

## Impact of Oral Care for Intensive Care Unit Patient on Pneumonia Infection Prevention: Literature Review Study

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### Abstract

**Background:** Oral cavity bacteria can be mostly harmful if inhaled into the lungs. Hospital acquired pneumonia (HAP), a critical condition that presents clinically two or more days after hospitalization, which may increase the risk of mortality. Lacking oral care can lead to Hospital acquired pneumonia. **Objective:** to explore effective oral care consequence on hospital acquired pneumonia prevention. **Methods:** This review article is performed according to the PRISMA guidelines. The literature exploration was done in Google Scholar and PubMed databases for articles published between 2017 and 2020. The search words were "oral care, oral hygiene, intensive care, critical care, ICU, respiratory infection, lung infection, pneumonia, and adult". **Results:** A total of 6 studies were included, the studies were randomized controlled trials (RCTs) and observational studies. Oral care with tooth brushing and purified water twice daily can significantly reduce the incidence of HAP. Brushing patient mouth with chlorhexidine is also effective in decreasing the HAP incidence. Implementing oral care protocols in ICU with chlorhexidine solution and nurse education can significantly lower the incidence of HAP. **Conclusions:** Good oral and dental care, particularly with tooth brushing and purified water twice daily, can significantly reduce the incidence of HAP in intensive care unit patients.

**Keywords:** oral care, oral hygiene, intensive care, ICU, respiratory infection, lung infection, pneumonia, and adult.

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## INTRODUCTION

Hospital acquired pneumonia (HAP) is one of the most common challenges infection and a major reason of morbidity and mortality in the hospital patients [1]. According to the international study of the prevalence and outcomes of infection in ICUs, Ventilation associated pneumonia (VAP), a subdivision of HAP, which is the most common infection and the leading causes of death in patients especially in ICU [2]. Ventilator patient's hold the higher risk of developing pneumonia infection with more than 6-20 times compared to non-ventilated ICU patients [3]. Previous studies has been reporting VAP incidence and mortality rate in the ICU are 36% and 13% respectively [4-6].

VAP is caused by entering the oral bacteria into the lower respiratory tract via the ventilator endotracheal tube (VET). Whenever VET is in place, most defenses against pneumonia are impaired because of the VET

compromised all physiological defense mechanisms such as nasal warming, humidification, mucus clearance by mucociliary, and cough. Contaminated mouth and nasal secretions can drain into lower respiratory and cause aspiration which is identified as one of the most causes of VAP [7]. Though, the VAP incidence and related infection are increasing, VAP prevention is a patient's life saving and cost lowering in ICUs [3].

Oral care in general is worsening in ICU patient because of their critical situation. Absence of effective oral care after patient admitted to the ICU, dental plaque accumulations on the teeth within 2-3 days which potentially facilitate respiratory pathogen to pass through lower respiratory tract and cause infection [8, 9]. The oral flora of critically ill patient changes within 2 days of intubation, there is a reduction of fibronectin which is accountable for the predominance of Gram-negative organisms, replacing normally found Gram-positive organisms [10]. Many methods are utilized to prevent

VAP such as head of bed elevation, daily sedation interruption, prevention of deep vein thrombosis, and daily oral hygiene [11]. Using topical or systemically antibiotics can lead to bacteria resistant [12, 13].

Therefore, brushing patient's teeth, gums, and tongue every 2-4 hours and rinsing patient's oral cavity with purified water or chlorhexidine may decrease VAP incidence by 60% [14]. Clinical guidelines recommend that oral hygiene care be provided to patients who are at risk of developing VAP, but the evidence to support this practice is not clear [15].

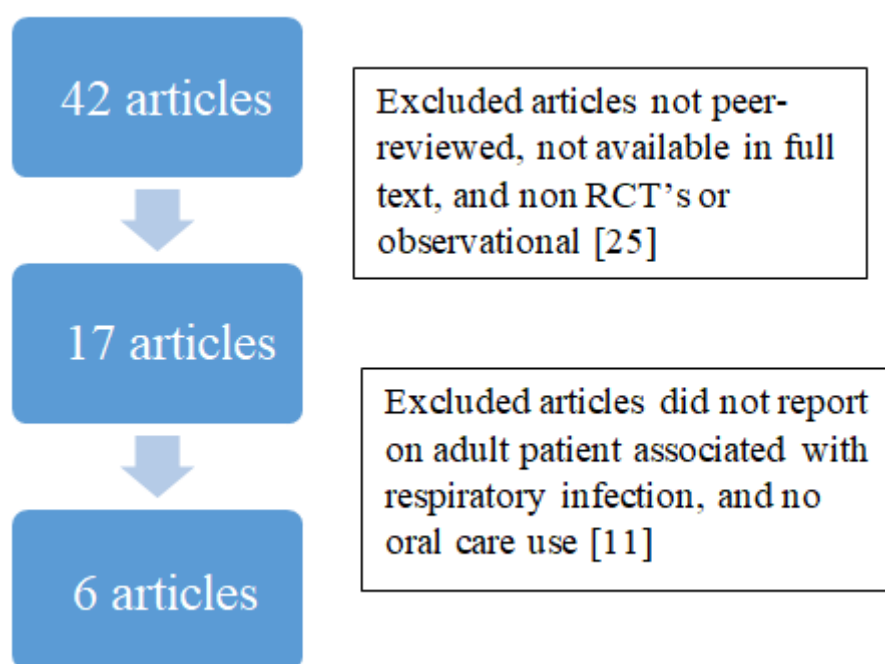
## METHODS

This review article was performed according to PRISMA guidelines. The literature exploration was done in Google Scholar and PubMed for articles published between 2017 and 2020. The search words were "oral care, oral hygiene, intensive care, critical care, ICU, respiratory infection, lung infection, pneumonia, and adult".

Inclusion criteria were include any study that were published in English and conducted in adults critically diseased patients in ICU, having respiratory infection or pneumonia  $\geq$  two day, and assessed the oral or dental care.

Exclusion criteria were exclude any study that were not peer-reviewed, did not report the results of respiratory infection or pneumonia in ICU patients or did not report dental or oral care use in such patients. Also, Articles that were not available in full text or not peer reviewed or letter to editor or other than RCT's or observational studies.

A total of 6 studies were included in this review according to inclusion and exclusion criteria after reviewing the title, abstract and full text of articles. The studies were randomized controlled trials (RCTs) and observational type on adults.



**Figure 1: Studies selection summary**

## RESULTS

A total of 682 patients were investigated and included in this review. All patients were on mechanical ventilation and endotracheal tube was implanted. The oral care included different ingredients for cleaning such as sodium bicarbonate mouth wash, chlorhexidine 0.2%, 0.12%, and 0.1%, purified water, chamomile, and saline and different method like toothbrushing, flossing, foam-

headed swab with before-and-after hypopharyngeal suctioning and/or oropharyngeal suction. Elevating the head of the bed was imbedded.

Oral care has been advocated to achieve the healthy oral environment. Several studies demonstrated that oral care might significantly decrease the incidence of mechanical VAP and colonization of dental plaques (Table 1).

**Table 1: Included studies summary**

Authors	Oral care	Participant	Results
de Lacerda Vidal <i>et al.</i> , 2017 [16]	A prospective randomized trial that compared the effectiveness of oral hygiene with toothbrushing and chlorhexidine gel (0.12%) to oral hygiene with chlorhexidine solution (0.12%) without toothbrushing in adult patients who were mechanically ventilated in the ICU	213 patients were included in the study as 108 were randomized to control group and 105 to intervention group of toothbrushing plus 0.12% chlorhexidine gel	The study found that toothbrushing plus chlorhexidine gel was associated with a lower incidence of VAP than oral hygiene with chlorhexidine solution alone. However, the difference was not statistically significant. Toothbrushing plus chlorhexidine gel was also associated with a significant reduction in the meantime of mechanical ventilation.  The study concluded that toothbrushing plus chlorhexidine gel may be beneficial in reducing the incidence of VAP and the duration of mechanical ventilation.
Kaya <i>et al.</i> , 2017 [17]	A study was conducted to compare the effects of two oral care agents, 5% glutamine and 2% chlorhexidine gluconate solution, for the prevention of VAP in neurosurgical ICU patients	88 patients who were randomly assigned to one of two groups: The study group received oral care with 5% glutamine, and The control group received oral care with 2% chlorhexidine gluconate solution	The results showed that there was no significant difference in the incidence of VAP between the two groups. There was also no significant difference in the oral health scores between the two groups. However, the APACHE II score was significantly lower at discharge than at day 1 in both groups.  The study concluded that both 5% glutamine and 2% chlorhexidine gluconate solution are equally effective in preventing VAP in neurosurgical ICU patients
Marino <i>et al.</i> , 2017 [18]	This study investigated the microbiome of dental plaque, endotracheal tubes (ETTs), and non-directed bronchial lavages (NBLs) in mechanically ventilated patients	Bacterial 16S rRNA gene sequences from 34 samples of dental plaque, non-directed bronchial lavages, and ETTs from 12 adult mechanically ventilated patients	The researchers found that the microbial communities of these samples were very similar, suggesting that the oral cavity is an important source of bacteria that can be aspirated into the lungs and ETTs. This finding highlights the importance of good oral hygiene in preventing VAP in mechanically ventilated patients
Atashi <i>et al.</i> , 2018 [19]	This study investigated the effect of oral care on the frequency of VAP in patients in ICU. The control group received routine oral care, while the intervention group received oral care that included brushing, flossing, and chlorhexidine mouthwash. Data were collected at the first, third, and fifth days of the study	80 participants who were randomly assigned to a control group or intervention group	The authors concluded that the oral care program did not significantly decrease the incidence of VAP in critically ill patients compared with routine oral care practices.
Galhardo <i>et al.</i> , 2020 [20]	This study investigated the impact of oral care and the use of chlorhexidine gluconate in preventing VAP in patients admitted to an ICU	229 patients included	The study concluded that the oral care protocol had a statistically significant effect in reducing the risk of developing early VAP in ICU patients. This demonstrates the importance of multidisciplinary teamwork in the hospital setting
Abd-alraheem <i>et al.</i> , 2020 [21]	The study aimed to assess the effect of oral hygiene for patients on a mechanical ventilator in ICU and the nurses' knowledge and practice	The study included 40 nurses and 60 patients who were orally intubated and on mechanical ventilation.	The researchers concluded that the nurses' knowledge and practice were unsatisfactory. They also found that there was a highly statistically significant relationship between low frequency of oral care and oral alteration and a highly statistically significant relationship between VAP occurrence and poor oral alteration.

## DISCUSSION

Oral cavity is a significant source of bacterial infection in critically ill patients in ICU when aspirated to the lower respiratory tract. Aspiration of oral bacteria into the lungs through endotracheal tubes in ventilated patient is the main source of VAP infection in critically ill patients. Marino *et al.*, study indicated that maintaining good oral care for ventilated patients will limiting aspiration pneumonia in those patients [18]. While simple oral care with toothbrushing and purified water twice daily will reduce VAP infections and improve oral health hygiene as Yao *et al.*, study fortified that [22]. A reduction in duration of mechanical ventilation, and a propensity to reduce the incidence of VAP and length of ICU stay, also notable with good oral care hygiene [16].

Significant reductions in VAP incidence may be achieved through improved nurse education and oral care protocols implementation in the ICU settings. Multidisciplinary oral health protocols was effective in reducing the mortality and morbidity related VAP infection. One study found there is a highly statistically significant relationship between low frequency of oral care for ICU patients and oral alteration which considerable a high risk for VAP in those patients [19-21].

On the other hand, Atashi and his colleagues compared the impact of oral care program on the incidence of VAP in critically ill patients with routine oral care practices in ICU. They found that oral care program could not significantly decrease the incidence of VAP in critically ill patients, but found the frequency of pneumonia was less with oral care program group [19].

Using mechanical toothbrushing method was not different from using conventional method by using the hand to clean and brush the patient's teeth and gum. Different size of the brush also assessed related this matter. Berry study showed that using soft and mechanical toothbrushing as part of daily oral care regimen with different type of solutions for ICU patients, is not helping in reducing VAP incidences [23]. While a comprehensive oral hygiene care regimen that includes brushing the teeth, suctioning moth fluid, and rinsing the mouth with different type of antiseptic solutions or foam swabs is very effective in the prevention of VAP infection comparing with only brushing the teeth [24, 25].

Different forms and concentrations of chlorhexidine with toothbrush have been used for ICU patient's oral care hygiene. Chlorhexidine found to be effective in preventing bacteria to persuade to the respiratory system and infect the system. 1%, 0.2%, and 0.12% of chlorhexidine mouthwash found significantly effective in oral care hygiene and preventing VAP infection in ICU patients [26-29]. Bacterial colonization

in the oral cavity of the ventilated patients found to be in a smaller amount after using chlorhexidine mouthwash [30]. Chlorhexidine gel 0.12% with toothbrushing also found to be effective in preventing VAP infection comparing to chlorhexidine solutions without brushing [16]. Kaya *et al.*, study showed no significant differences between 2% chlorhexidine and 5% glutamine solutions in the VAP infection prevention [17]. Berry *et al.*, studies in 2011 showed no significant difference between sodium bicarbonate mouth wash and chlorhexidine 0.2% aqueous oral rinse as bacterial colonization in the patient's mouth, but there a no significant differences in VAP infection incidences when compare to sterile water group [31]. Berry research in 2013 found that Listerine (®) or sodium bicarbonate were not more effective in the reduction of bacteria colonization or the incidence of VAP infection form sterile water [23].

## CONCLUSION

In conclusion, studies advise that good oral care twice daily or more with tooth brushing, can significantly decrease the VAP incidence for patient who are on mechanical ventilation. This can be acquired by enhancing nurse education and application of oral care protocols with chlorhexidine solution. Other effective oral care methods include oral care with chlorhexidine and brushing, enhanced oral care under the supervision of a dentist, and a comprehensive oral hygiene treatment regimen.

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