



EFFECTIVENESS OF ORAL CARE IN IMPROVING ORAL HEALTH STATUS AMONG MECHANICALLY VENTILATED PATIENTS

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ABSTRACT

Mechanically ventilated patients are vulnerable to impaired oral health due to endotracheal intubation, reduced protective reflexes, decreased salivary secretion, and biofilm accumulation. Structured oral care is an essential component of critical care nursing. This study aimed to determine the effectiveness of oral care every 8 hours compared with every 24 hours on oral health status among mechanically ventilated patients. A quantitative quasi-experimental pretest-posttest control group design was conducted in the Cempaka and Mawar Intensive Care Units of Dr. Moewardi Hospital, Surakarta, from April to June 2026. Sixty mechanically ventilated patients were selected using purposive sampling and allocated to intervention (8-hour oral care, n=30) and control (24-hour oral care, n=30) groups for 5 days. Oral health status was assessed using the Beck Oral Assessment Scale (BOAS). Data were analysed using the Wilcoxon Signed-Rank and Mann-Whitney U tests. The 8-hour group showed a significant improvement in oral health status ($Z=-4.912$; $p<0.001$), with good oral status increasing from 23.3% to 100%. The 24-hour group also demonstrated significant improvement ($Z=-4.245$; $p<0.001$), with good oral status increasing from 26.7% to 50.0%. Posttest BOAS scores differed significantly between groups ($U=12.500$; $Z=-6.526$; $p<0.001$). Oral care every 8 hours was more effective than every 24 hours in improving oral health status among mechanically ventilated patients and may be considered an evidence-based nursing intervention in intensive care practice.

Keywords: beck oral assessment scale; intensive care; mechanically ventilated patients; nursing intervention; oral care; oral health

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INTRODUCTION

Mechanically ventilated patients require intensive nursing care because invasive airway support alters normal airway and oral physiology. Endotracheal intubation, reduced consciousness, impaired protective reflexes, limited self-care capacity, reduced salivary secretion, and dry airflow may contribute to xerostomia, mucosal irritation, plaque accumulation, and pathogenic microbial colonisation (Zhao et al., 2020). Consequently, oral health is an essential component of comprehensive critical care because the oral cavity can serve as a reservoir for microorganisms that may be aspirated into the lower respiratory tract, contributing to respiratory infections, including ventilator-associated pneumonia (VAP) (Munro & Grap, 2024).

Structured oral care involving mechanical plaque and debris removal, tongue and mucosal cleaning, secretion management, maintenance of mucosal moisture, and appropriate antiseptic use can improve oral health and reduce microbial burden. However, oral care practices vary in technique, frequency, materials, documentation, and adherence. Frequency is particularly important because repeated care may limit the re-accumulation of plaque, secretions, and biofilm (Choi et al., 2022). Evidence based protocols have used approximately 8 hour intervals, whereas routine practice in some intensive care settings remains once daily (Saklani et al., 2021).

A preliminary assessment in the Intensive Care Unit of Dr. Moewardi Hospital, Surakarta, identified approximately 334 mechanically ventilated patients during December 2025 - February

2026, with routine oral care using 0.12% chlorhexidine once daily. This practice raised the need to evaluate whether increasing oral care frequency could improve oral health status. The Beck Oral Assessment Scale (BOAS), which assesses the lips, gingiva and oral mucosa, tongue, teeth, and saliva, provides a standardised measure for objectively evaluating oral health changes following nursing interventions (Anggraeni et al., 2020; Nasirmoghadas et al., 2025).

Despite evidence supporting structured oral care, research directly comparing practical oral care frequencies using a controlled pretest-posttest design and the Beck Oral Assessment Scale (BOAS) remains limited in the local intensive care context. Therefore, to address this research gap, this study aimed to determine the effectiveness of oral care administered every 8 hours compared with oral care administered every 24 hours in improving oral health status among mechanically ventilated patients over a 5-day intervention period. Accordingly, the study compared the changes in oral health status between patients receiving oral care every 8 hours and those receiving oral care every 24 hours. The study hypothesised that patients receiving oral care every 8 hours would demonstrate better oral health status than those receiving oral care every 24 hours.

METHOD

Study design and setting

This study used a quantitative quasi-experimental with pretest-posttest control group design involving an intervention group and a control group. Baseline oral health status was assessed before the intervention and reassessed after the intervention period. The study was conducted in the Cempaka and Mawar Intensive Care Units of Dr. Moewardi Hospital, Surakarta, Indonesia, from April to Juni 2026.

Participants and sampling

The study population comprised mechanically ventilated patients admitted to two intensive care units during the study period. Participants were recruited using purposive sampling based on predetermined eligibility criteria. Eligible participants were adults aged ≥ 18 years who had received mechanical ventilation for at least 24 hours, had decreased consciousness, relatively stable hemodynamic conditions, and were expected to require mechanical ventilation for at least 5 days. Patients were excluded if they had active oral or mucosal bleeding, a tracheostomy, severe thrombocytopenia (platelet count $< 50,000/\mu\text{L}$), or were receiving palliative care or had a do-not-resuscitate (DNR) order. The sample size was calculated using G*Power version 3.1.9.7 (Kang, 2021). Based on an effect size of 0.80, a significance level (α) of 0.05, and a statistical power of 0.80, with an additional 10% allowance for potential attrition, resulting in a total sample of 60 participants. Participants were equally allocated into an 8-hour intervention group ($n = 30$) and a 24-hour control group ($n = 30$).

Intervention

Both groups received oral care according to the established hospital procedure, with frequency constituting the principal difference between groups. The intervention group received oral care every 8 hours (three times per 24 hours), whereas the control group received oral care every 24 hours (once daily), for 5 consecutive days. The procedures were performed by professional nurses competent in intensive care, with support from trained enumerators. Oral care was performed using clean gloves, a mask and apron when indicated, a soft-bristled toothbrush or rolled gauze, an oral antiseptic solution according to institutional policy, a tongue depressor when necessary, a kidney basin, a small towel, lip moisturizer, and suction equipment. Mechanically ventilated or unconscious patients were positioned laterally or in a semi-Fowler position with the head turned to either side. The oral cavity was carefully opened, and the teeth, gingiva, tongue, and oral mucosa were systematically cleansed using a soft-bristled toothbrush or gauze moistened with the prescribed oral solution. Oral secretions were suctioned periodically, as clinically indicated, to minimize the risk of aspiration, followed by drying of the oral cavity and application of lip

moisturizer. No additional treatment beyond the established routine oral care procedure was provided.

Outcome measurement

The primary outcome was oral health status measured using the Beck Oral Assessment Scale (BOAS). The intervention was administered over a five day period by nurses with expertise in intensive care, with support from enumerators who held professional nursing qualifications and had completed certified intensive care unit (ICU) training. The instrument assesses the lips, gingiva and oral mucosa, tongue, teeth, and saliva using a four-point scale for each domain, producing a total score of 5-20. Lower scores represent better oral health status. For descriptive interpretation, scores of 5-10 were categorised as good/no oral dysfunction, 11–15 as mild-to-moderate dysfunction, and 16-20 as severe dysfunction. The study documentation reported content validity assessed by four experts, with I-CVI values of 0.75-1.00, S-CVI/Ave of 0.95, and S-CVI/UA of 0.80. Empirical item correlations ranged from 0.768–0.966, and Cronbach's alpha was 0.827, supporting the use of the instrument in the study.

Data analysis

Baseline characteristics were compared between groups using the Chi-square test. Distributional assumptions for BOAS scores were examined using the Shapiro–Wilk test. Because all BOAS measurements showed $p < 0.05$, the data were considered non-normally distributed. Within-group pretest-posttest differences were therefore analysed using the Wilcoxon Signed-Rank Test. The Mann–Whitney U Test was used to compare posttest BOAS distributions between the intervention and control groups. Statistical significance was set at $p < 0.05$.

Ethical considerations

Ethical approval was obtained from Dr. Moewardi Hospital with ethical clearance number 365/II/HREC/2026. Participation was voluntary and informed consent was obtained from the patient's family when the patient could not provide consent. Confidentiality was maintained by using coded data and reporting findings in aggregate. The intervention represented routine oral care and was implemented with attention to patient safety, beneficence, and justice.

RESULT

Participant characteristics

Sixty mechanically ventilated patients participated in the study, with 30 participants in each group. The distribution of age, sex, and duration of mechanical ventilation was comparable between groups. Most participants were aged 56-60 years, were male, and had been mechanically ventilated for 5 days.

Table 1.
Baseline characteristics of mechanically ventilated patients (n=60)

Characteristic	Category	8 hour group f (%)	24 hour group f (%)	p-value	Interpretation
Age	50–55 years	9 (30.0)	12 (40.0)	0.417	Comparable
	56–60 years	21 (70.0)	18 (60.0)		
Sex	Male	19 (63.3)	17 (56.7)	0.598	Comparable
	Female	11 (36.7)	13 (43.3)		
Ventilator duration	5 days	16 (53.3)	19 (63.3)	0.432	Comparable
	6 days	14 (46.7)	11 (36.7)		

Oral health status in the 8 hour group

Before intervention, 23 participants (76.7%) in the 8 hour group had moderate oral dysfunction and 7 (23.3%) had good oral status; no participant had severe dysfunction. After 5 days of oral care every 8 hours, all 30 participants (100%) were classified as having good oral status. The Wilcoxon Signed-Rank Test showed a significant pretest-posttest difference ($Z = -4.912$; $p < 0.001$). All 30

participants were classified as negative ranks, indicating that every participant had a lower BOAS score after the intervention.

Table 2.
Oral health status before and after oral care every 8 hours (n=30)

BOAS category	Pretest f (%)	Posttest f (%)	Wilcoxon Z	p-value
Good/no dysfunction	7 (23.3)	30 (100.0)	-4.912	<0.001
Mild-moderate dysfunction	23 (76.7)	0 (0.0)		
Severe dysfunction	0 (0.0)	0 (0.0)		

Oral health status in the 24 hour group

In the 24-hour group, 22 participants (73.3%) had moderate oral dysfunction and 8 (26.7%) had good oral status at pretest. Following the 5-day period, the proportion with good oral status increased to 15 participants (50.0%), while 15 (50.0%) remained in the moderate dysfunction category. No participant was classified as having severe dysfunction at either measurement. The Wilcoxon Signed-Rank Test demonstrated a significant pretest-posttest difference ($Z=-4.245$; $p<0.001$). Twenty-one participants (70.0%) had lower BOAS scores, whereas 9 (30.0%) had unchanged scores.

Table 3.
Oral health status before and after oral care every 24 hours (n=30)

BOAS category	Pretest f (%)	Posttest f (%)	Wilcoxon Z	p-value
Good/no dysfunction	8 (26.7)	15 (50.0)	-4.245	<0.001
Mild-moderate dysfunction	22 (73.3)	15 (50.0)		
Severe dysfunction	0 (0.0)	0 (0.0)		

Between-group comparison

The posttest BOAS distributions differed significantly between the two groups. The Mann-Whitney U Test produced $U=12.500$, $Z=-6.526$, and $p<0.001$. The mean rank was 15.92 in the 8 hour group and 45.08 in the 24 hour group. Because lower BOAS scores represent better oral health, the lower mean rank in the 8 hour group indicates a more favourable oral health status after the intervention.

Table 4.
Comparison of posttest BOAS between groups (n=60)

Group	n	Mean rank	Mann-Whitney U	Z	p-value
Oral care every 8 hours	30	15.92		-6.526	<0.001
Oral care every 24 hours	30	45.08	12.500		

DISCUSSION

The findings demonstrated that both oral care frequencies significantly improved oral health status, with greater improvement in patients receiving oral care every 8 hours. Comparable baseline characteristics in age, sex, and duration of mechanical ventilation support the between-group comparison, although the quasi-experimental design cannot completely eliminate selection bias. The predominance of patients aged 56-60 years is clinically relevant because ageing may be associated with changes in salivary secretion, mucosal integrity, and susceptibility to oral microbial colonisation. In mechanically ventilated patients, these conditions are further influenced by dependence on nurses for oral hygiene and the presence of invasive airway devices, highlighting the importance of regular oral assessment and care (Zhao et al., 2020).

The 5-6-day duration of mechanical ventilation may facilitate oral microbial colonisation and biofilm formation due to reduced salivary flow, impaired self-care, and the presence of an endotracheal tube. The 8 hour group demonstrated the most pronounced improvement, with all 30

participants showing reduced BOAS scores. This finding is consistent with previous studies reporting improved oral health following structured oral care among critically ill and intubated patients (Anggraeni et al., 2020; Nasirmoghadas et al., 2025). The consistent improvement suggests that systematic and repeated oral care may help control plaque, secretions, and biofilm accumulation during mechanical ventilation.

The 24 hour group also showed significant improvement, with the proportion of participants achieving good oral status increasing from 26.7% to 50.0%; however, 50.0% remained in the moderate dysfunction category. This suggests that once-daily oral care can improve oral health but may provide less sustained control of plaque, secretions, and microbial biofilm than more frequent care (Choi et al., 2022; Kelly et al., 2023). The between-group analysis further demonstrated a highly significant difference in posttest BOAS scores in favour of the 8 hour group. More frequent care may provide repeated opportunities to remove oral debris and secretions, maintain mucosal moisture, and disrupt microbial biofilm, consistent with structured and need-based oral care protocols (Saklani et al., 2021).

From a critical care nursing perspective, oral care should be implemented and documented as a structured nursing intervention rather than merely a routine hygiene activity. Incorporating BOAS assessment into daily practice may facilitate early identification of oral deterioration, evaluation of treatment responses, and adjustment of care frequency or technique. Standardised implementation may also promote continuity, monitoring, and quality improvement across nursing shifts (Asadi & Jahanimoghadam, 2024). Nevertheless, the findings should be interpreted considering the study limitations, including the quasi-experimental design, single-centre setting, sample size of 60 patients, five-day observation period, and incomplete control of potential confounders such as disease severity, sedation, comorbidities, and nutritional status.

Overall, both oral care schedules improved oral health status, but oral care every 8 hours was more effective than once-daily care in improving BOAS outcomes among mechanically ventilated patients over a five-day period. Because this study assessed oral health rather than VAP incidence, the findings should not be interpreted as direct evidence of reduced VAP, mortality, or other clinical outcomes. Future multicentre randomised controlled studies with larger samples and broader clinical outcomes are needed to determine whether improved oral health associated with more frequent oral care can translate into reductions in VAP and other patient-centred outcomes.

CONCLUSION

Oral care administered every 8 hours demonstrated significantly greater effectiveness in improving oral health status among mechanically ventilated patients compared with care provided every 24 hours. After 5 days, all patients in the 8-hour group achieved good oral health status, with a significant pretest-posttest improvement ($Z = -4.912$; $p < 0.001$). Although the 24-hour group also showed significant improvement, moderate oral dysfunction persisted in half of the participants ($Z = -4.245$; $p < 0.001$). A significant difference was observed between the two groups ($U = 12.500$; $Z = -6.526$; $p < 0.001$), indicating greater improvement with the 8-hour schedule. These findings support the integration of structured 8-hour oral care into evidence-based intensive care nursing practice. In clinical settings, intensive care units may consider implementing an 8-hour oral care schedule accompanied by standardised BOAS assessment and documentation.

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