THE ROLE OF DENTISTRY IN THE HOSPITAL ENVIRONMENT: THE ORAL MICROBIOTA CONTROL AS SECONDARY INFECTIONS PREVENTION

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Palavras-chave: Odontologia Hospitalar. Unidade de Terapia Intensiva. Pneumonia Associada à Ventilação. Interdisciplinaridade Hospitalar. Prótese dentária.

RESUMO

Objetivo: Esta revisão busca destacar a importância dos cuidados com a saúde bucal em pacientes internados em Unidade de Terapia Intensiva hospitalar. **Fonte dos dados**: A revisão foi feita com artigos em inglês e português, nos últimos 11 anos, nas plataformas: Google Scholar, Pubmed (MEDLINE), Scielo e Bireme (LILACS). **Síntese dos dados**: No que se refere ao ambiente hospitalar, principalmente unidades de terapia intensiva, a falta de atendimento odontológico pode comprometer a boa evolução do paciente internado. A lacuna entre o que seria melhor proposto ao paciente e o que de fato é realizado pelos atuais profissionais das unidades de terapia intensiva evidencia a necessidade de estudar criteriosamente esse assunto, a fim de que haja uma retomada dos conceitos sobre o padrão de gestão esperado, bem como a forma como o multiprofissionalismo se desenvolve na prática. Se a estrutura sofrer ruptura em qualquer nível, geralmente ocorre o aumento de doenças comumente associadas à terapia intensiva, como a pneumonia associada ao ventilador. A importância do dentista nas unidades de terapia intensiva pode evitar essas doenças ou, pelo menos, reduzi-las. **Conclusão**: Sob essa mesma perspectiva, a presença do cirurgião-dentista atuando de forma integrada com médicos, enfermeiros e técnicos de enfermagem é valiosa, sobretudo no tocante a higiene bucal a portadores de prótese oral.

Keywords: Hospital Dental Service. Intensive Care Units. Ventilation-Associated Pneumonia. Hospital Interdisciplinarity. Dental Prosthesis.

ABSTRACT

Objective: The purpose of this review is to highlight the oral health care importance on patients in the hospital Intensive Care Unit. **Sources of data**: The review was performed within articles published in English and Portuguese in the past 11 years, and the search was performed on the following platforms: Google Scholar, PubMed (MEDLINE), Scielo, and Bireme (LILACS). **Synthesis of data**: When it comes to the hospital environment, especially intensive care units, the lack of dental care could compromise the well evolution of the hospitalized patient. The gap between what would be best proposed to the patient and what, indeed, is done by the current professionals in the intensive care units, highlights the necessity to study this subject more carefully so that there is a resumption of concepts about the expected management pattern, as well as how the multiprofessionalism develops in practice. If the structure cracks in any level, it's often seen the rise of diseases commonly associated with intensive care, such as ventilator-associated pneumonia. The importance of a dentist in the intensive care units could avoid these diseases or, at least, reduce them. **Conclusion**: From this same perspective, the presence of a dentist working in an integrated way with physicians, nurses, and nursing technicians is valuable, especially concerning oral hygiene for patients using a dental prosthesis.

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INTRODUCTION

Inside the hospital intensive therapeutic care scenario, multidisciplinary connections are observed, where each health professional segment has a clear scope. Broadening the understanding of what is necessary for the individual's evolution, archaic bulkheads are on the hospital's hierarchical dynamics. Therefore, the need for an interdisciplinary and interprofessional system was examined.[1,2] Each biomedical branch becomes harmonious, cooperative, and effective for the patient,[3] given the importance of forming a team.

The attention a patient receives in an Intensive Care Unit (ICU), in the Hospital Dentistry (HD) context, may be emerging as one of the pillars for the prevention, diagnosis, and patient treatment. Besides, HD contributes also to reducing the hospitalization costs by decreasing the length of patients' stay in the hospital,[4] since oral health homeostasis can prevent various systemic complications, such as ventilation-associated pneumonia (VAP), one of the most common infections in ICUs.[5,6] Therefore, it is essential to keep routine oral hygiene in hospitalization to keep the patient's oral health. However, clinical procedures are as important as preventive procedures in a sense of improving the patient's welfare. One of the procedures that have positive impacts, including in pregnants, is periodontal therapy, since studies have been pointing out that pathogens and inflammatory mediators of the periodontal diseases can aggravate chronic inflammatory disease ones, such as rheumatoid arthritis or type 2 diabetes.[7,8]

In this sense, the oral cavity has a crucial role in controlling systemic infections, but lack of care can also start or worsen those oral and systemic infections.[8,9] The oral microbiota dysbiosis has a significant impact upon other microbiotas in the human body and, due to bacterial multi-resistance in ICUs, treatments with antimicrobials have become ineffective. With the development of HD and the establishment of oral cavity hygiene, the number of Healthcare Related Infections (HCRI) decreased.[10,11]

Thus, oral cavity hygiene is essential for the control and homeostasis of oral health since the biofilm presence confers a role in the etiopathogenesis of oral[10] and pulmonary infections.[12,13] In this same perspective, the oral prosthesis condition, regarding microbiota, assumes a high degree of importance due to the Hospital Infection Control Committee (HICC) orders. Therefore, in cases of the use of dental prostheses, all of them shall be removed from the patient and handed over to the family.[14]

The purpose of this review is to highlight the oral health care importance on patients in the hospital Intensive Care Unit.

SOURCES OF DATA

This study's methodology was based on a literature review, as qualitative research, in English and Portuguese languages by searching for scientific articles in Google Scholar, Pubmed (MEDLINE), Scielo, and Bireme (LILACS). Among the descriptors selected for the composition of the present work, priority was given to: "nosocomial infection", "healthcare-related infections", "secondary infections", "oral hygiene", "hospital dentistry", "oral microbiota", "vap frequency", "Brazilian ICUs", "intensive care unit", "oral prosthesis", "antibiotic resistance". In addition, some strategies were applied to the keywords such as boolean operators (AND and OR) in order to obtain a more accurate result. Altogether, for this study composition, 13 papers were selected in english and portuguese according to the inclusion and exclusion criteria (Table 01). The inclusion criteria were: articles published in the last 11 years that addressed Hospital Dentistry, Intensive Care Unit, Oral Microbiota, and Oral Prosthesis were included. Everything apart from that was excluded.

SYNTHESIS OF DATA

Initially, 135, 134, 97, 88 references were retrieved from Google Scholar, Pubmed (MEDLINE), Scielo, and Bireme (LILACS), respectively. After the application of a 11-year publication limit, 43, 55, 23, 19 remained, and based on the inclusion and exclusion criteria, 13 papers were selected and included in this review.

The Hospital Intensive Care Unit as a Dental Practice Field

HD is a Dentistry branch with a focus on the hospital environment, providing reparative or preventive services to inpatients,[15] inserted in a scenario of the low, medium, and high complexity procedures that aim to help in the improvement of the patient quality of life, as well as, possibly, his rehabilitation.[16]

The increase of HD on the American continent began in the middle of the 19th century with Drs' collaboration Simon Hullihen and James Garretson. Specifically, in Brazil, it gained prominence with Dr. Nataldo Alexandre in the 70s, performing services never done before and without official support. The standardization of Brazilian hospital dental services was carried out only in 2012 by the Federal Council of Dentistry (CFO), with the elaboration of a DH code of ethics. Consequently, according to Act 4252/2012, which sets out the *"inauguration of a sector for the provision of dental services in public hospitals and provides other measures"*,[17] approved by the Social Security and Family Commission of the Chamber of Deputies in 2018, the fundamental role of the Dentist within

ICUs, semi-intensive, coronary or even hospital rooms to contribute to the early diagnoses and disease prevention, such as Ventilation-Associated Pneumonia (VAP).[18]

Although a dentist's presence in the ICU is supported by the law mentioned above, the hospital's average number is deficient. On the other hand, since November 7, 2013, the state of Rio de Janeiro has introduced state law no. 6580, which makes it mandatory to keep a Dentist at all hospitals. The ICU is the structured hospital sector that houses patients in need of continuous monitored care, which may present decompensated conditions of one or more organ systems and multiple pathophysiological changes.[19] Any handling is performed by a specialized team with the supply of high-tech materials and equipment[20] necessary for the patient treatment. According to the Brazilian Ministry of Health, there is a standardization for the proper functioning of an ICU, Nacional Standard RDC 50/2002, which can be found on the government website.[21] It is worth mentioning that there is a differentiation between the ICU and the Center for Intensive Care (CIT) sectors, where the latter comprises the grouping of ICUs in the same place.

In this context, it is clear that the Dentist's performance goes beyond the traditional dental offices. Based on this premise, the CFO, in addition to recognizing the role of DH's account, established guidelines for the professional qualification through a specific course, bringing into effect Resolution CFO-162/2015. The system consists of a minimum workload of 350 hours, 30% of clinical hours, and 70% of theoretical classes, taught by a professor holding a Master of Sciences or PhD degree.[22]

It is observed a substantial mismatch between what is ideal for the patient and what is accomplished, mainly due to the lack of intercommunication between professionals and their efficient preparation regarding appropriate conduct for the best patient treatment.[23] The profession's relative impact is being Medicine, a fallacious protagonist immersive in being the hospital's essential segment.[15] It was based on this that Multidisciplinary Rounds were created in the hospital ICU. During these rounds, interprofessional teams interact to analyze and discuss all the patient's demands and, from there, the construction of conduct and treatment planning.

In a hospital setting, it is observed that hospital dentistry's role is fundamental to reduce the length of hospital stay and intervention risks.[23,24] Inside the hospital, it is possible to perform a series of exams essential for achieving consistent and fast diagnosis in a multidisciplinary and interprofessional way.[25] Together, all health professionals acting in hospitals such as Physicians, Nurses,[25,26] Nutritionists, Speech Therapists, Physiotherapists, Psychologists, and Social Screening interact daily in the ICU rounds.

Fernandes[27] points out that the symptomatic manifestations recurrent in the patient's oral cavity, like dry mouth, are related to other professional segments, such as the hospital's Nutrition sector. These symptoms are because patients, especially those wearing prostheses, have difficulties eating appropriately, contributing to the inadequate bacterial biofilm control and, consequently, causing changes in their diet. Therefore, dental care practices within these units are of great value for controlling systemic diseases.

Costa[28] points that the Dentist's role inside the hospital includes low, medium, and high complexity cases. Plus, Gomes & Esteves *et al*.[29] defines the procedures, such as biopsy procedures, scraping, extraction, removal of infection foci, abscess drainage, as it, all the procedures considered urgent and emergency according to the patient's need and medical consideration about the general clinical condition for performance is conducted by the dentist on duty. Ergo, in the hospital, the HD actuation can be a simple clinical screening of lucid and oriented patients. Still, there are higher complexity cases of patients undergoing maxillofacial surgery.[28]

Within this context, Ferreira *et al.*[26] and Martins[5] declare that dentistry insertion in the intensive therapeutic sector has been of great value for the consummation of the integral health concept, contributing to prevention, early diagnosis, and treatment of several recurrent diseases, such as pneumonia, and even HCRI.

Standard Operating Procedure for Oral Hygiene

The Standard Operating Procedure (SOP) is, in general, administered in the absence of the hospital Dentist and performed by the nursing team and nursing technicians.[30] In the best of scenarios, oral hygiene is performed on the patients three times a day. For this procedure, however, it is noted that there is no standard of effectiveness. This embezzlement can be inferred due to the lack of technical skill of oral care by the nursing team, which corroborates for the causing HCRI. It appears that, for effective SOP dynamics, professional training, commitment, and supervision are required.[31]

In the hospital environment, the frequency of oral hygiene is indicated according to the demand of each patient and must be determined by the Dentist. However, the current SOP adopted by the Brazilian Association of Intensive Medicine (AMIB)[14] and by the Brazilian College of Hospital Intensive Dentistry (CBROIH)[32], which suggests that oral hygiene should be done with an aqueous solution of chlorhexidine gluconate (0.12% or 0.2%) every 12 hours due to the effect of substantivity and at intervals, according to demand and prescription, oral hygiene can be done with sterile distilled water or filtered.



***Figure 01**: Oral Hygiene in Mechanical Ventilation Patients. Layout of the oral hygiene procedure. This same procedure can be done using saline solution. Not as a substitute, but in a complementary way if indicated.*

***Table 1**: Summary of Research on Dentists in the Hospital Environment.*

	Hospital ICU References	
Microorganisms of Medical Importance	The oral cavity acts as a reservoir for responsible medically important bacteria; these species being the main responsible for HCRI and antimicrobial resistance.	**Souto & Colombo**[37] **Souto & Colombo**[38] **Souto *et al.***[39]
Antimicrobial Resistance	The incorrect or unregulated clinical use of antimicrobials has increased the number of multiresistant species in the hospital environment, causing therapeutic failure.	**Silva**[51] **Leal *et al.***[52]
Secondary Infection	Reduction of secondary infections such as VAP and candidiasis due to the insertion of dentistry in the hospital and oral health control in the ICU in LOT and lucid patients.	**El-Rabbany *et al.***[12] **Hua *et al.***[13]
Dentist Performance	Decrease in secondary infection rates within the operating room due to preventive control of oral health homeostasis.	**Saleh *et al.***[3] **Fernandes *et al.***[27]
Controlling Systemic Health by Controlling Oral Health	Communication between oral microbiome, immune system and host.	**Larsen & Fiehn**[9] **Colombo & Tanner**[10]
Chlorhexidine in Microbial Control	Operating Protocol Standard oral hygiene with the use of chlorhexidine gluconate in aqueous solution as the first-choice antimicrobial for the control and homeostasis of the oral microbiota in a hospital environment.	**AMIB**[14] **CBROHI**[32]

In this sense, according to the AMIB[14] and the CBROHI[32] in patients lucid, oriented in time and space, responsible professionals should promote oral hygiene with mechanical removal of oral biofilm (Figure 1). While in a patient with lowered consciousness, the ideal is that the SOP oral hygiene is performed. This resolution is shown as a complementary oral hygiene procedure to the one already established by the hospital unit. In addition, professionals exposed to contaminated patients must perform oral hygiene at the beginning and end of the day, as a preventive measure, to reduce the viral load in the oral cavity and, consequently, in the waste.

According to CBROHI[32] patients with "*removable dentures should have them sanitized by soaking them in the 1% hydrogen peroxide solution for 30 minutes. Next, pack the dry dentures in a closed, dry, transparent container with personal identification*". When it comes to the patients itself, the correct protocol is to *"apply moistened gauze wrapped around the finger or buccal swab soaked in 15ml of 0.12% chlorhexidine aqueous solution all over the oral mucosa and teeth, always in the posteroanterior direction. Also sanitize the orotracheal tube and aspirate the oral cavity and oropharynx whenever necessary and at the end of oral hygiene as well as perform physical examination of the oral cavity and application of salivary substitute on the oral mucosa, if indicated. In the end, applying moisturizer to the lips (preferably dexpanthenol based moisturizers)".*

When it comes to patients with their own teeth, the correct way to realize the brushing is, according to AMIB[14], first, to have the toothbrush disinfected as well as "*moisten*

the brush with sterile distilled or filtered water". Up next, to "*gently position the brush head, in the region of free gum and the tooth, so that it forms an angle of 45° with the long axis of the tooth*" and "*with gentle vibrating movements, lightly press the bristles against the gum, making them penetrate the gingival sulcus and embrace the entire contour of the tooth. Then start a sweeping movement from the gum to the tooth, from smooth and repeated, for at least 5 times, involving 2 or 3 teeth in order to disorganize the biofilm''*.

According to Costa *et al.*[33], the use of 0.12% or 2% chlorhexidine digluconate is effective for oral hygiene. After mouth rinsing, only gram-positive bacteria were observed in the patient's oral cavity. In terms of frequency and efficiency of oral hygiene, the blunt management of HD leads to insufficient care due to negligence and ignorance of the oral hygiene protocol by the current professionals,[34] and the patient's caretakers. Among the methods used, aiming the oral biofilm control, there are mechanical and chemical techniques like brushing and antimicrobial solutions.[35]

Health Care Related Infections, Medical Importance Microorganisms and Antimicrobial Resistance

About infections contracted within the hospital environment, namely, diseases related to health care, there is a recurrent bacterial prevalence in the airways because it correlates the oral cavity and its pathogenic potential.[33] Also, this condition leads to a high degree of mortality and morbidity and has a high cost *per capita*.[36]

Since the oral cavity is a microorganisms habitat with medical importance because it is associated with systemic infections in humans, such as *Staphylococcus spp.*, *Enterococcus spp.,* and also some *Enterobacteriaceae* and *Pseudomonas spp.;* species associated with oropharyngeal and orofacial infections, such as the genera *Bacteroides spp., Porphyromonas spp., Prevotella spp., Fusobacterium spp., Aggregatibacter spp., Selenomonas spp., Eikenella spp., Streptococcus spp.* and *Campylobacter spp.*[37-39] care within ICUs should be increased, given the sometimes latent impossibility of patients to practice oral hygiene by themselves causing an increase of oral infections such as periodontal disease and candidiasis.[33-35]

In an imbalanced condition of the oral microbiota, these opportunistic species can multiply and favor the disease's aggravation. Thus, we witness the interconnection between oral symbionts that, due to some alteration, can promote a dysbiosis process. These opportunistic species are added to the oral biofilm making it less susceptible to the action of the immune system and treatment with antimicrobials, resulting in clinical complexity of infection, reinfection, and failure of therapy, which can lead to complications such as endocarditis, atherosclerosis, myocardial infarction, septicemia and pneumonia.[40]

In systemic infections, the HCRI prevalence is observed, especially in the respiratory tract, like pneumonia, which is understood by infectious conditions developed in patients hospitalized for at least two consecutive days in a hospital environment.[41] Likewise, there is a subtopic correlation with respiratory tract infections, the VAP manifestation, which has the highest frequency infections in hospital ICUs[42]. Therefore, the high accentuation in the curve of morbidity and mortality,[43,44] and higher internment costs.

According to Branco *et al*.[45], VAP is the second most frequent infection among patients admitted to the ICU. Mota *et al.*[41] observed a high correlation with HCRI, about 9 to 40% because the patient hospitalized for a minimum period of 48 hours is exposed to hospital pathogens. The infected patient will then increase the hospitalization period, and a higher chance of death since the degree of mortality in this hemisphere varies from 24 to 76%. Accordingly, Costa *et al*.[28] points out that in VAP, there are risk factors that are classified as modifiable and non-modifiable, for example, tracheostomy, reintubation, nasoenteric tube, nasogastric tube, duration of mechanical ventilation. The second refers to high age, the severity of the underlying disease, Chronic Obstructive Pulmonary Disease (COPD), trauma, neurological disease, surgery.

Besides its multifactorial causes, the VAP etiopathogenesis is influenced by the oral cavity's main microbial agents. Tomazelli *et al.*[43] indicates a high incidence of gram-negative bacteria in this situation so that their high rate is due to the contamination that would occur in the stomach. It is noteworthy that this happens because, in general, ICU patients are submitted to orotracheal intubation or tracheostomy,[46] this fact results in higher communication among the external environment, oral cavity, and lung. Thus, when a systemic degree is reached, the use of antimicrobials is necessary, as these substances are aggressive to pathogens but not to the host,[47] being used, in this case, to contain microbial development and not only to the presentation of cardinal signs of inflammation: pain, heat, redness, tumor, and loss of function.[48,49]

Scarvodelli *et al*.[50] and Silva[51] explain that in a VAP situation, the medication should be administered, in the first instance, intravenously and, depending on the patient's evolution, orally. However, Leal *et al.*[52] warn that if performed incorrectly, antibiotic therapy can result in antimicrobial resistance, which is configured in an adaptation of the microorganism itself in the face of the biochemistry of the applied drug, especially when considering the intensive care environment added to the susceptibility of the drug to debilitated patients.

According to a survey conducted at the adult ICU in Cascoal, state of Rondonia, Brazil, in 2018, among several antibiotics, those that the microorganisms isolated from tracheal aspirate showed more resistance were: Amoxicillin with Clavulanic Acid, Ampicillin and Cefotaxime.[44] In light of this perspective, the hospital dentist and the medical and nursing staff act as essential agents in identifying, treating, and observing subsequent bacterial, fungal, or viral complications initiated in the mouth, promoting homeostasis.[51-53]

CONCLUSION

In light of the presented, it is clear that within the scope of oral microbiology, the need for well-established guidelines is inferred to have, above all, interlocutions. These conversations shall include the professional's capacitation aiming at the applicability and practicality of the solutions to be adopted by the involved institutions.

Also, it is highlight that the role of the dentist within the hospital environment is mainly important in several aspects, ranging from preventing the worsening of more serious bacterial infections, through better control of the oral microbiota to reducing the cost to public health entities.

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