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**ORAL HYGIENE CARE IN CRITICALLY ILL PATIENTS
UNDERGOING NON-INVASIVE VENTILATION:
A SCOPING REVIEW**

**CUIDADOS DE HIGIENE ORAL NA PESSOA EM SITUAÇÃO
CRÍTICA SUBMETIDA A VENTILAÇÃO NÃO INVASIVA:
UMA SCOPING REVIEW**

**CUIDADOS DE HIGIENE ORAL EN LA PERSONA EN SITUACIÓN
CRÍTICA SOMETIDA A VENTILACIÓN NO INVASIVA:
UNA SCOPING REVIEW**

Ana Bernardo¹ , Guida Amaral² .

¹Unidade Local de Saúde do Litoral Alentejano, Unidade de Cuidados na Comunidade, Odemira, Portugal.

²Escola Superior de Saúde, Campus do IPS—Estefanilha, Instituto Politécnico de Setúbal, Setúbal, Portugal.

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Abstract

Introduction: Healthcare-associated infections have a significant impact on patients' lives, compromising the safety and quality of care. Oral hygiene, as an autonomous nursing intervention, plays an important role in the prevention and control of infection in critically ill patients undergoing non-invasive ventilation. **Objective:** To map the scientific evidence regarding oral hygiene practices in critically ill patients undergoing non-invasive ventilation. **Method:** This study consists of a scoping review, which included four scientific articles and one master's dissertation. **Results:** The evidence suggests that oral hygiene promotes comfort and contributes to the prevention and control of pneumonia, with both clinical and economic implications. The incidence of pneumonia in critically ill patients undergoing non-invasive ventilation (3.1%) is higher than that observed in the general hospitalized population (0.85%). Colonization of the oral cavity by microorganisms may lead to microaspiration into the airways and subsequent migration to the lungs, favoring the development of pneumonia. Therefore, the implementation of oral hygiene care is essential to reduce risks and optimize health outcomes. **Conclusion:** The implementation of oral hygiene protocols may result in significant health and economic benefits, promoting the quality and safety of care. Continued investment in this area is crucial to support evidence-based clinical practice and ensure improved health outcomes.

Keywords: Critical Care; Healthcare-Associated Pneumonia; Oral Hygiene; Non Invasive Ventilation.

Resumo

Introdução: As infecções associadas aos cuidados de saúde têm um impacto significativo na vida dos doentes, comprometendo a segurança e a qualidade dos cuidados. A higiene oral, enquanto intervenção autônoma de enfermagem, assume relevância na prevenção e controle da infecção na Pessoa em situação crítica submetida a ventilação não invasiva. **Objetivo:** Mapear a evidência científica relativa às práticas de higiene oral na Pessoa em situação crítica submetida a ventilação não invasiva. **Método:** O estudo consiste numa *scoping review*, na qual foram incluídos 4 artigos científicos e uma dissertação de mestrado. **Resultados:** A evidência sugere que a higiene oral promove conforto e contribui para o controle e prevenção de pneumonia, com repercussões clínicas e econômicas. A incidência de pneumonia na PSC submetida a ventilação não invasiva (3,1%) é superior à observada na população hospitalizada em geral (0,85%). A colonização da cavidade oral por microrganismos pode originar microaspiração para as vias aéreas e subsequente migração pulmonar, favorecendo o desenvolvimento de pneumonia. A adoção de cuidados de higiene oral mostra-se, assim, essencial para reduzir riscos e otimizar resultados em saúde. **Conclusão:** A implementação de protocolos de higiene oral poderá traduzir-se em ganhos significativos em saúde e na economia, promovendo a qualidade e segurança dos cuidados. O investimento contínuo nesta área é crucial para sustentar a prática clínica baseada em evidência e assegurar melhores resultados em saúde.

Palavras-chave: Cuidados Críticos; Higiene Bucal; Pneumonia Associada à Assistência à Saúde; Ventilação Não Invasiva.

Resumen

Introducción: Las infecciones asociadas a la atención sanitaria tienen un impacto significativo en la vida de los pacientes, comprometiendo la seguridad y la calidad de los cuidados. La higiene oral, como intervención autónoma de enfermería, desempeña un papel relevante en la prevención y el control de las infecciones en las personas en situación crítica sometidas a ventilación no invasiva. **Objetivo:** Mapear la evidencia científica relacionada con las prácticas de higiene oral en personas en situación crítica sometidas a ventilación no invasiva. **Método:** El estudio consiste en una *scoping review*, en la que se incluyeron cuatro artículos científicos y una tesis de maestría. **Resultados:** La evidencia sugiere que la higiene oral promueve el confort y contribuye a la prevención y el control de la neumonía, con repercusiones clínicas y económicas. La incidencia de neumonía en las personas en situación crítica sometidas a ventilación no invasiva (3,1%) es superior a la observada en la población hospitalizada general (0,85%). La colonización de la cavidad oral por microorganismos puede dar lugar a la microaspiración hacia las vías respiratorias y a su posterior migración pulmonar, favoreciendo el desarrollo de neumonía. Por lo tanto, la implementación de cuidados de higiene oral resulta esencial para reducir riesgos y optimizar los resultados en salud. **Conclusión:** La implementación de protocolos de higiene oral podría traducirse en importantes beneficios para la salud y la economía, promoviendo la calidad y la seguridad de los cuidados. La inversión continua en esta área es fundamental para sustentar la práctica clínica basada en la evidencia y garantizar mejores resultados en salud.

Descriptores: Cuidados Críticos; Higiene Bucal; Neumonía Asociada a la Atención Médica; Ventilación No Invasiva.

Introduction

Healthcare-associated infections (HAIs) represent a significant threat to the safety and quality of healthcare delivery, having a direct impact on morbidity, mortality, and hospitalization-related costs. In addition to their clinical implications, they entail relevant economic and social consequences, including functional disability, work absenteeism, and reduced quality of life⁽¹⁾.

The implementation of prevention programs and infection control measures has proven effective in reducing the incidence of HAIs and their associated costs⁽¹⁾. In this context, the National Patient Safety Plan 2021–2026, structured around five pillars, highlights under its fifth pillar the importance of promoting safe practices in safe environments. Reducing HAIs and antimicrobial resistance is therefore one of the central strategic objectives for ensuring the safety of individuals requiring healthcare⁽²⁾.

Healthcare-associated pneumonia (HAP), which generally develops after 48 hours of hospitalization, is one of the most frequent HAIs⁽³⁾. Its incidence is higher among critically ill patients undergoing non-invasive ventilation (NIV) (3,1%) compared with 0,85% in the general hospitalized population, although it is less prevalent than among patients undergoing endotracheal intubation, whose rates range from 9% to 27%⁽⁴⁾. Pneumonia in critically ill patients receiving NIV remains a significant clinical challenge.

It is estimated that the occurrence of pneumonia in patients undergoing NIV prolongs their stay in intensive care units (ICUs) to approximately 10,8 days, compared with 7,9 days in the absence of infection, and may even extend hospitalization to 25,9 days compared with the expected 15,3 days⁽⁴⁾. Saied *et al*⁽⁵⁾ support these findings, demonstrating that the incidence of pneumonia among patients receiving NIV in the ICU is 4,5 cases per 1000 patient-days, compared with 21 cases per 1000 patient-days among patients undergoing endotracheal intubation.

Evidence indicates that NIV-associated pneumonia is correlated with a significant increase in both mortality rates and length of hospital stay⁽⁶⁾.

Non-invasive ventilation is a form of ventilatory support that does not require the use of invasive airway devices⁽⁷⁾. It is delivered through an interface between the ventilator and the patient, usually via nasal, oronasal, or full-face masks, with the oronasal mask being the most commonly used interface in acute care settings^(7,8). This modality provides greater comfort, preserves physiological mechanisms, and contributes to reduced morbidity and mortality in various clinical situations. NIV is recommended for several causes of acute respiratory failure, including exacerbations of chronic obstructive pulmonary disease, cardiogenic pulmonary edema, weaning and post-extubation support, as well as in immunocompromised patients, thoracic trauma, and postoperative care^(7,8).

Studies conducted by Johnny *et al*⁽⁶⁾, Emery and Guido-Sanz⁽⁹⁾, and Rathbun *et al*⁽¹⁰⁾ have provided important findings regarding oral hygiene care, highlighting its role in pneumonia prevention in addition to promoting comfort and oral cleanliness.

Given the importance of preventing complications associated with NIV, a scoping review was conducted.

Methodology

A scoping review was conducted following the recommendations of the Joanna Briggs Institute (JBI). The research question was formulated according to the PCC framework: What evidence exists regarding oral hygiene practices for critically ill patients undergoing non-invasive ventilation (P) in the hospital setting (C), considering factors such as pneumonia prevention (C)?

The literature search was carried out between March 22 and March 29, 2024, using the EBSCOhost search platform and the databases MEDLINE Ultimate, CINAHL Ultimate, and MedicLatina. The following search strategy was applied: “oral hygiene” AND “noninvasive ventilation” AND “critical care”. The same search strategy, developed based on DeCS descriptors, was used across all databases to ensure methodological consistency and uniformity throughout the search process.

The inclusion criteria were: critically ill adult patients undergoing NIV requiring hospitalization; studies published in English or Portuguese between 2019 and 2024; and full-text availability. Studies involving participants with SARS-CoV-2 infection were excluded.

A total of 182 articles were identified. After removing seven duplicate records, titles and abstracts were screened according to the inclusion and exclusion criteria, resulting in the exclusion of 169 articles. Full-text review of the remaining six articles revealed that two did not address the research question. Consequently, four articles were included in this scoping review. Additionally, one master's dissertation was identified through the Portuguese Open Access Scientific Repositories (RCAAP) and included in the review (Figure 1).

During the full-text analysis, the relevance, consistency, and methodological rigor of each study were assessed to ensure that only studies addressing the research question were included. In accordance with the Joanna Briggs Institute recommendations for scoping reviews, formal JBI critical appraisal tools were not applied. Nevertheless, the level of evidence of the included studies was assessed according to the Oxford Centre for Evidence-Based Medicine classification.

Data were extracted from the included studies (Table 1), identifying and organizing information regarding study objectives, population/context, findings, and conclusions. The data presented allow comparison of study characteristics and provide a clear and concise summary of the main findings. A schematic synthesis of the data was also developed (Figure 2), alongside a descriptive synthesis of the results. This approach enabled the mapping of the available evidence on oral hygiene practices in critically ill patients undergoing NIV, the identification of knowledge gaps in this field, and the direction of future research.

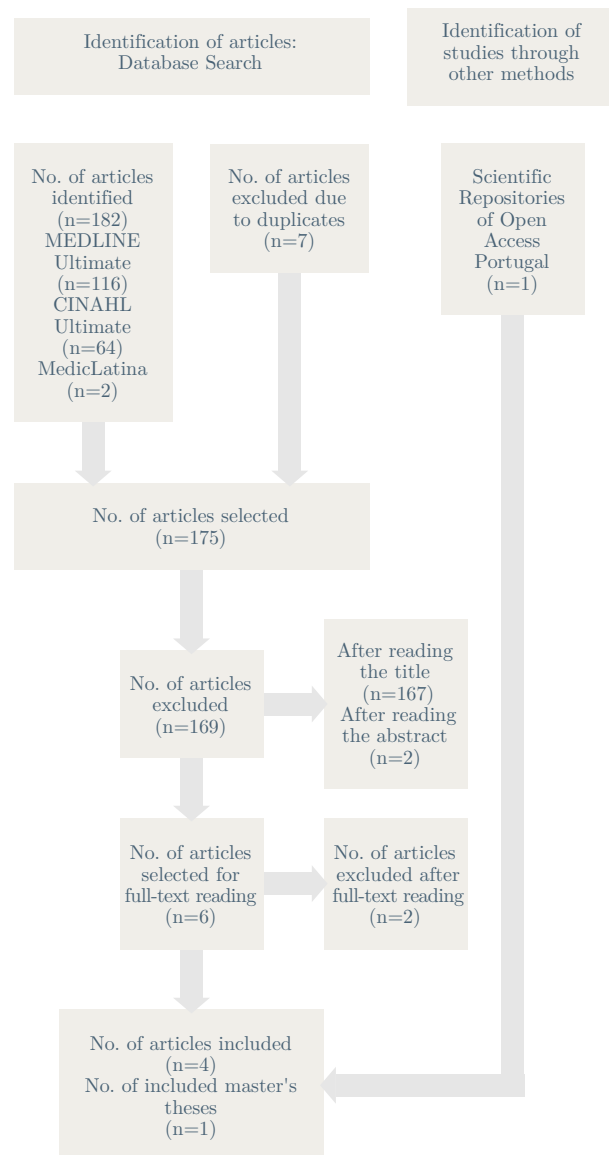


Figure 1: PRISMA flowchart adapted from Page *et al* ⁽¹¹⁾.

Results

The five documents included in this scoping review consisted predominantly of integrative literature reviews conducted in the United States of America ($n = 3$), France ($n = 1$), and Portugal ($n = 1$), all published within the last five years. These studies provide an overview of the current evidence related to oral hygiene care in critically ill patients undergoing NIV in hospital settings, highlighting appropriate interventions to maximize infection prevention, management, and control. The findings demonstrate a relationship between the colonization of microorganisms within the oral cavity, resulting from inadequate oral hygiene care, and the consequent increased risk of pneumonia in this patient population.

Table 1 presents the data extracted from each of the documents included in the scoping review.

Oral hygiene in critically ill patients undergoing NIV is a frequently undervalued intervention, despite its proven relevance in the prevention of NIV-associated pneumonia. In this context, oral hygiene care plays a central role in promoting the quality and safety of healthcare, while contributing to the reduction of the clinical, economic, and social impact of HAIs. At the same time, this practice is aligned with the 3rd specific competency of the specialist nurse in medical-surgical nursing in the care of critically ill patients, reinforcing the need to reflect on the role of the specialist nurse in the implementation of such care. The autonomous and specialized intervention of the nurse is consistent with established quality standards, being

Table 1: Data extracted from the studies included in the Scoping Review.

Title: Oral Care in Critically Ill Patients Requiring Noninvasive Ventilation: An Evidence-Based Review. Authors: Johnny, J., Drury, Z., Ly, T. e Scholine, J. Year: 2021. Objective: To provide nurses with evidence-based knowledge regarding oral care in critically ill patients requiring NIV. Level of evidence: Nivel 3A. Study design: Integrative Literature Review. Population/context: Patients receiving NIV. Results: Oral care is a preventive measure against pneumonia, although it is performed less frequently in critically ill patients receiving NIV. The incidence of pneumonia is higher in this population compared with the general hospitalized population and is associated with increased mortality and longer hospital stays. Conclusions: Adequate oral care promotes comfort and prevents complications associated with NIV, such as pneumonia. There is currently no standardized oral care protocol for patients receiving NIV due to variability in the available evidence.
Title: Oral care practices in non-mechanically ventilated intensive care unit patients: An integrative review. Authors: Emery, P., e Guido-Sanz, F. Year: 2019. Objective: To explore current oral care interventions in critically ill patients receiving NIV admitted to the ICU. Level of evidence: Nivel 3A. Study design: Integrative Literature Review. Population/context: Patients receiving NIV admitted to the ICU. Results: Oral care is an effective intervention for preventing pneumonia, with positive health and economic impacts. However, gaps in the literature remain. Toothbrushing is considered the ideal method for plaque removal and should be performed two to four times daily. Conclusions: The benefits of oral care are often underestimated. This intervention should be performed consistently in hospital settings. Further research is recommended to develop oral care protocols and ensure adherence to recommendations.
Title: Oral Microbes in Hospital-Acquired Pneumonia: Practice and Research Implications. Authors: Rathbun, K., Bourgault, A., e Sole, M. Year: 2022. Objective: To explore oral microorganisms associated with hospital-acquired pneumonia in patients receiving NIV and mechanical ventilation and to provide recommendations for prevention. Level of evidence: Nivel 3A. Study design: Integrative Literature Review. Population/context: Hospitalized adults with acute illness. Results: Common microorganisms were identified in patients receiving NIV and mechanical ventilation. Oral colonization with <i>Escherichia coli</i>, <i>Pseudomonas aeruginosa</i>, methicillin-resistant <i>Staphylococcus aureus</i>, and <i>Staphylococcus aureus</i> increases the risk of pneumonia in patients receiving NIV. Oral microorganisms were also found in the lungs, suggesting microaspiration. No standardized oral care practice was identified. Conclusions: Oral care is effective in preventing pneumonia by reducing microbial colonization of the oral cavity.
Title: What is new in non-ventilated ICU-acquired pneumonia? Authors: Saied, W., Martin-Loeches, I., e Timsit, J. Year: 2020. Objective: To compare recommendations for pneumonia prevention in patients receiving NIV and those undergoing mechanical ventilation, identifying similarities and differences. Level of evidence: Nivel 5D. Study design: Expert Opinion Article. Population/context: ICU patients with pneumonia receiving NIV or mechanical ventilation. Results: Lower respiratory tract colonization is associated with impaired cough reflex, inadequate oral hygiene, oropharyngeal colonization, and decreased consciousness. Common microorganisms were identified in both NIV and mechanically ventilated patients. Strategies to prevent pneumonia in patients receiving NIV remain unproven. Conclusions: Pneumonia is common among patients receiving NIV and negatively affects prognosis. Further research is needed to determine the impact of oral care on its prevention.
Title: Higiene Oral na Pessoa em Situação Crítica: o doente com Ventilação Não Invasiva. Authors: Alves, I. Year: 2022. Objective: To determine the procedure for performing oral hygiene in adults receiving NIV in a hospital setting. Level of evidence: Nivel 3A. Study design: Integrative Literature Review. Population/context: Hospitalized patients receiving NIV. Results: Oral care has gained relevance as a therapeutic intervention that promotes comfort and prevents infections. The protocol developed by Warren <i>et al</i> ⁽¹³⁾ was highlighted as appropriate for this population. Conclusions: The review aims to encourage healthcare professionals to adopt appropriate oral care procedures, as evidence demonstrates benefits for oral health and reductions in healthcare-associated infections.

recognized as a promoter of patient satisfaction, health promotion, prevention of complications, maximization of well-being and self-care, as well as infection prevention and control.

The schematic overview presented (Figure 2) systematizes the main conceptual axes and interrelationships identified in the evidence analysis. This resource allows visualization of how oral hygiene is integrated into different dimensions of specialized clinical practice.

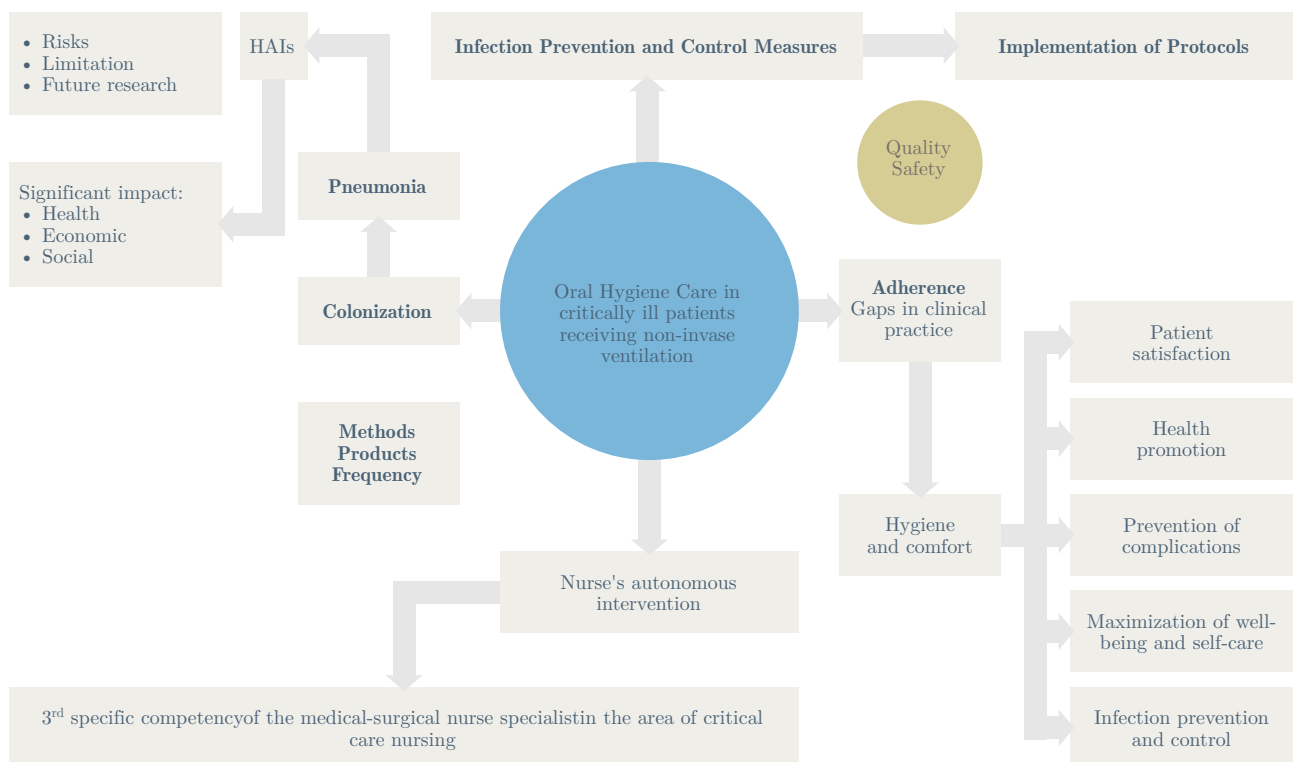


Figure 2: Schematic summary of the findings.

Discussion of Results

Scientific evidence regarding oral hygiene care in critically ill patients undergoing NIV remains limited. However, available data indicate a strong correlation between inadequate oral hygiene and an increased risk of pneumonia. NIV-associated pneumonia is associated with higher mortality rates and prolonged hospital length of stay⁽⁶⁾.

Appropriate oral hygiene care promotes patient comfort and contributes to the prevention and reduction of pneumonia⁽⁶⁾, with consequent economic and health-related impacts⁽⁹⁾. Alves⁽¹²⁾ supports this evidence, highlighting the growing role of oral hygiene as a therapeutic intervention that provides comfort and cleanliness, in addition to infection prevention. Giuliano *et al*⁽¹³⁾ further reinforce that improved oral hygiene contributes to source control, emphasizing its importance in pneumonia prevention.

Despite its benefits, oral hygiene care may pose risks when performed in patients with altered consciousness, inability to protect the airway, ineffective cough reflex, or behavioral changes, all of which may increase the likelihood of adverse events⁽⁶⁾. It is important to highlight that disconnecting the patient from NIV for oral hygiene procedures may result in hypoxemia, representing a significant clinical risk⁽⁶⁾.

Oral hygiene practices: prevention of colonization and pneumonia

The literature shows that several factors, such as reduced cough reflex, inadequate oral hygiene, oropharyngeal colonization, and depressed level of consciousness, are likely mechanisms of microbial colonization that increase the risk of respiratory infection⁽¹⁴⁾. Scientific evidence suggests a strong link between oral hygiene care and the development of pneumonia, as microorganisms present in the oral cavity may colonize the oropharynx and be micro-aspirated into the airways, eventually reaching the lungs⁽¹⁵⁾.

Therefore, oral colonization represents a significant risk factor for pneumonia in patients undergoing NIV, as demonstrated by the identification of oral microorganisms in the lungs, suggesting micro-aspiration

events⁽¹⁰⁾. Studies conducted by Rathbun *et al*⁽¹⁰⁾ and Saied *et al*⁽¹⁴⁾ confirm the presence of similar microorganisms in cases of pneumonia in both NIV and mechanically ventilated patients. Oral colonization by microorganisms such as *Escherichia coli*, *Pseudomonas aeruginosa*, methicillin-resistant *Staphylococcus aureus* (MRSA), and *Staphylococcus aureus* has been associated with an increased risk of pneumonia in patients undergoing NIV⁽¹⁰⁾.

Appropriate oral hygiene care has demonstrated effectiveness in preventing pneumonia by reducing microbial colonization in the oral cavity⁽¹⁰⁾, reinforcing its positive impact.

Oral hygiene practices: methods, products, and frequency

It is recommended that all patients receive oral hygiene using toothpaste containing sodium bicarbonate and oral cavity disinfection with antiseptic mouthwash. In patients at risk of aspiration, oral care should be performed using a suction toothbrush⁽¹⁵⁾. Giuliano *et al*⁽¹³⁾ support this approach according to patient stratification, although they do not refer to the use of sodium bicarbonate toothpaste. These authors also recommend the use of dental floss and lip balm as complementary measures⁽¹³⁾.

Emery and Guido-Sanz⁽⁹⁾ reinforce that the toothbrush remains the most effective tool for plaque removal, highlighting its central role in preventing respiratory infections associated with oral colonization.

The use of chlorhexidine is specifically mentioned for mechanically ventilated patients⁽¹⁵⁾. Giuliano *et al*⁽¹³⁾ state that its use may be considered according to institutional protocols; however, current evidence does not clearly support its benefits or risks. The literature presents conflicting results: Emery and Guido-Sanz⁽⁹⁾ report that chlorhexidine is not recommended by the American Association of Critical Care Nurses (2017); Saied *et al*⁽¹⁴⁾ suggest potential harm and propose alternatives such as oral decontamination solutions or topical antibiotics, although clinical benefits have not been clearly demonstrated; Johnny *et al*⁽⁶⁾ suggest its use due to availability and ease of access. Overall, evidence regarding oral antiseptic solutions remains inconsistent.

Regarding technique, the protocol by Warren *et al*⁽¹⁵⁾ recommends a 120-second brushing duration, with frequency varying according to patient stratification: every 4 hours (six times daily) for mechanically ventilated patients and every 6 hours (four times daily) for non-ventilated patients. Giuliano *et al*⁽¹³⁾ confirm this approach, while Emery and Guido-Sanz⁽⁹⁾ suggest a frequency of 2–4 times per day, noting that the time required for brushing limits higher frequency implementation. Johnny *et al*⁽⁶⁾ propose that twice-daily care provides the greatest benefit. These findings reveal discrepancies in clinical practice and variability in existing recommendations.

Oral hygiene practices: adherence and protocols

In infection prevention and control, oral hygiene care remains an undervalued nursing intervention in this patient population⁽⁹⁾, often perceived as a hygienic measure rather than an infection prevention strategy. Johnny *et al*⁽⁶⁾ observed an adherence rate of 85,9%, lower than that reported in mechanically ventilated patients (93,1%), possibly related to perceptions of its therapeutic value. Although its importance is recognized, a gap remains in translating knowledge into clinical practice⁽¹⁵⁾.

It is essential that patients receiving NIV are considered with the same level of priority as mechanically ventilated patients⁽⁹⁾ regarding infection prevention and control. Pneumonia in NIV patients is frequent and may worsen prognosis, often due to delayed diagnosis and imprecise preventive strategies⁽¹⁴⁾.

Johnny *et al*⁽⁶⁾, Emery and Guido-Sanz⁽⁹⁾, and Rathbun *et al*⁽¹⁰⁾ highlight the absence of standardized protocols and recommend further research and the development of specific guidelines for this population. They suggest future studies focusing on methods, impact, and frequency, including the use of chlorhexidine and oral decontamination solutions^(10,14).

Warren *et al*⁽¹⁵⁾ emphasize the importance of oral hygiene as a frequently neglected nursing intervention, demonstrating its high impact on patient safety and continuous quality improvement in critically ill patients. Their study, conducted over seven months across two different years in a hospital setting, evaluated

the implementation of an oral hygiene protocol that included kits with specific products and an educational leaflet for patients and caregivers.

Results showed a 50% reduction in pneumonia incidence, with an estimated prevention of approximately 16 deaths and savings of 1,04 million USD during the study period, attributed to pneumonia prevention. These findings demonstrate significant improvements in care quality and safety achieved through a simple, accessible, and low-cost intervention⁽¹⁵⁾.

The study also highlights the importance of continuous education and auditing of oral hygiene practices, emphasizing that training healthcare teams, patients, and caregivers contributes to improved clinical practice⁽¹⁵⁾. The implementation of protocol-based algorithms, personalized kits, and patient involvement in care contributes to reducing healthcare-associated pneumonia, enabling individualized care, standardization of clinical practice, and improved adherence to oral hygiene interventions⁽¹⁵⁾. Swallowing assessment is a crucial step in the protocol, allowing the selection of appropriate materials for each clinical situation and reducing the risk of micro-aspiration⁽¹⁵⁾, a preventive measure also supported by Giuliano *et al*⁽¹³⁾.

Although the importance of oral hygiene in preventing NIV-associated pneumonia is recognized, a significant research gap in this area remains. Therefore, it is essential to encourage nurses to adopt appropriate evidence-based procedures capable of improving oral health outcomes and contributing to the reduction of HAIs⁽¹²⁾.

Conclusion

Based on the scientific evidence reviewed, oral hygiene care in critically ill patients represents a significant clinical challenge. However, studies indicate that the appropriate implementation of these practices can effectively reduce microbial colonization, promote oral health, and contribute to the prevention of pneumonia. The evidence therefore reinforces the relevant role of oral hygiene in reducing HAIs.

The practical application of protocols, such as the one presented, translates into both clinical and financial benefits, promoting the quality and safety of care provided to patients. To achieve this, it is essential to invest in education and continuous training of nurses, ensuring adherence to evidence-based practices and promoting holistic and effective care.

Raising nurses' awareness of the relevance of this intervention is crucial to mitigate complications, reduce length of hospital stay, and potentially decrease mortality. This requires a change in practice behavior and the integration of oral hygiene care into daily clinical routines, supported by training and regular audits.

The scarcity of available scientific evidence further reinforces the need for future research to guide and improve oral hygiene practices in this clinical context.

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Corresponding Author/Autora Correspondente
 Ana Bernardo — Unidade Local de Saúde do
 Litoral Alentejano, Unidade de Cuidados na
 Comunidade, Odemira, Portugal.
anabernardo2@hotmail.com

Authors' contributions/Contributo das Autoras
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 collection, storage and analysis, review and
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 GA: Study design, data collection, storage and
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