

Review Article

Oral care in patients on mechanical ventilation in intensive care unit: literature review

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ABSTRACT

Intensive care patients need oral assessment and oral care to avoid complications caused by orofaryngeal bacteria. In this literature review, it is aimed to determine the practice over oral hygiene in mechanical ventilator patients in intensive care unit. For the purpose of collecting data, Medline/pub MED and EBSCO HOST databases were searched with the keywords ‘oral hygiene, oral hygiene practice, mouth care, mouth hygiene, intubated, mechanical ventilation, intensive care and critical care’ between the years of 2000- 2012. Inclusion criteria for the studies were being performed in adult intensive care unit patients on mechanical ventilation, published in peer-reviewed journals in English between the years of 2000-2012, included oral care practice and presence of a nurse among researchers. A total of 304 articles were identified. Six descriptive evaluation studies, three randomised controlled trials, four literature reviews, three meta-Analysis randomized clinical trials, one qualitative study and one semi-experimental study total 18 papers met all of the inclusion criteria. Oral care is emphasized as an infection control practice for the prevention of Ventilator-Associated Pneumonia (VAP). In conclusion, we mention that oral care is an important nursing practice to prevent VAP development in intensive care unit patients; however, there is no standard oral evaluation tool and no clarity on oral care practice frequency, appropriate solution and appropriate material. It can be recommended that the study projects on oral care in intensive care patients to have high proof level and be experimental, and longitudinal.

Keywords: Intensive care, Mouth care, Ventilator associated pneumonia

INTRODUCTION

Oral hygiene is important as it affects both wellness and clinical results of intensive care patients.¹⁻⁴ Oropharyngeal invasion by microorganisms is critical in development of nosocomial pneumonia (ventilator associated pneumonia/VAP) in intensive care units.⁵ Because, oropharyngeal invasion of aspirated microorganisms means disease development.⁶⁻⁸ VAP is a common type of nosocomial infections prolonging the hospital stay duration, increasing costs and mortality in intensive care patients on ventilator.⁹⁻¹⁰ In United States, VAP is ranked second among nosocomial infections.¹¹

Oral care, as a part of daily routine nurse care, is a method that decreases VAP incidence.^{5,12}

The most important mechanism in VAP development is aspiration of oral secretions colonized by microorganisms to lower respiratory tract. Reducing the number of oral microorganisms may have an important effect to prevent VAP. Prevention is the most crucial method to decrease VAP.^{9,13-16}

Bacterial growth over tooth plaque causes the organismal adherence over tooth surface. Gram (-) bacteria proliferated within 2 days causes changes in oral flora

and plaque development in teeth and this biofilm are spread through subgingival area and inflammation occurs throughout. Systemic antibiotics and local antimicrobial drugs are suggested to prevent micro-colonization. Direct extraction of plaque damages gingiva and teeth.¹⁷ It was reported that reducing the number of oral bacteria with oral care decreases translocation, respiratory colonization, and consequently, VAP risk.⁴⁻¹⁸

Although there are guidelines for oral hygiene in chemotherapy patients, there are no guidelines for oral hygiene practice in intensive care unit patients. It is planned that this study will initiate the efforts for a guideline production.

Purpose

In this literature review, it is aimed to determine the practice over oral hygiene in mechanical ventilator patients in intensive care unit.

METHODS

For the purpose of collecting data, Medline/Pub MED and EBSCO HOST databases were searched with the keywords “oral hygiene, oral hygiene practice, mouth care, mouth hygiene, intubated, mechanical ventilation, intensive care and critical care” between the years of 2000-2012.

Inclusion criteria for the studies were being performed in adult intensive care unit patients on mechanical ventilation, published in peer-reviewed journals in English between the years of 2000-2012, included oral care practice and presence of a nurse among researchers.

The answers to following questions were searched:

- What are the instruments used for oral examination in intensive care units?
- What are the oral care solutions used in intensive care unit patients?
- What are the oral care materials used in intensive care patients?
- How frequent are the intensive care unit patients performed oral care?

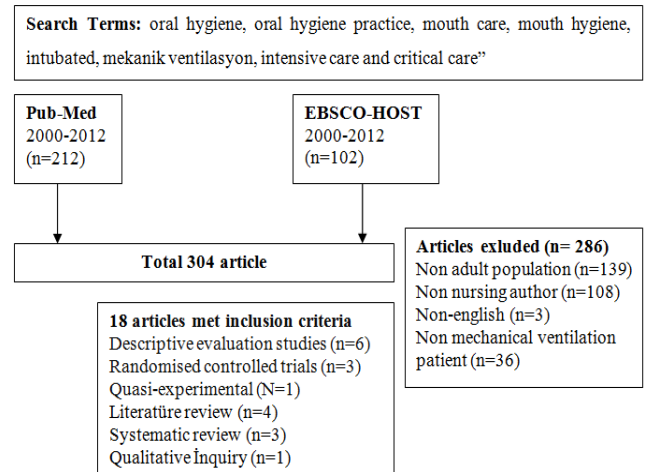


Figure 1: Search strategy.

RESULTS

Study reviews showed that nurses noted in all studies, that they performed oral evaluation; however they did not mention any standard form for oral examination.

Table 1: Descriptive evaluation studies (n=6).

	Oral assessment tools	Oral care solution	Oral care materials	Oral care practice frequency
Grap et al. (2003)	Unspecified	Chlorhexidine, isotonic sodium chloride, hydrogen peroxide mixture	Foam swab	5 times a day
DeKeyser Ganz et al. (2009)	71% nurse performed an oral assessment before beginning oral care but, none could describe what assessment tool was used.	75% chlorhexidine	84% gauze pad 34% toothbrush	Unspecified
Rello et al. (2007)	Unspecified	61% chlorhexidine	22% foam swabs 42% moisture agents, 41% manual toothbrushes	20% once daily, 31% twice or 37% three times
Feider et al. (2010)	93% nurses they did not mention any standard form for oral examination. Nurses evaluated for oral; 94% bleeding, 87% oral mucosal tears, ulcerations, abrasions or cracks, 85% dry mouth, 84% tissue color, 81% redness, 69% swelling	61% chlorhexidine glucanate 24% hydrogen peroxide, 21% normal salina, 19% lemon glycerin swab	97% foam swabs	50 % every 2 hours, 42 % every 4 hours.

Only in one of the studies, nurses noted that they evaluated for oral bleeding, oral mucosal tears, ulcerations, abrasions or cracks, dry mouth, tissue color, redness, swelling in different proportions. Moreover, in descriptive studies, oral care solutions used by nurses varied, however, most of them mentioned that they used chlorhexidine solution. Preferred oral care materials were foam swabs, cotton with forceps and tooth brush. It is

also seen in the same table, that oral care practice frequency varied among all studies.

In randomized controlled studies, meeting the study criteria, performed between the years of 2000 and 2012; it was emphasized that the use of chlorhexidine solution in variable concentrations was important in prevention of VAP development.

Table 2: Randomised controlled trials (n=3).

	Oral assessment tools	Intervention	Results
Houston et al. (2002)	Unspecified	Experimental group; peridex (0.12% chlorhexidine gluconate), 2 times daily, Control group; listerine (phenolic mixture), 2 times daily	The overall rate of nosocomial pneumonia was reduced by 52% in the peridex-treated patients. Among patients intubated for more than 24 hours who had cultures that showed microbial growth (all pneumonias occurred in this group), the pneumonia rate was reduced by 58% in patients treated with peridex. In patients at highest risk for pneumonia, the rate was 71% lower in the peridex group than in the listerine group.
Munro et al. (2009)	Unspecified	I. group; 0.12% solution chlorhexidine oral swab twice daily II. group; toothbrushing thrice daily III. group; both toothbrushing and chlorhexidine IV. group; usual care	Among patients without pneumonia at baseline, pneumonia developed in 24% by day 3 in those treated with chlorhexidine. When data on all patients were analyzed together, mixed models analysis indicated no effect of either chlorhexidine ($P = 0.29$) or toothbrushing ($P = 0.95$). However, chlorhexidine significantly reduced the incidence of pneumonia on day 3 (CPIS ≥ 6) among patients who had CPIS < 6 at baseline ($P = 0.006$). Toothbrushing had no effect on CPIS and did not enhance the effect of chlorhexidine.
Yao et al. (2011)	Unspecified	Experimental group; received a twice-daily oral care protocol of toothbrushing with purified water, Control group; usual hospital care, that is, daily oral care using cotton swabs	After 7 days of toothbrushing with purified water, cumulative VAP rates were significantly lower in the experimental (17%) than in the control (71%) group. The experimental group also had significantly better scores for oral health ($P < 0.05$) and plaque index ($P < 0.01$).

In the literature reviews performed between the years of 2000-2012; it was reported that chlorhexidine use for oral care is important to reduce VAP, tooth brushing with chlorhexidine can be recommended in decreasing VAP to provide higher standard for the patients on mechanical ventilation, but, more researches should be performed to show the effects of tooth brushing. They mentioned in literature review, that oral care practice frequency was 2,

3, and 4 times a day and was used as an oral evaluation tool.

Meta-analysis studies performed between the years of 2000-2012 (n=3) was concluded that chlorhexidine was an economic and safe method to prevent VAP in mechanical ventilator patients.

Table 3: Literature review (n=4).

Çalışma tipi		Results
Only randomized controlled trials	Halm MA, Armola R (2009) (Seven randomized controlled trials from diverse ICUs)	Oral care interventions were mechanical (toothbrushing) or pharmacological (chlorhexidine 0.12%–2%, 2% colistin, or a combination of the 2) delivered via rinse, swab, gel, or paste. Frequency ranged from every 2 hours to 2, 3, or 4 times a day. Measures included dental plaque scales, oral cultures scores, bacterial cultures, clinical pulmonary infection scores, and CDC diagnostic criteria for infections of the lower part of the respiratory tract (eg, fever, leukocytosis, pulmonary infiltrates).
Literature review	Roberts and Moule (2011) Eight studies that met the criteria and addressed the study aims were reviewed.	Results of studies investigating the use of tooth-brushing in reducing VAP incidence proved inconsistent, although all recommend tooth-brushing as important in maintaining good oral hygiene
A retrospective record review	Goss et al. (2011) A retrospective record review (between July 1, 2007 and December 31, 2007)	Study found that although oral care is a Center for Disease Control and Prevention (CDC) recommendation for the prevention of hospital-associated infections like Ventilator-Associated Pneumonia (VAP), indication of documentation of the specifics are lacking in the patients' medical record.
Literature review	Dale et al. (2012) Between 1960 and 2011, 84 papers met all of the inclusion criteria.	Oral care originally focused on patient comfort within the literature; now it is emphasized as an infection control practice for the prevention of Ventilator-Associated Pneumonia (VAP). Despite concern for its neglected application, the literature does not sufficiently address mouth care's practical accomplishment.

Table 4: Meta-analysis and randomized clinical trials (n=3).

		Conclusions
Sistematic review and meta-analysis	Chan et all (2007) Between 1994-2006	Oral decontamination of mechanically ventilated adults using antiseptics is associated with a lower risk of ventilator associated pneumonia. Neither antiseptic nor antibiotic oral decontamination reduced mortality or duration of mechanical ventilation or stay in the intensive care unit.
Meta-analysis and randomized clinical trials	Berolde and Andrade (2008) (Eight publications were analyzed)	In seven (87.5%) chlorhexidine diminished the colonization of the oropharynx, and in four (50%) there was a reduction of VAP. Chlorhexidine seems to reduce colonization, thus reducing the incidence of VAP.
meta-analysis	Balamurugan et al. (2012)	This meta-analysis indicated that chlorhexidine can serve as a cost-effective and safe antiseptic in preventing VAP in mechanically ventilated patients.

In a qualitative study (n=1), their perceptions of the purpose of oral care; their fears about providing it; the priority of oral care; and inadequate support for oral care were reported as affecting factors for oral care performed by participant nurses in intensive care unit.³¹ Moreover, in another semi- experimental study performed during the same dates (n=1), it was emphasized that oral care using both green tea and boiled water in intubated patients was crucial to improve oral mucosa.³²

DISCUSSION

It is seen that efficient oral care practice in intensive care patients is a crucial strategy to decrease the nosocomial pneumonia risk.^{14,20,23,33-37}

In intubated intensive care patients, oral integrity is destroyed due to mechanical reasons and keeping their mouth open for a long time due to orogastric and

nasogastric tubes. Among the other reasons of having a bad oral hygiene in intensive care unit patients are; therapeutic dehydration, insufficient nutrition, inhibition of immunity due to surgery, advanced age, drugs and diseases.³⁸⁻⁴²

Tools used for oral examination

Systematized clinical evaluation of oral cavity in intensive care unit with standardized methods is crucial for oral care planning and examination. Evaluation should include the status of teeth, gingiva, tongue, mucous membranes and limbs.^{15,43,44} A couple studies included limited samples, were shown that systematized evaluation is a crucial factor in critical patient examination.^{15,43,44} However, no standard evaluation tool could be determined for safety and validity in intensive care patients. In other studies, it was mentioned that oral care in intensive care unit is an important nursing function. It was mentioned that nurses evaluated the oral cavity; however there is no more detail.⁴⁵

It is reported that improving the tools and techniques for standard oral examination is crucial not only for research but also for evaluation of patient and practice and increase the life quality.⁴⁵

Oral care solutions

Garcia et al. (2009) concluded in their study that VAP incidence significantly decreased in patients who had comprehensive oral care.

Regarding oral care with chlorhexidine, different findings were mentioned in the studies both done by nurse academicians and clinical microbiologists. In those studies, chlorhexidine was used in various concentrations such as 0.12%, 0.2%, 2%.

Meta-analysis studies showed that chlorhexidine in oral care is important to decrease VAP.^{4,30,46,47}

For instance; Cuccio et al. (2012), in their study, mentioned that oral care with chlorhexidine in every 6 hours prevents VAP development.

Tantipong et al. (2008), in a metaanalytic study, reported that oral care with 2% chlorhexidine in patients on mechanical ventilator is an effective and safe method to prevent VAP.

Bopp et al. (2006) reported that using 0.12% chlorhexidine gluconate twice daily for oral hygiene in intensive care unit patients might be a strategy to decrease nosocomial pneumonia and suggested to perform supporting studies.

Munro et al. (2009), in their randomized control study, showed that not the tooth brush but chlorhexidine can prevent early term VAP development.

Roberts and Moule (2011), in the literature review, noted that chlorhexidine is effective in reducing dental plaque and important in decreasing hospital infections in intensive care patients. Although tooth brushing is recommended for good mouth hygiene, those studies searching tooth brushing to decrease VAP incidence are needed.

Beraldo and Andrade (2008), investigated the meta-analysis and randomized clinical studies in their literature review, and showed that chlorhexidine reduced oropharyngeal colonization in 7 studies and decreased VIP in 4 studies.

Labeau et al. (2011), suggested, in a literature review, that oral care with antiseptic solutions for prevention of VAP is important and clinicians should use it. In this study, the most effective form of chlorhexidine was 2%.⁴⁸

On the contrary to this study; Lorenze et al. (2012), in a randomized controlled study, found that manually tooth brushing with 0.12% chlorhexidine digluconate decreased VAP incidence.

There is no sufficient proof regarding the efficiency of oral care with sodium bicarbonate and hydrogen peroxide in intensive care unit patients.¹²

Since there is the possibility of microbial proliferation in hospital pipes and taps, it is recommended not to use tap water routinely for oral care in intensive care unit patients.⁵⁰

Yao et al. (2011) in a randomized controlled study, mentioned that oral care with tooth brush and purified water twice daily decreased VAP development and enhanced oral health and hygiene.²⁵

Material/materials used for oral care

In literature, it is noted that oral care with sponge or cotton sticks without brushing was not sufficient for plaque cleaning, and thus, tooth brush use is required if there is no risk of pain and bleeding in those patients.^{14,27,45,51} While there are proofs showing that tooth brush is superior for removing the tooth plaques, there are studies showing that nurses still perform oral care with oral sticks.^{53,55}

Brushing is a good method to remove the plaque from tooth surface.^{15,21} Proofs show that tooth brushing with chlorhexidine decreased oral plaque presence and VAP development.⁴⁵

Berry et al. (2007), recommended to use disposable oropharyngeal suction for oral cavity cleaning.⁴⁵

Meanwhile, Gu et al. (2012) in meta-analysis findings of their randomized controlled study, presented that there was no statistically significant difference between oral

care with or without the use of tooth brush for the development of VAP.

Berry et al. (2011) noted the consensus regarding the importance of personal storage container use to reduce the risk of oral hygiene instruments to minimal of being contaminated from shaving instruments and general hygiene materials to minimal.

Oral care frequency

Today, there is no proof regarding oral care frequency for oral hygiene, however, in the study of Berry et al. (2011), directive committee recommended tooth brushing at least twice a day.

CONCLUSION

In conclusion, we mention that oral care is an important nursing practice to prevent VAP development in intensive care unit patients; however, there is no standard oral evaluation tool and no clarity on oral care practice frequency, appropriate solution and appropriate material. It is seen that randomized controlled and systematized studies with high proof level are few. Most studies are descriptive, cross-sectional and the sample groups are non-randomized.

It can be recommended that the study projects on oral care in intensive care patients to have high proof level and be experimental, and longitudinal.

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