentate patients and poor in 38 (69.1%) ones (Table 3). The Mann–Whitney *U*-test demonstrated that the mean age of poor oral hygiene patients is advanced (P < 0.01; 42.2 ± 18.1 years) in relation to fair/good oral hygiene ones (26.6 ± 10.2 years). Poor oral hygiene patients presented fewer number of teeth (P < 0.001, 18.5 ± 10.3 teeth) in relation to fair/good ones (27.4 ± 4.0). Self-reported oral hygiene was not associated with OHI (P = 0.75; OR = 09, 0.2–4.2). Physical disability was not associated with OHI either (P = 0.63, OR = 0.7, 0.2–2.4).

The most frequent mucous oral lesion was candidiasis (n = 16; 19.5%), followed by fibrous hyperplasia (n = 8; 9.7%), leukoplasia or hyperkeratosis (n = 7; 8.5%), unspecific ulceration (n = 6; 7.3%) and actinic cheilitis (n = 1; 1.2%). Six (20%) of those patients presented more than one variety of lesion. Multivariate logistic regression did not find association of presence of oral lesions with studied variables (Table 4).

Active caries lesions were detected in 33 (60%) dentate patients. Multivariate logistic regression detected association with oral hygiene and smoking (Table 5).

Periodontal diseases were found in 41 (74.5%) patients and the mean number of periodontal pockets per patient was 8.7 ± 12.3 . The mean PI score was 0.7 ± 2.3 . Multivariate logistic regression demonstrated association with age (Table 5). Patients presenting clinical signs of periodontal diseases were older (P < 0.05; 42.05 \pm 18.06 years) than others (32.23 \pm 14.62 years).

All partially and complete dentate patients present dental plaque and the mean DPI score was 1.7 ± 0.7 (surfaces/teeth). Gingival inflammation was found in 54 (98.1%) patients and the mean GI score was 1.6 ± 0.7 (surfaces/teeth). One (1.9%) patient was healthy, 9 (16.3%) had slight gingival inflammation, 32 (58.2%) had moderate gingival inflammation and 14

Table 4.	Multivariate	logistic	regression	of oral	lesions t	o study
variables	5					

	Oral lesions							
	OR	95% CI	P-value					
Age	0.98	0.94-1.02	0.57					
Gender (men/women)	1.13	0.31-4.11	0.84					
Number of diseases	1.08	0.70-1.67	0.71					
Daily medications	1.18	0.19-7.08	0.85					
Time at hospital	1.23	0.59-2.53	0.57					
Smoker	1.06	0.27-4.12	0.92					
Alcohol intake	1.63	0.40-6.62	0.49					
Physical disability	1.37	0.43-4.33	0.58					
Number of teeth	1.01	0.93-1.09	0.72					
Prosthesis wear	2.49	0.54-11.41	0.23					
Toothache or oral pain	0.67	0.13-3.35	0.63					
Eating difficulty	3.14	0.85-11.56	0.08					
Poor oral hygiene	3.11	0.77-12.54	0.11					
Self-reported hygiene	0.74	0.18-3.03	0.67					
Constant	-	-	0.11					

(25.4%) had severe gingival inflammation. Gingival bleeding was found in 52 (94.5%) patients and the mean number of gingival bleeding sites was 7.7 ± 7.0 per patient. To analyse the relationship between periodontal health indexes and study variables, a multivariate linear regression was performed (Table 6). All PIs were associated with age. The plaque accumulation was associated with time at hospital and use of daily medications. Gingival inflammation was associated with a number of diseases and daily medications.

Discussion

The findings of this research showed a poor oral health status in hospitalized patients. The most prevalent oral health problem is poor oral hygiene, including teeth and prosthesis hygiene. The oral findings also indicate a high prevalence of edentulousness, gingival inflammation, periodontal disease, Neto et al. Oral health status among hospitalized patients

	Caries			Periodontal disease			
	OR	95% CI	P-value	OR	95% CI	P-value	
Age	0.99	0.92-1.08	0.97	1.09	1.01–1.18	0.01	
Gender (men/women)	0.06	0.00-1.04	0.05	2.36	0.39–14.39	0.34	
Number of diseases	0.88	0.43-1.88	0.74	1.46	0.60-3.50	0.39	
Daily medications	0.08	0.00-2.54	0.15	2.37	0.20-27.20	0.48	
Time at hospital	5.30	0.72-38.59	0.09	0.63	0.16-2.40	0.50	
Smoker	184.10	4.01-8443.30	0.007	4.58	0.48-43.54	0.18	
Alcohol intake	0.70	0.04-10.59	0.79	0.66	0.08-5.26	0.69	
Physical disability	0.53	0.07–3.53	0.53	2.47	0.45–13.45	0.29	
Number of teeth	1.06	0.86-1.30	0.55	1.10	0.96-1.27	0.14	
Prosthesis wear	2.39	0.55-101.86	0.64	1.18	0.13–10.79	0.13	
Toothache or oral pain	0.10	0.00-2.07	0.13	3.73	0.40-34.58	0.24	
Eating difficulty	7.66	0.46-126.94	0.15	0.25	0.01-4.28	0.34	
Poor oral hygiene	17.08	0.00-404.40	0.05	2.10	0.37-11.76	0.39	
Self-reported hygiene	0.04	0.00-1.46	0.08	7.68	0.81–72.35	0.07	
Constant	-	_	0.56	0.11	-	0.21	

Table 5. Multivariate logistic regression of caries and periodontal disease to study variables in dentate patients

Table 6.	Multivariate	linear	regression	analysis of	f periodontal	health	indexes

	DPI		GI			GBI			PI	PI		
	Coef	SE	Р	Coef	SE	Р	Coef	SE	Р	Coef	SE	Р
Constant	1.60	0.41	0.01	0.69	0.47	0.14	-0.04	0.26	0.8	7 0.04	0.85	0.96
Age	0.01	0.006	0.004	0.20	0.006	0.001	0.00	0.003	0.0	1 0.02	0.01	0.01
Gender (men/women)	0.11	0.21	0.59	0.22	0.20	0.28	0.04	0.14	0.0	7 0.34	0.38	0.37
Smoking (yes/no)	0.18	0.23	0.43	0.17	0.23	0.45	0.17	0.13	0.2	0 0.09	0.43	0.83
Alcohol intake (yes/no)	0.11	0.24	0.62	-0.02	0.24	0.92	0.04	0.13	0.5	1 -0.43	0.34	0.33
Number of diseases	0.10	0.07	0.20	0.16	0.07	0.04	0.01	0.04	0.7	3 -0.05	0.14	0.72
Daily medications (yes/no)	-0.89	0.31	0.006	-0.81	0.31	0.01	0.05	0.17	0.7	3 -0.59	0.57	0.31
Time of hospitalization	-0.31	0.14	0.04	-0.25	0.14	0.08	-0.05	0.08	0.5	2 -0.16	0.27	0.54
Physical disability (yes/no)	-0.06	0.18	0.73	-0.10	0.18	0.57	-0.03	0.10	0.7	7 -0.56	0.34	0.10
Oral prosthesis (yes/No)	0.04	0.23	0.75	0.33	0.23	0.16	0.14	0.13	0.2	9 0.70	0.44	0.11
Self oral hygiene (yes/no)	0.06	0.26	0.81	0.40	0.26	0.13	0.00	0.14	0.9	8 -0.40	0.49	0.41
Oral pain or toothache	0.11	0.23	0.66	-0.05	0.23	0.82	0.05	0.13	0.6	6 0.89	0.43	0.04
Eating difficulty	0.07	0.26	0.79	-0.21	0.26	0.41	0.06	0.14	0.7	4 0.23	0.49	0.63
			$r^2 = 0.48$			$r^2 = 0.47$			$r^2 = 0.3$	4		$r^2 = 0.49$

caries and oral lesions. It must to be pointed out that none of patients was hospitalized for reasons of oral conditions or oral lesions, although many patients presented poor indexes of oral health and many complained about oral problems, such as pain or difficulty when eating because of oral conditions. The prevalence of oral findings was not related to general health status, except for dental plaque and gingival inflammation. However, a major number of cases must be analysed to confirm these observations. Another important finding is the high prevalence of physical disabilities among these patients, indicating that almost half of them had difficulties to perform self-hygiene and could not be moved to the hospital's dental facility. This suggests that the treatment of some oral diseases in many hospitalized patients requires special approaches and must be made on patients' beds. Our results suggest that age, smoking and the health conditions were the main factors related to presence of oral health problems in hospitalized patients.

The main reasons for difficulty eating were oral problems. Furthermore, some patients reported to have eating difficulty during staying at hospital due to food consistency, although they prepared meals with adequate consistency for themselves at home. Other authors had identified a positive correlation among tooth loss, malnutrition and mortality rate in hospitalized and elderly patients (12, 17, 24). They reported that malnutrition risk is related to loss of masticatory capacity and consequently a poor diet in essentials nutrients (16, 17). It would be necessary to pay attention to how these patients could better feed during stay at hospital considering impairment of masticatory function and to identify patients who need soft consistency food.

We investigated the relationship between oral health problems and the general health conditions. Our hypothesis was that health status may be associated (but it was not necessarily the etiological factor) with a deficient oral health status. The relationship between oral health and systemic health is welldocumented in literature like a bidirectional interaction (1-5, 24-26). A poor systemic health status (such as ageing, comprised immune responses or chronic inflammatory diseases) could be implicated in increased susceptibility to oral diseases. Also, some oral lesions (especially periodontitis) may be associated with greater severity and incidence of systemic diseases (1-4, 6, 24, 25). The high prevalence of dental plaque, oral lesions, caries and periodontal diseases observed among hospitalized patients suggests that those subjects present the main oral risk factors to develop local and systemic complications. Many patients presented systemic conditions, such as HIV infection, diabetes and hypertension, which are directly correlated to oral health and are also affected by oral infections focus. In regression analysis, oral health status presented weak association to defined health status variables, except DPI and GI. The positive correlation of time of hospitalization and DPI and GI suggests that prolonged time at hospital may be associated with increased dental plaque accumulation and gingival inflammation. The poor oral hygiene in almost all hospitalized patients, especially the elderly ones, was reported by some authors (2, 11-13, 15). In this study, all dentate patients presented dental plaque. Although many patients were using toothbrush daily, none received oral hygiene instructions during hospitalization. Oral hygiene was very deficient in hospitalized patients, especially in elderly ones, even when they reported self oral hygiene. So, oral health cares at adult hospital sectors must be focused on oral hygiene and to identify oral lesion and oral infectious foci, especially if patients will stay long time at hospital. Preventive procedures, such as hygiene instructions or prophylaxis, prostheses hygiene and minor adjustments, treatment of mucous oral lesions, would be immediately applied. A discerning judgment, based on medical conditions and patients' complaints, must be held before performing invasive procedures. But, patients must be oriented about oral condition and conducted (when it is indicated) to dental treatments after they leave hospital.

A strong association of oral lesions and studied variables was not detected. However, others authors reported the main factors associated with oral candidiasis in hospitalized patients as the use of non-adapted removable dentures, poor oral hygiene and use of antibiotics (7, 13–15, 20). These factors were present in our series because the majority of removable oral prostheses presented a poor hygiene and were not welladapted to oral cavity. Oral lesions require attention because they impair satisfactory mastication and nutrition and are considered risk factors to oral cancer (25). Oral ulcer and candidiasis may favour the spreading of microorganisms to other organs and systems, especially in immune-comprised patients (20, 22).

Poor oral hygiene and increased DPI are risk factors to caries and periodontal diseases. Poor oral hygiene and smoking were associated with presence of caries, corroborating others authors (27–29). The presence of active caries represents an oral infection focus and in some examined cases, it was responsible for oral pain and eating difficulties. Other authors reported morbid outcomes caused by spreading of cariogenic microorganisms to heart and brain tissues (30, 31).

The DPI has a positive correlation to GI, indicating that presence of dental plaque increased gingival inflammation. Even in clinical health gingiva, transient bacteriaemia could occur during chewing (32) and the severity degree of bacteriaemia with oral origin is related to the severity of gingival inflammation (33). In some cases, these inflammations could be avoided or decreased by oral hygiene cares and minor periodontal procedures (33). Oral hygiene cares may be necessary to decrease plaque index and consequently decreased oral foci of periodontal pathogens.

There was a high prevalence of periodontal diseases among patients, but PI was not correlated to other PI and was just associated with age. The periodontal disease is a chronic inflammatory disease that probably was developed for a long time before hospitalization. The periodontitis is considered one of the most common chronic diseases amongst people aged more than 30 years (34, 35). Other authors showed that the hospitalized patients presented worse status of oral health, especially PIs, compared with non-hospitalized ones (11, 12). In Brazil, it is estimated that prevalence of periodontal disease ranges from 17% to 35% of people (34, 35), whereas 74.5% of dentate hospitalized patients in our investigation were affected. Periodontal indexes observed here were similar to those observed by VELLAZCO and BÚLLON (12) in hospitalized psychiatric patients. The authors observed that 77.5% of patients need periodontal treatment and 91.5% need oral hygiene attention. BARILLI and coworkers (2) had shown increased prevalence of periodontal disease (76.3%) and necessity of oral hygiene in hospitalized cardiac patients. Amongst the factors that may contribute to the worsening of periodontal health status in hospitalized patients, absence of oral hygiene instruction, advanced age (over 80 years old), gender, presence of more than one systemic disease, presence of cardiovascular disease, number of daily used medications and time of hospital stand (13, 21, 22) are held as the greatest responsible factors.

But in our study, we did not find a significant association of periodontitis with those factors.

Periodontal disease is an important oral health problem in hospitalized patients because it may evoke a bacteriaemia that may spread to other tissues such as the lungs (causing pneumonia in immunocompromised patients) (5).

Mouth may represent a bacterial and fungal reservoir that is potentially dangerous to immunodeficient individuals. Besides HIV positive patients and those submitted to immunosuppressive therapy, it should be useful to give some attention to oral health in patients submitted to surgeries because they experience a temporary suppression of immune defences. Ingested microbes could colonize surgical wound and bacteriaemia is associated with morbidity in post-surgical patients (36).

At the gynaecology and obstetrics sector, including the maternity ward, five pregnant women were observed. There are welldocumented correlations among periodontal disease and preterm birth (8–10). Pregnant patients may be hospitalized for many reasons and some have more than one risk factor associated with gestational complications, including periodontal disease.

We conclude that a majority of patients need oral health care; poor oral hygiene and accumulation of dental plaque are the most evident problems and may lead to gingival inflammation. The majority of patients presented with infections in the mouth and some of them are described as risk factors to worsening systemic health status. Ageing and health conditions seemed to be associated with periodontal health. Ageing are related to tooth loss and the later is a factor associated with eating difficulty. A future action of a dentistry professional in hospital facilities may contribute to ameliorate oral health problems, and to some extent, the systemic condition and feeding of hospitalized patients.

Conflict of interest

The authors declare that they have no conflict of interest.

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