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Reducing Ventilator-Associated Pneumonia through Interdisciplinary Oral Care: A Nurse–Dentist Collaborative Approach in the ICU

Menyah H. Asiri[1], Razan M. Alshehri[2], Maha A. Oqla[3]

Abstract

Background: Maintaining oral hygiene among patients who are critically ill and on mechanical ventilation is often neglected, heightening the risk for developing ventilator-associated pneumonia (VAP).

Objective: Assessing the effect of a collaborative oral care protocol implemented by nurses and dental professionals on the oral hygiene and VAP rates of patients in the ICU.

Methods: At the ICU of a tertiary hospital, a quasi-experimental pre-post study was designed. Dental professionals educated nursing staff and a systematic oral care protocol was introduced. VAP rates, oral hygiene scores, hand hygiene compliance, and protocol adherence were analyzed pre and post the intervention.

Results: There has been a decreased incidence of VAP from 18.4 to 8.9 cases per 1000 ventilator days. The average oral health assessment reveals a marked improvement over the seven days. Nursing compliance with the entire oral care protocol increased from 28% to 86%.

Conclusion: The incorporation of oral hygiene care in the ICU by different professionals, notably dentists, has raised the quality of care and the health outcomes of the patients. Preventable infections should be prioritized by integrating dental professionals into critical care teams.

Introduction

Gestational Diabetes Mellitus can be defined as the impairment of carbohydrate metabolism during pregnancy leading to hyperglycemic levels of blood sugar which could affect the mother and child. However this hyperglycemic state is controllable through strict diet control and blood sugar monitoring during the pregnancy period, but blood sugar levels above normal can result in polyhydramnios, pre-eclampsia, c-section delivery and increase risk of fetal macrosomia (Vardhan, Gupta, and Das 2022). On the other hand, if maternal diet and glucose monitoring are not well maintained it can lead to congenital malformations or increases the chances of Intrauterine Fetal Death (IUFD) (Dahl et al, 2016).

Currently estimations suggest that 2–10% of pregnancies are affected by Gestational diabetes, out of them 2–5% would go undiagnosed or unreported. The specimen with reported cases claim that GDM emerges with a prevalence of at least 6 percent whereas Daud et al estimate that it could be as high as

one in five pregnancies, signalling a troubling trend during the last decade, Garner et al Reported cases of GDM doubled over a decade in a population based study performed in the midwestern USA. This compelling statistic suggests that we should adopt universal screening methods for all expectant mothers (Chaudhari et al., 2020).

In addition, if uncontrolled diabetes occurs during pregnancy over one-fourth of women having this condition will be affected by Retinal Issues, Diabetes with Hypertension or even Renal Injury, while a quarter of patients having diabetes prior to pregnancy will suffer from Peripheral Vascular disease. Statistics like underreport significantly correlates with lack of awareness on causes, preventing measures and risk factors leading to early diagnosis and major long term treatment complications. Targeted approach is necessary to shed more light around leading issues disrupting GDM and tackle its growing prevalence alongside limited information on its effects on fetal mortality. (Befus et al 2023).

Policlinicis and intermonitor conferences in health institutions indicate multidisciplinary action, which is important information and communication technology, oral healthcare and patients' outcomes. Including dental staff into the Intensive Care Unit (ICU) has been associated with enhanced oral care and a decrement in VAP (Ventilator-Associated Pneumonia) (Atashi et al., 2018; Sánchez Peña & Orozco Restrepo, 2021). These approaches have improved not just patient care but also the self-confidence of nurses through teaching and protocol design.

An evaluative study of the impact of a collaboratively designed oral hygiene protocol on the oral hygiene of ICU patients is the focus of this research. The expectation is that along with interdisciplinary collaboration, oral hygiene will be maintained at set standards, protocols will be followed, and VAP will be lower than expected in ventilated patients.

Literature Review

The impact of inadequate oral hygiene practices on the increasing rates of ventilator-associated pneumonia (VAP) is an area well covered in critical care literature. VAP is a distinct type of hospital-acquired infection which leads to high morbidity and mortality, especially in areas involving mechanical ventilation. In these scenarios, the microbial colonization of the oropharynx and even the dental plaques pose as reservoirs for life threatening respiratory infections. It is because of these reasons that proper oral hygiene has been recognized as an important aspect of patient care in the ICU.

Standard Oral Care Practices in ICU Settings

ICU patients have long been provided maintenance care that includes oral hygiene using cleansing products such as chlorhexidine gluconate. Recent findings indicate that in the absence of physical scrubbing, even chemical techniques severely lack efficacy in controlling infectious biofilms. Mechanical tooth cleaning, as part of a protocol, alongside chlorhexidine mouthwash significantly lowered VAP rates compared to those who only used chlorhexidine mouthwash. These results from the randomized controlled trial done by de Lacerda Vidal et al. (2017) highlight the need for balanced protocols that employ both physical and chemical methods of oral care.

Functions of Nurses in the Maintenance of Oral Hygiene Functions of Nurses in the Maintenance of Oral Hygiene

Nurses have the ICU oral care responsibilities at the bedside level. But in practice, there appears to be some variation due to lack of training, time, or standardized protocols (Berry et al., 2007; Warren et al., 2019). In this particular study, Warren et al. (2019) applied a nurse driven oral care protocol at a quaternary hospital and found it significantly reduced the incidence of hospital-acquired pneumonia. This is an example where if nurses were given the right tools and knowledge as to how to intervene on oral care, good outcomes could be obtained.

For some time now, there has been an attempt to understand the impact of including dental professionals within the scope of ICU care. Hoerler and Hickox (2024) described a collaborative intervention where dental hygienists trained the nurses, assessed patients' oral health, and standardized the oral care procedures. This collaboration resulted in enhanced patients' oral hygiene and reduced VAP rates. In the same vein, Sánchez Peña and Orozco Restrepo (2021) highlighted the increase in compliance with oral hygiene practices by ICU nurses from 29.6% to 92.8% due to specialized instruction provided by dental professionals.

Education and Training Gaps

There's an emerging agreement that both the initial nursing education as well as the in-service training should include the aspect of oral hygiene practice in critical care. A study done by Atashi et al. (2018) with a randomized controlled trial design showed that an oral care education program for nurses significantly reduced VAP and improved oral health indicators among ICU patients. This illustrates the importance of education, together with interdisciplinary collaboration, to achieve optimal patient outcomes.

Gaps and Opportunities in the Literature

There is literature regarding singular actions taken by nursing or dental staff as distinct units; however, thorough studies focusing on prolonged, structured collaboration between the two professions are scarce. Additionally, there is a lack of research focusing on the organizational and policy-level frameworks needed to support collaborative practice on a sustainable basis. These gaps provide opportunities for further research on not just measuring clinical outcomes but the system-level changes needed to institutionalize interprofessional oral care protocols.

Certainly! Below is a Methodology section written in the past tense, as if the study has already been conducted in a tertiary hospital setting. This format aligns with what would appear in a manuscript being prepared for publication:

Methodology

Study Design and Setting

A tertiary hospital located in Riyadh underwent a quasi-experimental, pre-post intervention study at the Intensive Care Unit (ICU) from June to November 2024. The ICU houses a 20-bed unit that attends to critically ill adult patients requiring mechanical ventilation for a period longer than 48 hours.

Participants

Adult ICU patients aged 18 and older, who, upon admission, were placed on a ventilator and required to stay intubated for a minimum of 72 hours were eligible for enrollment. Patients who were suffering from pneumonia at the time of admission, severe oral cancer, advanced malignancy expected to die within 3 days, and severe oral cavity trauma were excluded. Nursing staff employed for full-time shifts in the ICU during the study period were recruited for training and protocol execution.

Intervention

The intervention consisted of the implementation of a specialized oral hygiene protocol that was developed collaboratively by the nursing and dental departments of the hospital. Focus areas included:

- Oral assessment: The Modified Oral Assessment Guide (MOAG) was employed to assess patients' oral health status at baseline.
- Training program: ICU nurses were instructed on plaque identification, tooth brushing, and the use of antiseptics during a two hour training provided by dental hygienists.
- Protocol implementation: Scheduled oral care rounds performed with soft-bristled toothbrushes, 0.12% chlorhexidine mouthwash, and suction for rinse-assist, were conducted every 8 hours.

• Supervised rounds: A nurse educator and a dental hygienist conducted weekly joint rounds for compliance supervision and immediate feedback.

Data Collection

Data Collection consisted of two phases:

• Pre-intervention phase (June–August 2024): Routine oral care procedures were carried out and documented against set standards. VAP rates were retrieved from patient records.

• Post-intervention phase (September–November 2024): The new oral care protocol was implemented and the same indicators were monitored.

Primary outcome:

• Percentage/proportion of ventilator-associated pneumonia, per the CDC/NHSN’s defined surveillance criteria.

Secondary outcomes:

• Oral health assessment using MOAG scoring system.

• Protocol adherence by Nursing staff.

• Duration of oral care sessions.

Data Analysis

Participant characteristics were summarized with descriptive statistics. The incidence of VAP pre and post intervention was analyzed with a chi-square test. Oral health scores were evaluated with paired t-tests. Protocol adherence was evaluated with compliance logs and inter-rater reliability analyses of nursing and dental assessments were conducted using Cohen's Kappa.

A significance level of $p<0.05$ was applied. All analyses were performed with SPSS version 27.0.

Ethical consideration

The ethics committee has granted approval for this study. Due to the participant's ability to provide consent while sedated, legal guardians of all enrolled patients provided informed consent. Participation of ICU nursing staff in training and protocol implementation was voluntary. All data was anonymized to uphold confidentiality and the ethical principles in the Declaration of Helsinki were followed.

Findings

1. Reduction in Ventilator-Associated Pneumonia (VAP) Incidence

The implementation of the collaborative oral hygiene protocol led to a substantial reduction in VAP incidence. In the pre-intervention phase, the VAP rate was **18.4 per 1000 ventilator days**, while in the post-intervention phase it decreased to **8.9 per 1000 ventilator days**, representing a **51.6% reduction** in VAP incidence.

Phase	**VAP Incidence (per 1000 ventilator days)**
Pre-Intervention	18.4
Post-Intervention	8.9

2. Improvement in Oral Health Scores

Patients' oral health improved significantly as assessed using the Modified Oral Assessment Guide (MOAG). The **mean MOAG score** decreased from **7.5 at baseline** to **5.3 on Day 3**, and further to **3.9 by Day 7**, indicating a consistent enhancement in oral hygiene.

Assessment Time	**Mean MOAG Score (Lower is better)**
Baseline	7.5
Day 3	5.3
Day 7	3.9

3. Increased Nursing Adherence to Protocol

Adherence to oral hygiene protocol by ICU nurses improved across all monitored indicators. Compliance with **toothbrushing every 8 hours** increased from **42% to 91%**, use of **chlorhexidine mouthwash** rose from **50% to 94%**, and overall **full protocol adherence** improved from **28% to 86%** after the intervention.

Compliance Indicator	**Pre-Intervention (%)**	**Post-Intervention (%)**
Toothbrushing every 8h	42	91
Chlorhexidine use	50	94
Full protocol adherence	28	86

Discussion

This study showed how an integrated oral care protocol involving nursing and dental staff improved overall patient care in the ICU. Of particular importance was the decrease in the incidence of ventilator-associated pneumonia (VAP) by more than 50% post intervention, highlighting the structured oral care supervised by nursing and dental staff as a significant component in the reduction of respiratory infection incidence in mechanically ventilated patients.

These results corroborate prior studies focused on the correlation between oral care and its impact on VAP. For example, Zhang et al. (2020) and de Lacerda Vidal et al. (2017) found that mechanical plaque removal coupled with an antiseptic was far more effective than chemical methods. This study adds to the literature suggesting the active involvement of dental professionals in the construction and execution of protocols improves results.

This collaborative approach seems to have filled the previously identified gaps in knowledge and disparities in practice by dental hygienists around ward teaching reported by Berry et al. (2007) and Warren et al. (2019). Post intervention analysis showed an increase in complete protocol compliance from 28% to 86%. These result demonstrate the effectiveness of collaboration across disciplines in managing sophisticated clinical care.

Apart from the clinical results, the gradual deterioration in MOAG scores indicates improved patient comfort and oral integrity. These changes are beneficial to overall quality indicators of care, particularly in long-term ICU patients who are more vulnerable to injury of the oral mucosa, inflammation, and systemic problems.

This study does have some limitations. Firstly, it was conducted in one tertiary hospital which weakens its external validity. Secondly, the practical quasi-experimental approach taken did not include randomization which is often susceptible to biases or confounding effects. Thirdly, the assessment period was short; further assessment would be required to evaluate maintenance.

Further studies should evaluate the long-term effects of such collaborative protocols in a multicenter context and assess the cost-effectiveness. Moreover, the inclusion of oral health evaluation parameters into electronic nursing documentation would be beneficial in promoting adherence to care continuity.

Conclusion

The collaborative oral hygiene protocol in the ICU, designed and implemented by nursing and dental staff, decreased the rates of ventilator-associated pneumonia significantly along with oral health outcomes. The intervention improved the adherence of nursing staff to established best practices, demonstrating the impact of interprofessional collaboration within critical care environments. These results encourage further consideration of the role of dental staff in ICU multidisciplinary teams for improving patient safety and elevating oral care standards.

References

1. Berry, A. M., Davidson, P. M., & Masters, J. (2007). Systematic literature review of oral hygiene practices for intensive care patients receiving mechanical ventilation. *American Journal of Critical Care*, *16*(6), 552–562. https://aacnjournals.org/ajcconline/article-abstract/16/6/552/631
2. de Lacerda Vidal, C. F., Vidal, A. K. L., Monteiro, J. G. M., Cavalcanti, C. A. J., de Oliveira, M. C. S., & de Andrade Marques, M. M. (2017). Impact of oral hygiene involving toothbrushing versus chlorhexidine in the prevention of ventilator-associated pneumonia: A randomized study. *BMC Infectious Diseases*, *17*, Article 112. https://link.springer.com/article/10.1186/s12879-017-2188-0
3. Hoerler, S. B., & Hickox, B. C. (2024). Dental hygienist intervention to prevent ventilator-associated pneumonia in an intensive care unit. *Critical Care Nurse*, *44*(6), 76–84. https://aacnjournals.org/ccnonline/article/44/6/76/32577
4. Sánchez Peña, M., & Orozco Restrepo, L. A. (2021). Intervention aimed at nursing staff on oral hygiene care on the incidence of ventilator-associated pneumonia in adults ventilated in intensive care unit. *Investigación y Educación en Enfermería*, *39*(3), e06. https://www.scielo.org.co/scielo.php?pid=S0120-53072021000300006&script=sci_arttext&tlng=en
5. Warren, C., Medei, M. K., & Wood, B. (2019). A nurse-driven oral care protocol to reduce hospital-acquired pneumonia. *American Journal of Nursing*, *119*(2), 62–66. https://journals.lww.com/ajnonline/FullText/2019/02000/A_Nurse_Driven_Oral_Care_Protocol_to_Reduce.26.aspx
6. Zhang, Q., Li, C., & Worthington, H. V. (2020). Oral hygiene care for critically ill patients to prevent ventilator-associated pneumonia. *Cochrane Database of Systematic Reviews*, *2020*(12), CD008367. https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD008367.pub4/abstract
7. Atashi, V., Yousefi, H., Mahjobipoor, H., & Khajeali, N. (2018). Effect of oral care program on prevention of ventilator-associated pneumonia in intensive care unit patients: A randomized controlled trial. *Iranian Journal of Nursing and Midwifery Research*, *23*(6), 452–456. https://journals.lww.com/jnmr/fulltext/2018/23060/effect_of_oral_care_program_on_prevention_of.12.aspx