



Oral Hygiene Using the 3T Principles in a Mechanically Ventilated Patient: A Case Study

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Abstract

Introduction: Mechanically ventilated patients often have difficulty maintaining oral hygiene because of reduced consciousness, an endotracheal tube (ETT), and sedation. These conditions can increase plaque, biofilm, bacterial colonization, and the risk of Ventilator-Associated Pneumonia (VAP). The 3T principles (Right Technique, Right Equipment, and Right Use of Antiseptic) provide a structured approach to maintaining oral hygiene in these patients.

Objective: To describe the implementation of nursing care involving oral hygiene based on the 3T principles for a patient on mechanical ventilation and to evaluate changes in oral hygiene using the Beck Oral Assessment Scale (BOAS).

Method: A descriptive case study utilizing the nursing process approach was conducted on a single patient receiving mechanical ventilation in the Intensive Care Unit (ICU) of RS Islam Jakarta Pondok Kopi. The intervention was carried out over three days using the Modified Bass Technique, a suction toothbrush, and 0.2% chlorhexidine. Evaluation was performed using the Beck Oral Assessment Scale (BOAS).

Result: Following the three-day intervention, improvements were observed in the condition of the lips, mucosa, gingiva, tongue, teeth, and saliva. The BOAS score decreased from 20 at baseline to 6 after three days of intervention, indicating an objective improvement in oral condition. "The nursing outcome based on the Indonesian Nursing Outcome Standards (SLKI) was documented at level 5 for the oral hygiene outcome at the end of the care period."

Conclusion: Oral hygiene using the 3T principles was followed by improved oral hygiene status over three days, as shown by decreased BOAS scores. The Modified Bass Technique, suction toothbrush, 0.2% chlorhexidine according to clinical indications and hospital policy, and BOAS assessment provided a structured approach to oral care. However, this single case cannot establish a causal effect or effectiveness of the 3T approach. Further studies with larger samples and comparative designs are needed to evaluate its effectiveness and potential impact on outcomes such as VAP.

Keywords: Chlorhexidine; Mechanical Ventilation; Oral Hygiene; Suction Toothbrush; Toothbrushing; Ventilator-Associated Pneumonia.

Introduction

Patients undergoing mechanical ventilation in the Intensive Care Unit (ICU) are at high risk of compromised oral hygiene due to impaired consciousness, an inability to perform self-care, the presence of an endotracheal tube (ETT), and disrupted oral physiological functions. These conditions can lead to a persistently open mouth, xerostomia, secretion retention, the accumulation of plaque and biofilm, and alterations in the oral microbiota. In mechanically ventilated patients, an unmaintained oral cavity can become a breeding ground for microorganisms that potentially contribute to airway colonization and respiratory complications, including ventilator-associated pneumonia (VAP). Therefore, maintaining oral hygiene is a crucial aspect of care for critically ill patients on mechanical ventilation.

Oral hygiene care for mechanically ventilated patients requires a systematic approach; impaired consciousness and compromised swallowing or cough reflexes facilitate the accumulation of secretions and debris, while the presence of an ETT can limit access to the oral cavity. Oral care must prioritize mechanical cleaning such as tooth brushing as well as secretion management, the maintenance of tissue moisture, and the prevention of aspiration. Current guidelines and scientific evidence support routine tooth brushing for adult patients on mechanical ventilation, whereas the use of chlorhexidine for VAP prevention requires careful consideration, as evidence regarding its benefits remains inconsistent. Thus, the use of antiseptics should not replace mechanical cleaning as the primary component of oral hygiene maintenance.

In this case report, the “3T” principle is employed as a practical framework formulated by the authors to organize the implementation of oral hygiene for a mechanically ventilated patient. The 3T principle comprises “Teknik yang Tepat” (Right Technique), “Peralatan yang Tepat” (Right Equipment), and “Penggunaan Antiseptik yang Tepat” (Right Use of Antiseptics). Right Technique involves the use of the Modified Bass Technique to facilitate plaque removal, particularly around the gingival margins. Right Equipment entails the use of a suction toothbrush, which supports mechanical cleaning while aiding in the removal of saliva, secretions, and debris during the procedure. Meanwhile, the Right Use of Antiseptics emphasizes the rational selection and application of antiseptics based on clinical indications, the patient's condition, concentration, standard operating procedures (SOPs), and safety considerations. The 3T principle in this report is not intended as a validated intervention instrument or framework, but rather as a practical framework to organize and describe the oral hygiene components applied in this case.

This case involves Mrs. W, a 60-year-old woman diagnosed with non-hemorrhagic stroke (NHS), hypertension, and congestive heart failure (CHF). The patient experienced a decline in consciousness and required mechanical ventilation via an endotracheal tube (ETT). Initial assessment revealed dry and cracked lips, dry mucosa and gums, a thick white coating on the tongue, viscous and malodorous saliva, and plaque accumulation on the teeth. These conditions indicated compromised oral hygiene and total dependence for self-care needs. This case report aims to illustrate the implementation of oral hygiene organized according to the “3T” principles comprising the Modified Bass Technique as the “Right Technique”, the use of a toothbrush with a suction feature as the “Right Equipment”, and the use of antiseptics tailored to clinical conditions and standard operating procedures as the “Right Antiseptic Use” and to describe changes in oral hygiene status, measured using the BOAS, in ICU patients undergoing mechanical ventilation.

Objective

To describe the implementation of oral hygiene based on the 3T principles proper technique, proper equipment, and proper use of antiseptics and to evaluate changes in oral

hygiene status using the Beck Oral Assessment Scale (BOAS) in patients undergoing mechanical ventilation in the Intensive Care Unit.

Method

Design and setting

This report integrates employs a descriptive single-case study design to describe the delivery of nursing care specifically oral hygiene to a patient undergoing mechanical ventilation. Oral hygiene interventions were performed for three consecutive days, twice daily (morning and afternoon). The procedure was based on the ICU oral hygiene SOP, with additional procedural details documented according to the implementation performed in this case. The implementation was tailored to the patient's clinical condition. Pre-procedure steps included patient identification, hand hygiene, procedure explanation, equipment preparation, donning of personal protective equipment (PPE), assessment of the oral cavity and secretions, and checks of ETT security and the patient's clinical status. To organize the components of the oral hygiene procedure, the author utilized the "3T" practical framework: "Tepat Teknik" (Correct Technique), "Tepat Alat" (Correct Equipment), and "Tepat Penggunaan Antiseptik" (Correct Use of Antiseptics). This 3T framework was formulated by the author and serves as a descriptive-operational framework rather than a validated measurement instrument or clinical framework.

Population and Case Selection

The case subject was selected purposively based on pre-established clinical criteria relevant to the objectives of this case report. Inclusion criteria comprised adult patients undergoing invasive mechanical ventilation via an endotracheal tube (ETT) who exhibited impaired consciousness or total dependence for self-care and presented with poor oral hygiene. Patients capable of performing oral hygiene independently or those with clinical conditions contraindicating oral hygiene procedures were excluded.

A 60-year-old female patient diagnosed with non-hemorrhagic stroke, hypertension, and congestive heart failure was selected as the case subject. The patient exhibited impaired consciousness, was undergoing mechanical ventilation via ETT, and presented with poor oral hygiene, thereby requiring total assistance with oral care. This case selection was based on clinical suitability and relevance to the focus of the report, rather than statistical representativeness.

Instrument and measurement

The primary instrument used to assess oral hygiene status is the Beck Oral Assessment Scale (BOAS). BOAS evaluates five components of oral condition: lips, mucosa and gingiva, tongue, teeth, and saliva. Each component is scored based on the severity of the observed oral condition, with higher scores indicating more severe oral dysfunction. The total BOAS score is used to characterize overall oral hygiene status before and during the intervention.

Clinical observations were also conducted to assess relevant oral findings, including dryness of the lips and mucosa, tongue coating, plaque accumulation, salivary characteristics, and the presence of oral lesions. Assessments were performed prior to the intervention and following the administration of oral hygiene care throughout the three-day intervention period.

Nursing outcomes were also evaluated using the Indonesian Nursing Outcome Standards (SLKI), specifically the "Improved Oral Hygiene" category (L.11103). The nursing outcome for the diagnosis of Self-Care Deficit related to oral hygiene is based on the SLKI, specifically the Oral Hygiene outcome. The relevant outcome indicator for oral care is "maintaining oral hygiene." This indicator is assessed using a five-point scale: 1 = decreased, 2 = moderately decreased, 3 = moderate, 4 = moderately improved, and 5 = improved (SLKI

Working Group Team DPP PPNI, 2018). The final score is determined based on the patient's observed oral hygiene condition in relation to the established outcome indicators. The SLKI assessment serves as a measure of nursing outcomes, while the Beck Oral Assessment Scale (BOAS) acts as the primary structured assessment tool for monitoring changes in oral condition; the SLKI outcome is used to support the evaluation of nursing care.

Data collection and analysis

Data were collected through patient history taking with the family, direct observation, physical examination, medical record review, laboratory and diagnostic tests, and collaboration with ICU nurses. Clinical data included the level of consciousness, use of an endotracheal tube (ETT) and mechanical ventilation, presence of a nasogastric tube (NGT), hemodynamic and respiratory status, and oral cavity conditions such as dryness of the lips and mucosa, tongue coating, plaque accumulation, saliva characteristics, and oral lesions. Oral hygiene interventions were performed for three consecutive days, twice daily (morning and afternoon). Procedures adhered to the standard operating procedures (SOP) for oral hygiene care at the ICU of Jakarta Islamic Hospital Pondok Kopi and were tailored to the patient's clinical condition. Pre-procedure steps included patient identification, hand hygiene, procedure explanation, equipment preparation, donning of personal protective equipment (PPE), assessment of the oral cavity and secretions, and checks of ETT security and the patient's clinical status. The patient's head was elevated to approximately 30–45° provided there were no contraindications to help minimize the risk of aspiration. Prior to secretion suctioning, hyperoxygenation was performed in accordance with the unit's suctioning protocol. Secretions from the ETT and oral cavity were removed using a suction system at a pressure of 100–120 mmHg, following the secretion suctioning SOP.

Mechanical cleaning was performed using a suction toothbrush and the Modified Bass Technique. The bristles were positioned at an angle of approximately 45° to the gingival margin. Short vibratory movements were applied to each group of tooth surfaces (approximately 10–15 times), followed by a rolling or sweeping stroke from the gingiva toward the tooth crown. Cleaning was carried out systematically on the accessible buccal/labial, occlusal, lingual, and palatal tooth surfaces. When cleaning the mucosa and soft tissues, the foam tip of the suction toothbrush is used to gently wipe the gingiva, the right and left buccal mucosa, the hard and soft palates, the floor of the mouth, the tongue, and the lips within safely accessible areas. The wiping motion is performed in a single direction—from posterior to anterior—using light pressure to help remove debris and secretions without traumatizing the soft tissues. Throughout the cleaning process, the suction remains active to assist in removing saliva, secretions, and dislodged debris.

0.2% chlorhexidine is used as an adjunct antiseptic in accordance with ICU oral hygiene care protocols. Following the procedural protocol, approximately 3–5 mL of 0.2% chlorhexidine is applied gradually to the bristles and foam sponge of the suction toothbrush. For areas with adherent debris or secretions, sterile gauze moistened with 0.2% chlorhexidine is used for gentle wiping, including the retromolar area, buccal sulcus, mucosa, and the area surrounding the endotracheal tube (ETT) fixation. The use of chlorhexidine is an adjunct measure and does not replace mechanical cleaning.

Once mechanical cleaning is complete, the suction toothbrush is replaced with an oral suction catheter. The oral cavity is then irrigated incrementally using 0.9% NaCl (total volume approximately 5–10 mL); about 1–2 mL is administered to each side in stages, immediately followed by suctioning to remove fluid, secretions, and debris. Irrigation and suctioning are performed with due regard for the patient's clinical condition and the risk of aspiration. After cleaning, the oral cavity is assessed, and the lips are moisturized. The ETT fixation is inspected; if clinically indicated, the fixation point is shifted to the opposite side of the mouth to alleviate

pressure on the same area. Following the adjustment of the fixation, the ETT position and cuff pressure are checked according to unit protocols, maintaining the cuff pressure within the 20–30 cmH₂O range.

The total duration of the procedure is tailored to the patient's clinical condition and tolerance. The mechanical cleaning phase using the suction toothbrush lasts approximately 2–5 minutes, while the irrigation and suction phase takes about 10–15 seconds per cycle of fluid administration and suctioning, as required. Secretion suctioning is performed briefly and intermittently in accordance with standard operating procedures and the nature of the secretions rather than continuously without assessment. The suction parameters and the volume of fluid used adhere to the unit's standard procedures as outlined in the SOP, while the actual implementation is adjusted according to the patient's clinical condition.

BOAS assessments were conducted each morning during the three-day intervention period, both before and after the morning oral hygiene procedure. On the first day, a BOAS score of 20 was recorded prior to the morning procedure and served as the baseline value. Following the morning oral hygiene procedure, a reassessment yielded a BOAS score of 14. On the second day, the pre-procedure assessment showed a BOAS score of 14, while the post-procedure reassessment resulted in a score of 10. On the third day, the BOAS score was 10 before the morning procedure and 6 after it. Thus, the pre-procedure score on a given day corresponded to the post-procedure score from the previous day. Oral hygiene interventions were performed twice daily morning and evening but BOAS measurements were taken only before and after the morning procedure to ensure consistency and avoid repetitive measurements after every intervention session. The same assessor performed the evaluations at each measurement time point. The BOAS tool was used to assess five components: lips, mucosa and gingiva, tongue, teeth, and saliva. A decrease in the total BOAS score indicated an improvement in oral condition based on the instrument's criteria.

Data analysis was descriptive, comparing BOAS scores before and after the morning procedure on each day. Changes in BOAS scores were observed to illustrate the evolution of the oral cavity condition throughout the intervention period. As this report is a single case study without a comparison group, no inferential statistical analysis was performed. The changes in BOAS scores were not used to establish a causal relationship or to determine the general effectiveness of the intervention.

Ethical Considerations

The nursing care was implemented after informed consent was obtained from the patient's family because the patient had a decreased level of consciousness and was unable to provide informed consent independently. All procedures were performed in accordance with the hospital's standard operating procedures, patient safety principles, and applicable nursing standards. Patient privacy, confidentiality, and anonymity were maintained throughout the data collection, documentation, analysis, and preparation of the case report.

Result

Patient Characteristics

This case involves a 60-year-old female patient admitted to the Intensive Care Unit (ICU) with a diagnosis of non-hemorrhagic stroke, complicated by hypertension and congestive heart failure. The patient presented with a depressed level of consciousness scoring E1M1Vt on the Glasgow Coma Scale (GCS) and was receiving mechanical ventilation via an endotracheal tube (ETT). She also had a nasogastric tube in place and was entirely dependent on others for activities of daily living.

An initial clinical assessment revealed compromised oral hygiene. The patient's lips appeared dry and cracked; the oral mucosa and gingiva were also dry and exhibited minor

lesions. A thick white coating covered the tongue, saliva appeared viscous and malodorous, and significant plaque accumulation was observed. Additionally, minor trauma to the lips resulting from ETT fixation was noted.

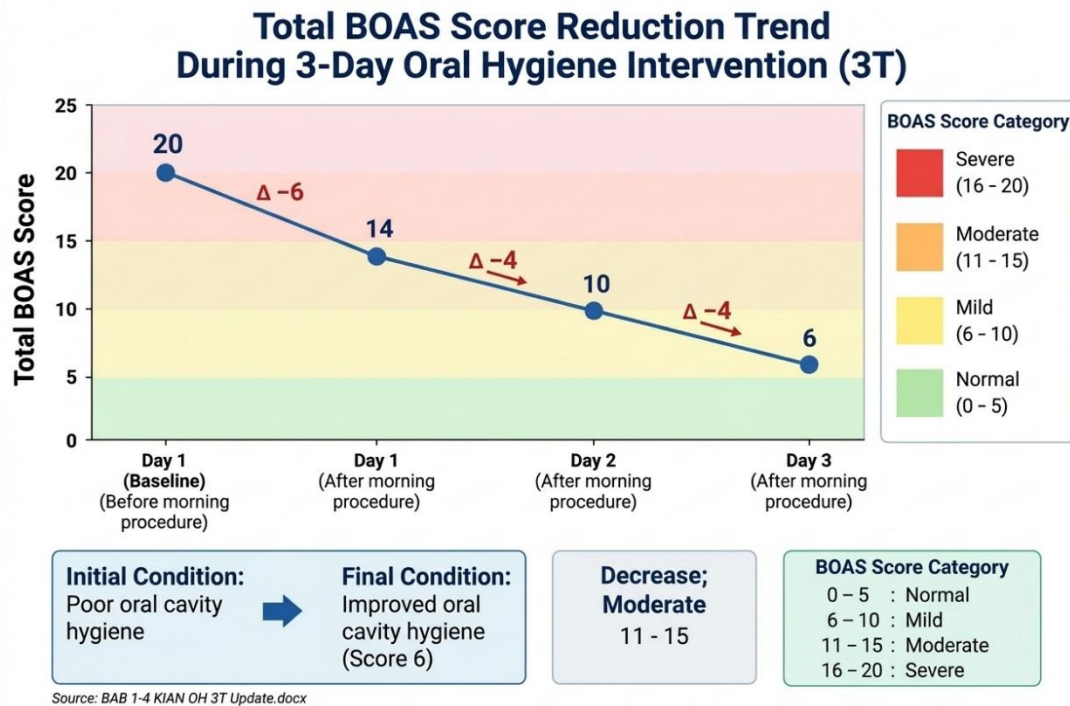


Figure 1. Trends in Total BOAS Scores and Changes in Oral Cavity Condition During the 3-Day Intervention Period.

Tabel 1. Changes in BOAS Scores and Oral Conditions During the Three-Day Intervention

Evaluation Time	Lips	Mucosa/ Gingiva	Tongue	Teeth	Saliva	Total BOAS
Pre-intervention (Day 1, before morning intervention)	4	4	4	4	4	20
Day 1, after morning intervention	3	3	3	3	2	14
Day 2, after morning intervention	2	2	2	2	2	10
Day 3, after morning intervention	1	1	1	2	1	6

The BOAS assessment demonstrated a progressive improvement in oral hygiene status during the three-day intervention. The initial BOAS score was 20, indicating severe oral dysfunction. Following the implementation of oral hygiene using the 3T principles, the score decreased to 14 on day 1, 10 on day 2, and 6 on day 3. Thus, the total BOAS score decreased by 14 points from baseline to the end of the intervention period.

Discussion

This case report demonstrates progressive improvement in oral hygiene status following the implementation of an oral hygiene regimen based on the "3T" principles proper technique, proper equipment, and proper use of antiseptics in a mechanically ventilated patient. The BOAS score decreased steadily from 20 pre-intervention to 14 on day one, 10 on day two, and 6 on day three. These changes were accompanied by observable improvements in various aspects of the patient's oral condition including the lips, oral mucosa and gingiva, tongue, teeth, and saliva throughout the three-day intervention period.

The patient's initial oral condition reflected clinical issues commonly encountered in mechanically ventilated patients unable to perform self-care. The patient had a reduced level of consciousness and was fitted with an endotracheal tube (ETT) and a nasogastric tube (NGT), rendering them entirely dependent on nursing assistance. These factors can impede routine oral care and contribute to the accumulation of plaque, tongue coating, secretions, and oral debris. Furthermore, the presence of an ETT can cause oral discomfort and mucosal trauma, while impaired oral function and altered salivary conditions can further compromise oral hygiene. The progressive decline in BOAS scores indicates that consistent oral hygiene practices are associated with improvements in the patient's oral condition.

This intervention emphasizes mechanical plaque removal through tooth brushing using the Modified Bass Technique. Mechanical cleaning is essential because plaque and debris cannot be adequately removed solely through the use of antiseptic agents. Evidence from various studies on mechanically ventilated patients indicates that tooth brushing is a crucial component of oral care, although its independent impact on ventilator-associated pneumonia (VAP) remains inconclusive. A systematic review and meta-analysis comparing the use of chlorhexidine combined with tooth brushing versus chlorhexidine alone found a lower estimated risk of VAP with the combination approach, although the observed difference was not statistically significant. The use of a suction toothbrush is another key component of this intervention. For mechanically ventilated patients, oral care must account for the risk of aspiration, as patients may be unable to control saliva and oral secretions. A suction toothbrush enables mechanical cleaning while simultaneously aspirating secretions, saliva, and dislodged debris. This approach facilitates the removal of oral contaminants while prioritizing patient safety. In this case, the use of suction during oral care is particularly relevant, given the patient's significantly impaired level of consciousness and dependence on mechanical ventilation.

The use of 0.2% chlorhexidine should be viewed as an adjunct to mechanical oral cleaning rather than the primary driver of improvements in BOAS scores. Chlorhexidine has been extensively studied as part of oral care for mechanically ventilated patients, particularly regarding the prevention of VAP. However, evidence regarding the additional benefits of combining chlorhexidine with tooth brushing is not entirely consistent. A systematic review and meta-analysis reported that the combination of chlorhexidine and tooth brushing was associated with a 24% reduction in the relative risk of VAP compared to the use of chlorhexidine alone; however, the confidence interval included the null value, and the difference was not statistically significant. Therefore, the improvement in this case should be understood as the result of the overall oral hygiene process particularly repeated mechanical cleaning, the removal of secretions and debris, and the maintenance of oral moisture—rather than being solely attributable to the use of chlorhexidine.

The use of chlorhexidine 0.2% should be interpreted as an adjunct to mechanical oral cleaning rather than the primary explanation for the improvement in BOAS. Chlorhexidine has been widely investigated as part of oral care for mechanically ventilated patients, particularly in relation to VAP prevention. However, evidence regarding the additional benefit of combining chlorhexidine with toothbrushing is not completely consistent. A systematic review and meta-analysis reported that chlorhexidine combined with toothbrushing was associated with a 24% lower relative risk of VAP compared with chlorhexidine alone, but the confidence interval crossed the null value and the difference was not statistically significant. Therefore, the improvement in this case should be understood as the result of the overall oral hygiene process, particularly repeated mechanical cleaning, removal of secretions and debris, and maintenance of oral moisture, rather than being attributed specifically to chlorhexidine.

The 3T approach provides a practical framework for managing oral hygiene care in mechanically ventilated patients. The first component, "right technique," emphasizes appropriate mechanical cleaning of tooth surfaces and gum margins. The second component, "right equipment," highlights the use of toothbrushes with integrated suction capabilities that combine brushing with secretion management. The third component, "right use of antiseptics," emphasizes the application of suitable and complementary antiseptic agents, taking into account clinical conditions and institutional protocols. Integrating these three components is clinically relevant because effective oral care requires not only the right agents but also appropriate mechanical cleaning, equipment, timing, and patient safety measures.

The observed improvement in BOAS scores also has implications for nursing practice. Oral hygiene for mechanically ventilated patients should be viewed as a vital component of comprehensive nursing care rather than merely a routine comfort measure. Periodic assessment enables nurses to detect oral issues early and evaluate responses to interventions. Utilizing structured oral assessment tools, such as BOAS, can facilitate more systematic documentation and communication among healthcare professionals. Furthermore, incorporating mechanical cleaning, suctioning, antiseptic use, and lip moisturization into standard oral care procedures can enhance consistency in clinical practice.

Although a decrease in BOAS scores was observed over the course of the oral hygiene regimen, this temporal association cannot be interpreted as evidence that the application of the 3T principles directly caused the improvement in oral condition. Changes in the oral status of critically ill patients can be influenced by various concurrent factors, including changes in hydration and hemodynamic status, fluid therapy, medication use, nutritional status, alterations in the volume and characteristics of secretions, mechanical ventilation, routine suctioning, and other ICU care interventions. Furthermore, since multiple oral hygiene components were implemented simultaneously, the specific contribution of each component to the change in BOAS scores cannot be isolated. Therefore, the reduction in BOAS scores from 20 to 14, 10, and 6 in this case is best understood as a clinical change observed during the structured oral hygiene period, rather than an estimate of the causal effect of the 3T principles. Establishing a causal relationship would require a comparative study design that controls for confounding factors and isolates or tests the contribution of each individual intervention component.

Despite the observed improvements, this case report has several limitations. First, the study involved only one patient; therefore, the findings cannot be generalized to all patients undergoing mechanical ventilation. Second, the intervention combined multiple components—including mechanical tooth brushing, suctioning, chlorhexidine use, and lip moisturization—making it impossible to specifically determine the contribution of each component to the changes in BOAS scores. Third, the intervention period was limited to three days, precluding an assessment of long-term oral health outcomes or the development of VAP. Finally, the absence of a comparison group means that changes in oral condition cannot be definitively attributed solely to the intervention.

Future research should involve larger samples and comparative or controlled designs to evaluate the effectiveness of structured oral hygiene based on the 3T principles. Further studies could also examine the contribution of individual components such as mechanical tooth brushing, suction-assisted oral care, and the use of antiseptics to changes in oral health status and relevant clinical outcomes, such as VAP incidence, duration of mechanical ventilation, and length of ICU stay.

Restate the Key Findings

This case report describes changes in oral condition observed during the implementation of structured oral hygiene care based on the "3T" practical framework right

technique, right equipment, and appropriate use of antiseptics in a mechanically ventilated patient. The patient's BOAS score decreased from 20 at baseline to 14 on the first day, 10 on the second day, and 6 on the third day. The reduction in BOAS scores was accompanied by observable changes in the oral condition, including increased moisture of the lips and oral mucosa, reduced tongue coating and oral debris, and improved findings in the lips, mucosa and gingiva, tongue, teeth, and saliva. These findings describe progressive changes in the observed oral condition during the three-day period of structured oral hygiene care.

Interpret the Results

An initial BOAS score of 20 indicated severe oral dysfunction, consistent with the patient's clinical status. The patient exhibited a decreased level of consciousness, was entirely dependent on nursing assistance for self-care, and was receiving mechanical ventilation via an endotracheal tube (ETT). These factors limited the patient's ability to maintain oral hygiene independently and likely contributed to the accumulation of plaque, oral debris, tongue coating, and secretions. Furthermore, the mouth remaining constantly open due to the ETT, combined with impaired oral function, led to dryness of the lips and oral mucosa. The presence of thick, malodorous saliva during the initial assessment further underscored the poor oral condition.

The gradual decline in the BOAS score indicated an improvement in oral status following repeated oral hygiene interventions. The drop from 20 to 14 on the first day demonstrated an initial response to the intervention, while the subsequent decreases to 10 and 6 on days 2 and 3 showed continued improvement throughout the intervention period. Clinically, this progression was accompanied by increased oral moisture and a reduction in coating and debris. These changes are significant because oral dryness and the accumulation of plaque and debris can create conditions conducive to microbial colonization and the deterioration of oral health in critically ill patients.

These findings can also be understood from the perspective of mechanical plaque control. In this case, the Modified Bass Technique was employed as the primary method of mechanical cleaning. Proper toothbrushing facilitates the physical removal of plaque and debris from tooth surfaces and the area near the gumline. Mechanical cleaning is crucial for patients unable to perform independent oral care, as the use of antiseptic agents alone cannot substitute for the physical removal of accumulated plaque and debris.

The use of a suction toothbrush offers additional practical advantages. During oral cleaning, the device enables the simultaneous removal of saliva, secretions, and dislodged debris via a suction mechanism. This is particularly relevant for such patients, given their reduced level of consciousness and dependence on mechanical ventilation. The combination of mechanical cleaning and suctioning supports oral hygiene while helping to minimize the accumulation of oral secretions during the procedure.

However, the use of 0.2% chlorhexidine should be viewed as a complementary component of the oral hygiene intervention rather than the sole factor responsible for the observed improvement. The intervention comprised several integrated components, including mechanical toothbrushing, suction-assisted cleaning, antiseptic application, and lip moisturization. Therefore, the improvement in BOAS scores is best interpreted as a comprehensive response to the structured oral hygiene process, rather than an effect specifically attributable to chlorhexidine. This distinction is important because the case report was not designed to determine the independent contribution of each intervention component.

Compare with Previous Studies

The findings of this case generally align with existing literature emphasizing the importance of structured oral care for patients undergoing mechanical ventilation. Oral care

is crucial for critically ill patients because mechanical ventilation, altered consciousness, impaired self-care ability, and the presence of an endotracheal tube (ETT) can disrupt normal oral hygiene and promote the accumulation of plaque and oral secretions. Consequently, routine mechanical oral cleaning is typically included in the nursing care of patients receiving mechanical ventilation.

Previous studies have also examined the combination of tooth brushing and chlorhexidine use in mechanically ventilated patients. A systematic review and meta-analysis by Silva et al. reported that combining tooth brushing with chlorhexidine was associated with a lower estimated risk of ventilator-associated pneumonia (VAP) compared to using chlorhexidine alone, although the difference was not statistically significant. These findings reinforce the view that mechanical cleaning remains a vital component of oral care, whereas antiseptics should be regarded as an adjunct.

In this case, 0.2% chlorhexidine was used as an adjunct antiseptic in accordance with the oral hygiene care SOP at the ICU of Jakarta Islamic Hospital Pondok Kopi. Its use was not intended to replace mechanical cleaning but rather to serve as a supplementary component of the oral hygiene protocol. The selection and application of chlorhexidine took into account the patient's clinical condition, the concentration specified in the institutional SOP, and safety principles during the procedure. Thus, the use of chlorhexidine in this case must be understood within the context of clinical practice and institutional policy, rather than as evidence that this specific concentration caused the improvement in BOAS scores.

This case aligns with that perspective, as the care provided prioritized mechanical plaque removal using a suction toothbrush, alongside secretion management, maintenance of oral moisture, and the use of an antiseptic as an adjunct. The changes in BOAS scores over three days provide a descriptive overview of the evolution of oral hygiene status during the structured oral hygiene regimen. However, these results cannot be used to draw conclusions regarding the effectiveness of the 3T principle in preventing VAP, as VAP was not a specifically evaluated outcome in this case report.

Differences in outcomes must also be considered when comparing this case with previous studies. This case report focuses on changes in oral hygiene status assessed using the BOAS, whereas some earlier studies evaluated clinical outcomes such as VAP incidence, duration of mechanical ventilation, or length of ICU stay. Therefore, the contribution of this case report lies primarily in describing changes in oral hygiene status during the implementation of structured oral hygiene care, rather than in demonstrating effectiveness in preventing VAP.

Although a decrease in BOAS scores was observed over time during the oral hygiene implementation period, this temporal association cannot be interpreted as evidence that the application of the 3T principles directly caused the improvement in oral cavity condition. Changes in the oral status of critically ill patients can be influenced by various concurrent factors, including changes in hydration and hemodynamic status, fluid therapy, medication use, nutritional status, changes in the volume and characteristics of secretions, mechanical ventilation, routine suctioning, and other ICU care interventions. Furthermore, several oral hygiene components were applied simultaneously, making it impossible to isolate the contribution of each component to the changes in BOAS scores. Consequently, the shift in BOAS scores from 20 to 14, 10, and 6 in this case is best understood as a clinical change observed during the structured oral hygiene care period, rather than an estimate of the causal effect of the 3T principles. Assessing a cause-and-effect relationship would require a comparative study design that controls for confounding factors and isolates or tests the contribution of each intervention component.

The novelty and primary contribution of this case report lie not in the development of a new oral hygiene technique, but rather in the presentation of the "3T" practical framework formulated within this report to organize the various components of oral care delivered in an integrated manner to mechanically ventilated patients. In this case report, oral hygiene was performed in accordance with ICU Standard Operating Procedures (SOPs), while the 3T framework was utilized to structure the implementation into three specific aspects: "Tepat Teknik" (Right Technique), "Tepat Alat" (Right Equipment), and "Tepat Penggunaan Antiseptik" (Right Use of Antiseptics).

The 3T framework integrates mechanical cleaning techniques, the selection of equipment to facilitate secretion management, and the rational use of antiseptics tailored to the patient's condition and institutional policies. This approach offers a simple, structured method for documenting and communicating key components of oral hygiene within ICU nursing practice. The patients' oral condition was subsequently assessed using the Beck Oral Assessment Scale (BOAS) to track changes in oral status throughout the intervention period.

As the 3T framework presented here was developed specifically for this report rather than being a pre-validated instrument or intervention the findings do not constitute a validation of the framework itself nor provide definitive evidence of its efficacy. Its practical contribution lies in illustrating how oral hygiene components, implemented according to ICU SOPs, can be systematically organized via the 3T framework and evaluated using the BOAS instrument in mechanically ventilated patients unable to perform self-care.

Discussion of Limitations

This case report has several limitations that should be considered when interpreting the findings. First, the study involved only a single patient. Therefore, the findings cannot be generalized to all patients undergoing mechanical ventilation, as oral conditions and clinical responses may vary depending on diagnosis, level of consciousness, duration of mechanical ventilation, comorbidities, nutritional status, medication use, and other clinical factors.

Second, the intervention comprised multiple components, including the modified Bass technique, a suction toothbrush, 0.2% chlorhexidine, and a lip moisturizer. Because all components were implemented concurrently, the specific contribution of each component to the observed reduction in BOAS scores could not be determined. In particular, the improvement cannot be attributed exclusively to the use of chlorhexidine.

Third, the intervention was conducted over a period of only three days. Although a gradual decrease in BOAS scores was observed, the short observation period did not provide information regarding the sustainability of the improvement or the patient's long-term oral health status. Fourth, this case report did not include a comparison group; therefore, the changes in BOAS scores cannot be definitively attributed solely to the intervention. Other factors related to the patient's clinical recovery and concurrent ICU care may have also contributed to the observed changes. Variations in several clinical factors and concurrent ICU care were not quantitatively documented at every measurement point; thus, the potential influence of these factors on BOAS score changes could not be evaluated in isolation. Finally, this case report focused on changes in oral hygiene status and did not evaluate clinical outcomes such as the incidence of ventilator-associated pneumonia (VAP), duration of mechanical ventilation, length of ICU stay, or mortality. Consequently, these findings should be interpreted primarily as evidence of improved oral hygiene status rather than as evidence of reduced VAP risk. An improvement in BOAS scores was observed during the period of comprehensive oral hygiene intervention.

Despite these limitations, this case provides a practical illustration of structured oral hygiene implementation using the 3T principle for patients undergoing mechanical ventilation.

The gradual improvement in BOAS scores highlights the potential benefits of consistent oral assessment and comprehensive oral care in ICU nursing practice. Further studies involving larger samples, longer monitoring periods, and comparative designs are needed to evaluate the effectiveness of the 3T approach and determine its relationship with key clinical outcomes in patients undergoing mechanical ventilation.

Highlight the Implications

These findings have several implications for nursing practice in the ICU. First, oral hygiene must be viewed as an integral component of nursing care for mechanically ventilated patients, rather than merely a measure to provide comfort. Patients with altered consciousness who are totally dependent on caregivers require systematic oral assessment and assistance with oral hygiene, as they are unable to maintain oral cleanliness independently.

Second, the "3T" principle offers a practical framework for standardizing oral hygiene procedures. The first principle, "right technique", emphasizes appropriate mechanical cleaning of tooth surfaces and gum margins. The second principle, "right equipment", highlights the use of tools such as suction toothbrushes, which facilitate both mechanical cleaning and the removal of oral secretions. The third principle, "right use of antiseptics", emphasizes that antiseptic agents should be used appropriately to complement mechanical cleaning, in accordance with the patient's clinical condition and institutional standard operating procedures (SOPs).

Third, the use of structured assessment tools like BOAS can support the systematic monitoring of oral conditions. In this regard, repeated BOAS assessments allow for the objective documentation of changes in oral hygiene status throughout the three-day intervention period. Periodic assessments can also assist nurses in identifying any deterioration in oral condition and determining whether modifications to oral care are required.

From a clinical perspective, these findings underscore the importance of consistent oral hygiene that addresses mechanical cleaning, secretion management, oral moisture, and patient safety. However, the 3T approach should be viewed as a structured nursing care framework rather than a standalone intervention definitively proven to prevent VAP. Further research is needed to determine whether implementing this approach yields benefits beyond improved oral hygiene status.

Suggest Future Research

Future research could evaluate the implementation of the 3T oral hygiene approach in mechanically ventilated patients using larger sample sizes and more robust study designs, such as quasi-experimental or randomized controlled trials. Such studies could compare various oral hygiene techniques, types of equipment, and antiseptic use to identify the contribution of each component to changes in oral health status. Additionally, the use of suction toothbrushes could be further investigated regarding outcomes such as dental plaque accumulation, oral health conditions, and microbial colonization, as well as clinical outcomes associated with mechanical ventilation, including the incidence of ventilator-associated pneumonia (VAP). Future research should also consider longer follow-up periods, standardized assessment instruments, and comparison groups with or without antiseptic use to clarify the contribution of each intervention component. Evidence from such studies is expected to support the development of more standardized, evidence-based oral hygiene protocols for mechanically ventilated patients in the ICU.

Conclusion

In this case report, the implementation of an organized oral hygiene regimen based on the "3T" principles proper technique, proper equipment, and proper use of antiseptics was followed by an improvement in the oral cavity status of a mechanically ventilated patient. The BOAS score decreased from 20 at baseline to 14 after the first day of intervention, 10 after the second day, and 6 after the third day. These changes indicate an improvement in oral condition observed during the structured oral hygiene care period. However, as this report involves only a single patient, lacks a comparison group, employs multiple intervention components simultaneously, and takes place within the complex context of ICU care, these changes cannot be interpreted as evidence of a causal relationship or the effectiveness of the 3T approach. In this report, the 3T approach is presented as a practical framework formulated to organize oral hygiene implementation, rather than as a validated intervention. Research utilizing comparative designs, larger sample sizes, and control for confounding factors is required to evaluate the contribution of each component and the utility of the framework in clinical practice.

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Author Contribution

AR contributed to the conceptualization of the study, development of the case study design, data collection, implementation of the nursing intervention, and preparation of the initial manuscript. ARS contributed to the study conceptualization, supervision of the nursing intervention, interpretation of the findings, and critical revision of the manuscript. DAS contributed to data collection, clinical documentation, literature review, and manuscript preparation. ES contributed to methodological supervision, interpretation of the results, critical review, and final revision of the manuscript. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of Interest

The authors declare that there are no financial, personal, or professional conflicts of interest that could have influenced the conduct, interpretation, or reporting of this case study.

Ethical Clearance

This case study was conducted in accordance with applicable ethical principles for research involving human participants. Ethical approval was obtained from the Ethics Committee of Rumah Sakit Islam Jakarta Pondok Kopi (RSIJ Pondok Kopi), Jakarta, Indonesia, under approval number 535/XIV-EKS/RSIJPK/07/2026. Written informed consent for the use of clinical information for scientific publication was obtained in accordance with institutional requirements. Patient confidentiality and anonymity were maintained throughout the preparation and publication of this case study.

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