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EVALUATION OF THE ORAL HEALTH CONDITION OF PATIENTS ADMITTED TO CARDIOLOGY INTENSIVE CARE UNIT

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ABSTRACT

Aim: Assessing the oral health condition of patients hospitalized in a cardiology intensive care unit. **Methods:** Convenience sample encompassing 104 patients, from both sexes, in the age group 34 to 93 years. General data and information about health profile were collected from medical reports and through interviews. Data about white tongue, prosthesis and gingival inflammation processes were recorded in individual files. The t test was applied to find whether there were significant differences between percentages ($p < 0.5$). The Bonferroni theorem was used to adjust the critical alpha level when the analysis of a certain parameter involved multiple tests of the same kind. **Results:** Oral hygiene activities are performed in the ICU ($p = 0.0000$) usually two times a day ($p < 0.025$). Most patients had white coat on the entire tongue: 38 patients (36.54%) ($p < 0.008$). There was no gingival inflammation process in 35 patients (33.65%) ($p < 0.005$) and 80.77% of the sample ($p = 0,0000$) were toothed. Awaken patients (not sedated) had white tongue, regardless of oral hygiene frequency. **Conclusion:** Oral hygiene procedures in place in the ICU are not effective to removetongue coating and most patients stay in it for 48 hours or more (critical period).

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INTRODUCTION

The intensive care unit (ICU) is a hospital sector featured by the constant monitoring of patients presenting potentially severe conditions or with disturbances in one or more organic traits. Patients are observed and receive constant and intensive treatments, which are administered by interdisciplinary health teams trained to help these individuals to recover.[1-3] Patients in this environment must receive specific oral-health care throughout their hospitalization time in order to prevent oral diseases, complications in the stomatognathic system and the emergence of systemic infectious diseases related to nosocomial pneumonia and to bacterial endocarditis acquired in hospital environments.[4-8] Lack of hygiene, specific evaluation protocols and oral health preventive procedures are common in patients hospitalized in ICUs[9-12], due to management and adaptation difficulties, and to the reduced number of professionals trained to work with standards different from the ones used in medical office. The condition of the patients leads to significant increase in the number of white tongue and dental biofilm cases. These diseases are possible microbial reservoirs of gram negative bacteria related to hospital infections.[13-17]Oral health promotion in patients presenting critical conditions demands special health education, prevention, planning, management, professional adaptation and clinical intervention care focused on their well-being and quality of life. Dental procedures are related to biofilm control through mechanical teeth brushing and white tongue elimination, as well as through training about the best procedures and prevention actions to give comfort to this

population provided to nurses or to nursing technicians.[18,19] Dental clinical actions performed by trained professionals in ICUs aim at integrating the stomatognathic system to general health, i.e., at eliminating infection foci, inflammation processes and pain caused by oral issues influencing the patient's systemic condition (intubation, tracheostomy and normal conditions).[20,21,22] The need of formalizing effective oral health interventive protocols is demanding, as well as professional and educational training with professionals from other health fields about dental care in hospital environment, mainly in ICUs. Preventive procedures and protocols must be standardized to promote good oral health condition results and to help organizing individual strategies to provide systemic benefits to patients.[3,8,23-26] The aim of the current study was to assess the oral health condition (gingival inflammation, white tongue, the use of dental prosthesis) of patients hospitalized in the cardiology ICU in Brasilia, Brazil.

MATERIALS AND METHODS

The study was conducted in Private Cardiology Hospital, Brasilia, Brazil. It was approved by the Cardiology Hospital Direction Board, by ICU managements and by the Ethics Research Committee (ERC) of Catholic University of Brasilia (UCB) under CAAE n. 78245917.0.0000.0029. Patient family members and patients themselves (awaken) signed the informed consent form. All ethical and legal protocols were carried out in compliance with the Declaration of Helsinki.The study followed a descriptive and prospective design to assess the oral health condition of patients hospitalized in the assessed ICU. Activities were performed once a week, for four hours, for five months, according to the researcher's shifts in the hospital. Data were collected through the clinical examination of 104 individuals (male and female) in the age group 34 to 93 years, based on convenience sampling.Inclusion criteria were: male and female patients hospitalized in the ICU of the assessed hospital who signed the informed consent form (ICF). Awaken patients (without sedation) who signed their ICFs and sedated patients or patients in vulnerable state (intubated and/or subjected to tracheostomy), whose legal guardians signed their ICFs. Exclusion criteria were: patients hospitalized in the ICU and patients whose family members refused to authorize their participation in the research – this procedure did not affect the given healthcare.

The following instruments were used to collect data about the patients – all legal and ethical regulations were followed:

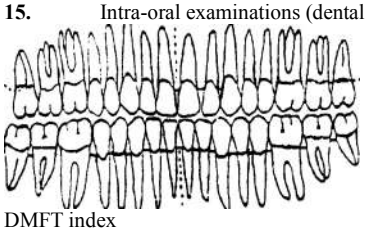
- Medical reports, and reports from the interdisciplinary ICU team, provided general identification data: sex, age, race (skin color), hospitalization time, reason for ICU hospitalization, hospitalization condition (tracheostomy, intubation, normal), patient's diet (normal, soft, mixed or nasoenteral diet), clinical follow-up by health professionals (physician, nurses, nursing technicians), physical therapist, speech therapist, psychologist, dietician, dental surgeon, and hospitalization time in the ICU.[29-31]
- Questioning: based on an individual and standardized file of hospitalized patients on normal awareness conditions (without sedation) and on the oral hygiene frequency in the ICU right after hospitalization (none, one, twice, three times, more than three times).
- The intra- and extra-oral examinations were performed as professional adaptation measures related to logistics and to time aspects for caregiving (schedule set fordental evaluation procedures – it did not impair the daily routine and system of the ICU).
-

The natural (windows) and artificial light in the hospital were used. Clinical material (mouthpiece, tweezers, exploratory probe, clinical spatulas), gauze, cotton roller and wooden spatulas were used to move the tongue from the jugal mucosa. Mouth openers (made with 12 wooden sticks + gauze + tape), oral expanders, solid Vaseline, dentifrice, 0.12% chlorhexidine, forceps (needle holder), tooth brush and a surgical sucker - coupled to a vacuum suction system - were organized for the clinical examination. The clinical evaluation of the oral condition of patients subjected to intubation or to tracheostomy was performed through team work. The procedure was based on the interdisciplinary support of the physiotherapist (tube stabilization and movement, besides patient's proper positioning under monitoring) and of the nursing team (nursing technicians) through clinical assistance actions and constant suction (aspiration). The presence of gingival inflammation was clinically evaluated[27],as well as the use of dental prosthesis and the presence of white coating on the tongue dorsum[28] The Modified Gingival Index[27], which is less invasive and traumatic to ICU patients, was used to evaluate gingival inflammation processes.

This index is appropriate to the visual inspection of the marginal and papillary gingiva of all teeth. Patients who had teeth and implants (fixed prosthesis, removable partial dentures and fixed prosthesis on implant) were assessed. Classification after visual inspection was: 0 = no inflammation; 1 = slight inflammation or small changes in color and texture, but not in all parts of the papillary or marginal gingiva; 2 = little inflammation, such as in the previous criteria, all over the marginal and papillary gingiva; 3 = moderate, surface bright inflammation, erythema, edema and / or hypertrophy of the papillary and marginal gingiva; 4 = severe inflammation, erythema, edema and / or hypertrophy of marginal gingiva of the unit, or spontaneous, papillary, congestion or ulceration bleeding. Prosthesis evaluation was based on the insertion and/or removal of them: upper and lower total prosthesis, upper and lower removable partial prosthesis, fixed prosthesis, implant-supportedprosthesis. On the other hand, the evaluation of the tongue dorsum was conducted through visual inspection, which was classified as: sub-clinical – invisible, in one and two thirds of the tongue, and in the entire tongue.[28] Guiding or oral hygiene measures were not taken in patients before the evaluation. This procedure was adopted in order to observe the hospital routine and the procedures performed to assure oral health. The oral hygiene protocol[19,29,30]adopted in the ICU after the oral condition evaluation of the patients was based on removing the biofilm, the white tongue and food leftovers. Patient positioning on the ICU bed (45°), patient sedation evaluation and the stabilization of the orotracheal tube (artificial respiration) were performed by physical therapists whenever necessary. Nasal feeding was suspended by the nursing team whenever necessary.[24,25,31,32] Procedures were performed in a standardized way: lip hydration with solid Vaseline and the use of mouth expander (better visualization of regions in the back of the mouth). Total and removable prosthesis were removed from patients'mouth and cleaned through mechanical action (toothbrush and 0.12% chlorhexidine).

Clinical Evaluation File
Evaluating the oral health condition in the ICU
Evaluation number:

1. Sex:
Male ( ) Female ( )
2. Skin color:
White ( ) Black ( ) Brown ( )
3. Age: years
4. Reason for hospitalization in the ICU:
5. Hospitalization time in the ICU:
( ) 01 day
( ) 02 days (48 hours)
( ) 03 days (72 hours)
( ) more than three days (more than 72 hours)
6. Awareness level:
Awake ( ) Sedated ( )
7. Ramsay scale (sedated patient in the ICU):
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6
8. Patients' hospitalization condition in the ICU:
Tracheostomized ( ) Intubated ( ) Normal conditions ( )
9. Patient's diet in the ICU:
Normal ( ) Pasty ( ) Mixed ( ) Nasoenteral ( )
10. Caregiver or family member:
Present ( ) Absent ( )
11. Follow-up conducted by health professional in the ICU:
Physician ( ) Nurse or nursing technician ( ) Physical therapist ( )
Speech therapist ( ) Psychologist ( ) Dietician ( ) Dental surgeon ( )
12. How is the oral hygiene done in the ICU:
With assistance ( ) Without assistance ( )
13. Frequency of oral hygiene performed in patients hospitalized in the ICU on a daily basis:
None ( ) 01 time ( ) 02 times ( ) 03 times ( ) More than 03 times ( )
14. Extra-oral examinations (descriptive):
15. Intra-oral examinations (dental description):



DMFT index
- Caries:
- Lost:
- Sealed:

16. Presence of gingival inflammation process:
Yes ( ) No ( )
17. Modified Gingival Index (Lobene at al., 1986):
( ) 0 = no inflammation
( ) 1 = slight inflammation or small changes in color and texture, but not in all parts of the papillary and marginal gingiva
( ) 2 = slight inflammation, such as in the previous criteria, in all marginal and papillary gingival portions
( ) 3 = moderate, bright surface, erythema, edema and / or hypertrophy in the marginal and papillary gingiva
( ) 4 = severe inflammation: erythema, edema and / or hypertrophy in the marginal gingiva of the unit or spontaneous, papillary, congestion or ulceration bleeding.
18. Use of dental prosthesis:
Yes ( ) No ( )
19. Type of dental prosthesis:
1. Upper and lower total prosthesis ( )
2. Upper Total Prosthesis ( )
3. Lower Total Prosthesis ( )
4. Upper and lower removable partial prosthesis ( )
5. Upper removable partial prosthesis ( )
6. Lower removable partial prosthesis ( )
7. Upper and lower protocols (dental implants + total prosthesis) ( )
8. Upper protocol (dental implants + total prosthesis) ( )
9. Lower protocol (dental implants + total prosthesis) ( )

20. Presence of white coating (biofilm) in the tongue dorsum (*Cruz et al, 2014*):
Absent ( ) 1/3 of the tongue ( ) 2/3 of the tongue ( ) the entire tongue ( )
21. Oral hygiene (presence of dental biofilm):
Satisfactory ( ) Dissatisfactory ( )
22. Dental prosthesis (hygiene conditions):
Satisfactory ( ) Dissatisfactory ( )

Dental and prosthesis (fixed or protocols – implants associated with fixed total prosthesis) hygiene was promoted through mechanical teeth brushing, associated with dentifrice, under irrigation with 0.12% chlorhexidine and constant suction (surgical sucker and ICU vacuum pump).

The clinical procedures performed to reduce and eliminate white tongue were conducted with hemostatic forceps and gauze soaked in 0.12% chlorhexidine solution. The mechanical movements were performed in posteroanterior direction, under constant suction.[9,33]

Data analysis

The overall and oral features of patients in the ICU was set through descriptive analysis; data were recorded in numbers and portions (percentages). Only patients' age was recorded through mean and standard deviation, because these are numerical data. The t test was applied to a sample between the proportion of categories set for each variable to determine whether there was significant difference between percentages, at 5% significance level ($p<0.05$). The Bonferroni theorem was used to justify the critical level of 'p' when the analysis involved multiple t tests within the same variable. The statistical analysis was processed in the Statistical Package for Social Sciences (SPSS) software, version 23.0 (IBM Corporation, Armonk, NY, EUA).

RESULTS

The mean age 67.65 ± 13.42 years (younger age, 34 years - older age, 93 years) was recorded during the evaluation conducted to find the general features of patients in the hospital ICU. Most patients were white ($p<0.016$) men ($p=0.017$).

The three main reasons for hospitalization in the ICU were: aortic valve replacement (27.88%), heart attack (15.38%) and pneumonia (9.62%). Half of the patients in the ICU were hospitalized for more than three days ($p<0.016$). Most of the assessed patients (68.27%) were awake, i.e., did not receive any kind of sedation ($p=0.0001$). There was no significant statistical difference between the scores of sedated patients (31.73%) based on the Ramsay Scale. Most patients in the ICU (79.81%) were in normal conditions ($p<0.016$) in comparison to the ones who were subjected to tracheostomy or to intubation. Most patients (72.12%) were orally fed ($p = 0.0000$) Ttable 1).Based on patients' overall conditions, we assessed the oral health conditions of patients in the cardiology ICU according to standardized methodologies and clinical investigation (Table 2). All patients were followed-up by physicians, physical therapists, speech therapists, psychologists and dieticians during their time in the ICU. Only one patient (0.96%) was followed-up by a dental surgeon during an emergency. Most patients were not subjected to oral hygiene procedures at any time during their stay in the ICU (42.81%) or were subjected to such procedure only once since they were referred to intensive care (37.50%).

Table 1. Profile of patients hospitalized in the intensive care unit of a cardiology hospital - Brasilia, Brazil

General features of the patients Hospitalized in the cardiology ICU (n = 104)	n		%	*p* Value
Age (years)	67.65 ± 13.42	(34 – 93)		
Sex				
Male	64		61.54	0.017*
Female	40		38.46	
Race				
White	77		74.04 a	< 0.016**
Black	24		23.08 b	
Brown	03		2.88 c	
Hospitalization time in the UTI				
01 day	13		12.50 a	
02 days (48 hours)	23		22.12 a	
03 days (72 hours)	16		15.38 a	
More than 03 days (more than 72 hours)	52		50.00 b	< 0.016**
Reason for the hospitalization in the ICU				
Heart surgery (aortic valve replacement)	29		27.88	–
Revascularization	07		6.73	
Heart arrhythmia	08		7.69	
Pneumonia	10		9.62	
Bypass	04		3.85	
Chest pain	08		7.69	
Heart surgery (pacemaker)	05		4.81	
Angioplasty	07		6.73	
Aneurysm	03		2.88	
Heart attack	16		15.38	
Cardiac catheterization	03		2.88	
Pulmonary emphysema	01		0.96	
Myocarditis	02		1.92	
Valvuloplasty	01		0.96	
Awareness Level				
Awake (without sedation)	71		68.27	0.0001*
Asleep (sedated)	33		31.73	
Score 1 in the Ramsay Scale	01		0.96	
Score 2 in the Ramsay Scale	07		6.73	
Score 3 in the Ramsay Scale	13		12.50	NS***
Score 4 in the Ramsay Scale	04		3.85	
Score 5 in the Ramsay Scale	01		0.96	
Score 6 in the Ramsay Scale	07		6.73	
Hospitalization condition in the ICU				
Tracheostomy	03		2.88 a	
Orotracheal intubation	18		17.31 b	
Normal conditions	83		79.81 c	<0.016**
Feeding procedure in the ICU				
Oral feeding	75		72.12	0.0000*
Nasoenteral feeding	29		27.88	

* The One-sample t-test between percentages was significant at .05 critical alpha level ($p < 0.05$).
** Bonferroni's theorem was used to adjust the critical alpha level. Different letters between percentages indicate statistically significant differences ($p < 0.01$).
*** NS: non-significant ($p > 0.003$).

Table 2. Oral health condition of patients hospitalized in the ICU of a cardiology hospital – Brasilia, Brazil

Oral health features of patients hospitalized in the cardiology ICU	n	%	*p* Value
Professional follow-up (n = 104)			
Medical follow-up and assistance of other health professionals †	104	100	–
Dental follow-up	01	0.96	
Oral hygiene follow-up (n = 104) ‡			
None	44	42.31 a	< 0.005**
1 time	39	37.50 a	
2 times	16	15.38 b	
3 times	02	1.92 c	
More than three times	03	2.88 c	
Oral hygiene frequency in awaken patients (n = 71)			
None	29	40.85 a	< 0.005**
1 time	22	30.99 a	
2 times	16	22.54 a	
3 times	01	1.41 b	
More than three times	03	4.23 b	
White coating in the tongue dorsum (n = 104)			
Sub-clinical (invisible during examination)	11	10.58 a	
1/3 of the tongue	23	22.12 a,b	
2/3 of the tongue	32	30.77 b	
The entire tongue	38	36.54 b	< 0.008**
Oral healthcondition (n = 104)			
No changes related to inflammation	31	29.81 a	
Gingival inflammation	32	30.77 a	
Root remains and mobility	06	5,77 b	
Prosthesis (total, partial and/or implant-supported prosthesis)	43	41.35 a	< 0.008**
Modified Gingival Index (*Lobene et al, 1986*)			
Degree 0 (no inflammation)	35	33.65 a	< 0.005**
Degree 1 (slight inflammation)	18	17.21 a,b	
Degree 2 (small inflammation)	19	18.27 a,b	
Degree 3 (moderate inflammation)	11	10.58 b	
Degree 4 (severe inflammation)	01	0.96 c	
Edentulous patients (not evaluated)	20	19.23	
Tooth (n = 104)			
Toothed	84	80.77	0.0000*
Edentulous	20	19.23	

†Medical follow-up, physical therapist, speech therapist, psychologist and dietician.
‡Question made to awaken patients and to the nursing team when the patient was sedated.
* The One-sample t-test between percentages was significant at .05 critical alpha level ($p < 0.05$).
** Bonferroni's theorem was used to adjust the critical alpha level. Different letters between percentages indicate statistically significant differences ($p < 0.005$).

The nursing team was responsible for answering this question on behalf of the sedated patients. We found similar result when the question was asked to the awaken patients: not even once (40.85%) and 1 or 2 times (30.99% and 22.54%, respectively), at statistical significance $p < 0.005$. Most patients were toothed (80.77%) ($p < 0.05$). Some of them had dental prosthesis (41.35%) either partial, total or implant-supported. Most patients had white coating either in part of or in the entire tongue ($p < 0.008$). Most patients did not present any sign of clinical inflammation (degree 0 – 33.65%) or presented low inflammation level (degree 1 – 17.21% or degree 2 – 18.27%), at statistical significance ($p < 0.005$), between gingival scores. It is likely that this result was influenced by the chosen evaluation method, which was only visual[16].

DISCUSSION

Men ($p = 0.017$) were more prevalent (61.54%) than women (38.46%) in the sample. Such result can be explained by the fact that men are less concerned with their general health; thus, given life adversities and health issues, they are more often affected by cardiac and systemic complications. Therefore, men usually demand more complex medical intervention and take longer to recover in intensive care units.[34]According to Nelson et al[3], the elderly are the most common patients in critical conditions and they demand special actions to fulfil their special needs. The integrated assistance model focuses on beneficial daily action to elderly's integral health recovery.

It helps ruling out inflammation and infectious processes, as well as mouth pain influencing their systemic condition.[4,10,12,22,33,18,29,42] The oral cavity can work as a microbial reservoir for gram-negative bacteria associated with pneumonia (due to mechanical or nosocomial ventilation) or with systemic diseases such as bacterial endocarditis caused by content aspiration (dental biofilm, white coating and food leftovers). Bacterial endocarditis often happens in the ICU due to possible changes in the consciousness level of hospitalized patients.[5,9,13,20] Hospitalization time in the ICU has direct influence on bacterial pathogenicity in the oral cavity. The critical time in the ICU lies between 48 and 72 hours, when there are micro-biological changes in the biofilm. More than 90 patients in our study stayed in the ICU for more than 48 hours, when bacterial changes in the dental and lingual biofilm take place. This outcome highlights the need of special care with oral health and of effective and interdisciplinary assistance to patients.[15,23,24,35]

The causes for hospitalization in the cardiology hospital ICU regarded different situations, but the following reasons stood out among them: cardiac surgery for valve replacement (n=29), heart attack (n=16) and pneumonia (n=10).These cases needed the assistance of a dentist, dental procedures prior to more invasive treatments based on international protocols and preventive procedures to adjust the oral environment.[9,25,36,37,38] Patients hospitalized in ICUs are often sedated for better behavioral and hospitalization-distress control. Most patients evaluated in our study (n=71) were awake (without sedation)

and in normal conditions (n=83).This profile helped better understanding the research context, the effective participation of the patients in our study and oral health reliability at hospital level.[39]Based on our study, the specific condition shown by hospitalized patients evidenced that the oral route was the feeding process adopted in the ICU. The results were different from those recorded in other studies[7,8,13]related to patients subjected to nasoenteral feeding, given their adverse health conditions and dependence.We assessed patients subjected to orotracheal intubation (n=18) and to tracheostomy (n=3) who presented different unconsciousness score level (Ramsay Scale). These patients underwent specific professional management and were subjected to adaptation techniques to allow evaluating their oral condition. Their family members and the nursing technicians were trained in oral hygiene and clinical evaluation procedures related to the existing assistance protocols and methodologies.[8,20,39-41]It is not possible comparing this assistance type to other hospital services given the specificities of the cardiology hospital and the main diseases and procedure types applied to ICU patients in it. The assistance given to critical patients must be integral and interdisciplinary in order to allow fast recovery and better quality of life. Observed the absence of a dentalsurgeon in the ICU team. Such fact may have caused the lack of operational standard education, prevention and clinical measures to promote the oral health of hospitalized patients.[3,8,29,32,34]

Only one case demanded the presence of a dental-surgeon for an emergency clinical intervention. The professional was provided by the partnership, and extra contact, with the hospital ICU system. The oral hygiene of ICU patients must be constantly provided to them, just as the other healthcare procedures. We must keep in mind the number of studies that credit the relevance of oral health for hospital infection prevention.[20,33,42-44]Based on the performed evaluations, the frequency of standardized oral hygiene in ICU patients provided by the nursing team, nursing technicians and by patients themselves is low. The lack of oral hygiene procedures for hospitalized patients was noteworthy in all the assessed patients, either sedated or not.[21,31] Such outcome can be linked to the fact that most of the assessed patients had white coating on the entire tongue, i.e., there was no clinical or educational policy applied to this ICU to rule out microbial reservoirs on the tongue. Our results do not comply with other studies in this field.[13,16,17,26,45]Regardless of hygiene frequency (none, once, twice or more) in patients in this ICU, white tongue, either partial or on the entire tongue, was a common condition.[5,7,17,23,41]Oral hygiene has been provided to patients hospitalized in the ICU of the assessed hospital, but there is no specific protocol about it to be followed, since the procedures in place do not involve tongue hygiene and preventive actions. Besides the studies by Munro et al[14], Poboet al[16], Kiyoshi-Teo and Blegen[23], Miranda et al[29], Miranda et al[30] and Belissimo-Rodrigues et al[33], only few investigative and clinical studies, based on the general description of oral heath, were conducted given the difficulty and short possibilities to assess the oral health of ICU patients. Such framework credits our study as a new source of guidelines for further discussions about oral health prevention protocols in ICUs. Our results can also guide new research, studies and clinical actions.[19,24,41,44,46]

Oral health evaluation is essential for the excellency of the assistance provided to patients in critical conditions, since it allows relating existing problems to systemic issues and highlighting pneumonia and bacterial endocarditis cases – which stand out in cardiology hospitals. Therefore, this evaluation helps lowering the mortality rates and costs with interventions.[7,10,28]Oral issues such as gingival inflammation – hygiene deficiency and food leftovers on the teeth –, possible infection points and dental prosthesis were the most common conditions in the assessed patients. In this case, our results do not differ from those recorded in other studies about this topic, because the main issue lies on adjusting the oral environment of critical patients.[11,18,27,29,46]Assessing the presence of gingival inflammation, and its possible relation to periodontal diseases, is extremely important to cardiac patients, mainly to prevent systemic infection such as bacterial endocarditis. Thus, we need strong clinical actions to minimize the possible effects of gingival inflammation on patients hospitalized in cardiology ICUs.[9,22,38,45]

Adopted the modified gingival index to assess the presence of gingival inflammation around the teeth. This method can be non-invasive and visual; thus, it provides ethical respect to the patient. Based on our observations, the presence of slight and small inflammation is similar to the absence of inflammation in the oral cavity. This finding can be related to the adoption of international protocols based on using 0.12% chlorhexidine as standard operational program in the assessed ICU. Therefore, our results were similar to those in studies about this subject.[1,11,14,27,26]Gingival inflammation must be observed in patients hospitalized in cardiology hospitals. Procedures to prevent bacterial endocarditis must prioritized,according to Lockhart et al[9], since they describe how the oral health, mainly the periodontal diseases, increase the risk of developing cardiac issues. These procedures also emphasize the need of having oral health practices prior to cardiac-surgical procedures, such as the focus on preventing bacterial endocarditis.[8,38,41]Based on our results, most of the assessed patients were toothed, i.e., they needed more specific procedures for the maintenance of their oral health and for the elimination of issues related to it.[28,31]Patients with natural teeth tend to have more biofilm accumulation - which often favors pneumonia development - than edentulous patients. However, dental prosthesis can be a potential reservoir of microorganisms when they are not properly sanitized, besides favoring the emergence of opportunistic diseases such as oral candidiasis.[41,45,46]The best way to promote oral health lies on controlling dental biofilm and white tongue through mechanical and chemical means. The mechanical means consist of correct brushing (use of normal toothbrush or toothbrush adapted to vacuum suction) and of tongue cleaners. Patients unable to perform the mechanical biofilm control due to intubation, tracheostomy or sedation must be treated with specific management, clinical adaptation and interdisciplinary planning techniques associated with the chemical means (0.12% chlorhexidine).[1,4,5,7-12,12,17,19,20,29,33,44]

Patients can be connected to equipment and under specific health conditions (intubation and/or tracheostomy), as well as facing a systemic condition hard to control. These conditions stop the possibility of taking effective actions to promote their oral health. According to Miranda et al[29] and Osman and Aggour[43],it is necessary planning and performing interdisciplinary clinical actions addressed in manuals and protocols of invasive procedures to be put in place in ICUs. It is necessary preparing and training professionals to work with procedures developed for ICU patients. The ethical responsibility and functions most be shared with the involved health professionals in order to enhance the assistance given to

critical patients.[3,8,15,20,22,28,29,36,40] The tongue is a complex organ involved in speech and expression as well as in gustation, mastication, and deglutition. The oral cavity, along with the tongue, are sites of neoplasms, reactive processes, infections, and shows symptoms of chronicsystemic diseases that includes some kind of immunosuppression. Since, *Candida albicans*is the most prevalent human fungal pathogen, with an ability to inhabit diverse host niches and cause disease in both immunocompetent and immuno compromised individuals. *C. albicans*also readily forms biofilms on indwelling medical devices and mucosal tissues, which serve as an infectious reservoir that is difficult to eradicate and lead to lethal systemic infections.[47] Furthermore, non-albicans *Candidaspp.(Candida tropicalis)*are an emerging cause of hospital-acquiredbloodstream infections, associated with high mortality due to the challenges in diagnosis and delayed treatment.[48]Other important component of oral biofilmarestreptococci, *Streptococcusmutans*has beenisolated from infectiousend ocardit is and *Streptococcusoralis*hasbeen found in numerous types of infections.Therefore,bacteria in the oral environment tend to grow by forming a multispecies biofilm, which increases the chances of horizontal gene transfer,creating a large reservoir of antibiotic resistance genes.[49]Based on our results, it is essential to have a dental surgeon in the intensive care team and to elaborate and implement a standard protocol to be applied to patients hospitalized in the assessed cardiology ICU. This protocol must address procedures to promote oral health as part of the integral assistance given to patients in critical conditions and to improve the quality of the service provided to them.

CONCLUSION

It is essential standardizing and implementing oral-dental and dental prosthesis prevention and care protocols to promote the oral health of patients hospitalized in the assessed ICU.The oral hygiene procedures performed in the assessed cardiology ICU are not effective to rule out the microbial reservoir found intongue coating.Most patients stayed in the ICU for 48 hours or more (critical period) and demanded daily dental procedures for oral health promotion and to prevent hospital infections. Patients hospitalized in the assessed ICU needed integral assistance during education, prevention and clinical procedures for oral health promotion.

Author Contributions

Study concept and design: Miranda, Costa, and Bezerra. Analysis and interpretation of data: All authors. Drafting of the manuscript: All authors. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: All authors. Evaluation of patients: Miranda. Study supervision: Miranda and Bezerra.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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