REVIEW ARTICLE

Dentistry for the critical care patients

Bishnupati Singh¹, T K Giri², Brajbhushan Mall³, M D Chethan⁴, Vallabh Mahadevan⁵, Namrata Sinha⁶

¹Department of Prosthodontics, Dental College, Regional Institute of Medical Sciences, Imphal, Manipur, India, ²Department of Prosthodontics, Crown, Bridge and Implantology, R’Ahmed Dental College & Hospital, Kolkata, West Bengal, India, ³Department of Oral Surgery, Dental College, Regional Institute of Medical Sciences, Imphal, Manipur, India, ⁴Department of Prosthodontics, Bapujee Dental College and Hospital, Davanagere, Karnataka, India, ⁵Department of Prosthodontics, Ragas Dental College & Hospital, Uthandi, Chennai, Tamil Nadu, India, ⁶Department of Oral Medicine, Dental College, Regional Institute of Medical Sciences, Imphal, Manipur, India

Keywords
Denture care, oral health assessment, oropharyngeal colonization, pediatric care

Abstract
Oropharyngeal colonization and later translocation will lead to nosocomial pneumonia and other secondary infections. Oral care for the critically ill patients in intensive care units (ICU) demands meticulous maintenance due to the evidence suggestive of secondary systemic infections in the individuals. In the absence of definitive guidelines, and adequate knowledge on the part of nurses imparting oral care to these patients leads to the prevalence of hospital acquired infection and at times mortality. The use of toothbrushes over swabs and use of chlorhexidine mouth rinses helps in reducing the count of microbes. A review of the available literature and compilation of guidelines for delivering oral care after the assessment of dental health will reduce the prevalence of these infections in the ICU.

Introduction
Of significant concern is the prevalence of nosocomial infection in acutely and critically ill patients. The mouth often facilitates entry for life-sustaining interventions, such as endotracheal intubation for ventilation and oro gastric tubes for enteral nutrition in the intensive care units (ICU). These interventions, unfortunately, require the patient to maintain an open mouth and impair the natural airway defenses. This vulnerable position, in combination with other treatments, can contribute to a rapidly deteriorating oral state and dependence on nursing to alleviate tube-related discomfort, thirst, oral lesions and the accumulation of saliva, sputum, and oral bacteria. Colonization of the oropharynx is a critical factor in the development of nosocomial pneumonia.⁴ The growth of potentially pathogenic bacteria in dental plaque provides a nidus of infection for microorganisms that have been shown to be responsible for the development of ventilator-associated pneumonia.⁴ These microorganisms in the mouth translocate and colonize the lung, which can result in VAP.⁴ The prevention of ventilator-associated pneumonia. Cost-effective oral hygiene may result in improved oral health and comfort in the critically ill. Until date, there are few literature reviews by dental healthcare professionals combining the different methods and strategies for adequate oral hygiene measures and protocol of care to be routinely followed for critical care patients. The paper reviews different oral hygiene methods and mechanical elimination of foci of nidus leading to colonization and pathosis.

Consequences of Neglect
In a recent systematic review, 11 clinical studies were identified demonstrating a significant association between periodontal disease and the occurrence of nosocomial infections.⁶ Elderly institutionalized, chronic obstructive pulmonary disease, and ICU patients are at higher risk of periodontal colonization by nosocomial pathogens because of difficulties in oral hygiene, changes in salivary properties, and reduction of anaerobic flora.⁵ In ICU patients Oropharyngeal colonization by aerobic pathogens occurs very rapidly because of acquired changes in local antibacterial resistance, i.e., decreased immunoglobulin (Ig)-A salivary content, reduced salivary secretion, mechanical injury induced by nasogastric and
endotracheal tubes and mucosal desiccation. Mucosal adhesion of aerobic bacilli is then facilitated and allows rapid bacterial growth on the pharyngeal mucosa.\(^\text{[8,9]}\) The dental plaque is also involved in the sequence of initial colonization and represents an additional source of nosocomial colonization and infections in ICU patients. Dental plaque is a dynamic and complex system that associates microorganisms embedded in an extracellular matrix. It results from colonization and growth of aerobic, anaerobic, and filamentous microorganisms on the surfaces of teeth, dental prostheses and soft tissues. Dental plaque is predominately located on the subgingival and supragingival surfaces of the teeth, but without mechanical elimination the entire tooth surface can be covered by it. Improper oral hygiene along with absence of mechanical elimination is the main factor leading to multiplication and accumulation of dental plaque and thereafter colonization by aerobic pathogens. Intubation and mechanical ventilation both increase the risk of bacterial pulmonary infection because the invasive endotracheal tube allows direct entry of bacteria into the lower respiratory tract. Bacterial colonization in the respiratory tract is further facilitated by the absence of the cough reflex and excessive mucus secretion in the mechanically ventilated patients.\(^\text{[10]}\) Various strategies and precautions have been put into place to reduce the incidence of VAP and other hospital acquired infections from the viewpoint of dentistry.

**Standard Oral Assessment Tools**

In spite of the importance ascribed to oral hygiene, best practice guidelines are not readily available to guide practice. In a Brazilian study of nursing teams in ICU, 29% of the nurses did not know about the most common oral diseases, such as dental caries, gingivitis, periodontitis, and candidiasis.\(^\text{[11]}\) An oral care plan appropriate for each patient should be devised. Factors such as general health, medical condition prognosis medication and therapeutics as well as the previous standard of oral hygiene and oral care skills should be taken into account; whenever possible there should be co-operation and participation from patients’ relatives in drawing up a care plan. Barnett however, stated that better mouth care would not necessarily occur, even if there were more of an emphasis placed on assessment, because of a theory – practice gap.\(^\text{[12]}\) Hunt suggested that the reasons why elements of care such as oral hygiene are practiced inappropriately may be that either knowledge is not possessed, understood or believed or there is an inability to convey knowledge from theory into practice, or there is an unwillingness to change in relation to the provision of care.\(^\text{[13]}\)

This clinical practice guideline (CPG) for the provision of oral hygiene is developed through the process of a prospectively derived consensus method following a systematic literature review and validation process. The provision of effective oral care is an important strategy in reducing nosocomial pneumonia. The use of a designated oral care protocol can increase compliance and assessment of mouth care. Systematic clinical assessment of the oral cavity using standardized methods is important in the planning and evaluation of oral care in the critically ill. Assessment should include the condition of the teeth, gums, tongue, mucous membranes and lips and barriers to mouth care delivery e.g., oro-pharyngeal tubes. The mere presence of an oral care guideline does not necessarily guarantee compliance, however of concern is the absence of protocol in a large number of units. The presence of structured protocol will affect practice, but education and sensitization with facts for the targeted is a must to increase knowledge and improve awareness. National organizations have listed oral care in a number of prevention interventions.\(^\text{[14,15]}\) Measurement of progress and guided intervention can only be achieved with oral assessment through reliable and valid measures.

Oral care procedure for ICU patients must include customized guidelines co-related with available evidence to assess oral health with validity and reliability. Of the available oral health assessment tools, no single scale has been identified appropriate for all clinical setup. The BRUSHED Assessment Model prompts nurses to check for particular clinical signs during the oral assessment, namely bleeding, redness, ulceration, saliva, halitosis, external factors, and debris.\(^\text{[16]}\) Modified Beck oral assessment scale and the mucosal-plaque score can be effective tools to assess the oral cavity and design customized oral care regime for the critically ill patients.\(^\text{[17-19]}\)

**The “Brushed Teeth” Oral Assessment Tool**

**Brushed teeth**

- b: Bleeding
- R: Redness
- U: Ulceration
- S: Saliva
- H: Halitosis
- E: External factors
- D: Debris
- T: Teeth

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gums, mucosa, coagulation status?</td>
<td>b</td>
</tr>
<tr>
<td>Gums, stomatitis, tongue?</td>
<td>R</td>
</tr>
<tr>
<td>Size, shape, number, location, infected?</td>
<td>U</td>
</tr>
<tr>
<td>Consistency, hyper/hypossecretion?</td>
<td>S</td>
</tr>
<tr>
<td>Character, acidotic, infected?</td>
<td>H</td>
</tr>
<tr>
<td>ETT tapes/ribbon, braces, angular cheilitis?</td>
<td>E</td>
</tr>
<tr>
<td>Plaque, thrush, foreign particles?</td>
<td>D</td>
</tr>
<tr>
<td>Decay, loose, broken swelling abscess?</td>
<td>T</td>
</tr>
</tbody>
</table>

**Recommendations/Oral Care Protocol**

The use of a soft bristled brush can remove debris and subsequent plaque to assist in decreasing microbial colonization. Although nurses have a positive attitude to oral hygiene, rarely ICU included a soft toothbrush for maintenance of oral hygiene even
though recommended in best practice guidelines. At present, there is no evidence to support an optimal frequency for oral hygiene however the guideline recommends brushing at least twice a day. In the absence of strong evidence based on quality trials the recommended duration of brushing should be 3-4 min using a brush which allows access to all areas of the mouth. The American Association of Critical Care Nurses guidelines recommends brushing the teeth twice a day, swabbing the mouth every 2-4 h, and suctioning the oral cavity frequently as per need to minimize colonization of endotracheal microbes. At present, there is no evidence to support an optimal method of storing oral hygiene tools, e.g., toothbrush. However, the recommendation is to store these tools separate from other personal hygiene products in an individual clean Container. Mouth swabs (foam and cotton) should be used where there is a contraindication to brushing (e.g., bleeding gums in the presence of thrombocytopenia. As part of imparting routine oral care to the critical care patients, nurses should wipe the endotracheal tube gently with a toothbrush or carefully wipe with gauze to remove debris accumulated on the surfaces. If an endotracheal tube was present, the tube was included in the oral care subglottic suction is recommended to decrease the risk of VAP in the critically ill and should be part of the mouth care regimen.

At the present time, there is no evidence to support the use of one oral rinse over another in oral care. The exception is in the cardiac surgical patient regarding the use of chlorhexidine gluconate 0.12%. Antiseptic decontamination of gingival tissues and accompanying dental plaque remarkably decreased the count of aerobic pathogens in patients on mechanical ventilators in oropharynx region. The efficacy of oral rinse in reducing the incidence of respiratory infections lacked potency due to multi-resistant bacteria colonizing the pathway. Chlorhexidine gluconate is a commonly used broad-spectrum antibacterial mouth rinse that decontaminates the oropharynx and reduces dental plaque. The rinse is active against both gram negative and gram positive organisms, and there are no documented cases of microbial resistance. Once fixed to the oral surfaces, chlorhexidine gluconate is released between 8 and 24 h. Thus, the 12 h (BD) use of chlorhexidine gluconate is recommended. Many nurses and other caregivers are unaware that sodium lauryl phosphate and sodium mono fluoro phosphate present in the majority of toothpaste interact and inactivate the effect of fluoride results from its action on the tooth/plaque interface, promoting demineralization of early caries and reducing tooth enamel solubility. Additional benefits include reducing the formation of plaque acids. Use of fluoride in toothpaste and other products has been proven to reduce dental caries in children. A Cochrane collaboration systematic review of over 42,300 children in 70 trials demonstrated an average reduction of 24% in decayed, missing, and filled tooth surfaces in children using fluoride toothpaste. (95% confidence interval 21-28; P < 0.0001) Fluoride concentrations as low as 400 parts per million of fluoride (ppm F) are available in children’s toothpastes, but research suggests a fluoride concentration of at least 1000 ppm F is needed to reduce dental caries. Thus, it is recommended that spitting out excess toothpaste rather than rinsing, or keeping rinsing to an absolute minimum, more effectively reduces caries. Numerous studies completed in children with cancer using an oral hygiene regime have recommended the use of a chlorhexidine gluconate mouth rinse because it reduces the severity of mucositis and alleviates oral discomfort. No serious side effects of chlorhexidine gluconate mouth rinse have been reported, but altered taste sensation, tooth discoloration, and tongue discoloration may occur. This tooth discoloration is easily removed by dental hygienists.

**Hand Washing Practice**

Large proportions of nurses do not wash their hands before entering ICU while some wash their hands before and after patient contact. A number of nurses preferably washed their hands after contact with a source of the microorganism; it was also found that the use of alcohol rubs was very minimal. While it is recommended for health care workers including nurses to wash hands before entering ICU, it, therefore, suggested that the use of waterless alcohol gels may improve the hand hygiene of healthcare workers because these gels are less damaging to the skin, and they efficiently and effectively remove transient flora from the hands. Hands should be washed in contact with patients, the materials around them and the secretions from the patient, and before and after invasive procedures whether or not gloves are used or changed.

**Pediatric ICU**

An oral care plan appropriate for each patient should be devised. Factors such as general health, medical condition, prognosis, medication, and therapeutics as well as the previous standard of oral hygiene and oral care skills should be taken into account whenever possible, and there should be co-operation and participation from patients’ relatives in drawing up a care plan. A small, soft toothbrush is recommended for intubated, dentate children. Current guidelines by the New Zealand Dental Association recommend that the gums of babies whose teeth have not yet erupted should be cleaned and moistened with a small, soft toothbrush or a gauze swab moistened with clean water or saline. A plain foam swab is recommended only to moisten the oral cavity or to apply mouth rinse. The anti-caries effect of fluoride results from its action on the tooth/plaque interface, promoting demineralization of early caries and reducing tooth enamel solubility. Additional benefits include reducing the formation of plaque acids. Use of fluoride in toothpaste and other products has been proven to reduce dental caries in children. A Cochrane collaboration systematic review of over 42,300 children in 70 trials demonstrated an average reduction of 24% in decayed, missing, and filled tooth surfaces in children using fluoride toothpaste. (95% confidence interval 21-28; P < 0.0001) Fluoride concentrations as low as 400 parts per million of fluoride (ppm F) are available in children’s toothpastes, but research suggests a fluoride concentration of at least 1000 ppm F is needed to reduce dental caries. Thus, it is recommended that spitting out excess toothpaste rather than rinsing, or keeping rinsing to an absolute minimum, more effectively reduces caries. Numerous studies completed in children with cancer using an oral hygiene regime have recommended the use of a chlorhexidine gluconate mouth rinse because it reduces the severity of mucositis and alleviates oral discomfort. No serious side effects of chlorhexidine gluconate mouth rinse have been reported, but altered taste sensation, tooth discoloration, and tongue discoloration may occur. This tooth discoloration is easily removed by dental hygienists.
Denture Care

The care of dentures in an area often neglected by nurses,[36] Sweeney and Bagg recommend thorough cleaning at least once a day and preferably rinsing after every meal.[37] Dentures should be removed at night and soaked in a dilute solution of Milton (for acrylic dentures). Jagger and Harrison found that a large number of people do not know how to clean dentures satisfactorily.[38] This finding is complicated by nurses attitudes toward handling a patient’s dentures. Eadie and Shou found that carers in their study considered oral care unpleasant, unrewarding and problematic.[39]

Conclusion and Implications

The provision of mouth care for orally intubated patients is a complex, multifaceted practice. Changes in nursing discourse over time have produced a gap between the scientific and practical issues of mouth care. Limitations of the literature in offering solutions to identified problems and a critical discussion of the work being encouraged may benefit Nurses, educators, and administrators. The practice of oral care should be reunited with scientific work for a paradigm shift toward practically oriented forms of inquiry. Using descriptive, qualitative methods would add vital energy to this area of investigation and may enhance understanding of a complex body of nursing work.[38] Oral care training is not often delivered by specialists during initial nurse education and that this is significant.[15,39] The delivery of oral health care can be improved only when nurses are trained adequately in evidence-based oral health care, not only at their initial level but also at post-basic education. Integrating theory and practice closely will discourage unwarranted practices existing in oral hygiene practices. Nurses should identify individual oral care needs and customize the delivery mechanism, as now they have adequate tools for this task. A commitment to change practice at the managerial level will achieve it with ease. Innovative research in the frequency of oral health care delivery and cost criteria of frequently used oral care products is required to improve the efficacy and safety. Identification of barriers in changing ineffective practices by nurses are equally worthy for further investigation. In-depth review of the available literature reiterates the fact that current practices ignore research and are inadequate in providing optimum care for the sensitive patients in ICUs. A renewed effort to invent evaluate and develop oral care guidelines for critically ill patients should be initiated and support nurses in their implementation.

References

22. Grap MJ, Munro CL, Elswick RK, Sessler CN, Ward KR. Duration of action of a single, early oral application of chlorhexidine on


How to cite this article: Singh B, Giri TK, Mall B, Chethan MD, Mahadevan V, Sinha N. Dentistry for the critically ill. J Oral Dis Markers 2017;1:10-14.