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Risk-Adapted Oral Care Protocols for Critically Ill Patients: Scientific Rationale And Clinical Perspectives

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Abstract

Oral deterioration in critical illness is heterogeneous. A cooperative non-intubated patient with preserved salivary flow does not require the same intensity or technique of care as an intubated patient with severe xerostomia, mucosal ulceration, bleeding risk and impaired swallowing. Uniform schedules may therefore result in under-treatment of high-risk patients and unnecessary or unsafe procedures in others. This narrative review develops the scientific rationale for a risk-adapted oral care framework based on systemic stability, airway status, aspiration risk, mucosal integrity, salivary function, dental and prosthetic conditions, and capacity for self-care. The proposed framework links assessment findings to mechanical plaque control, moisturizing care, device-pressure prevention, secretion management, antiseptic use when indicated, documentation and referral. It is presented as a conceptual protocol requiring local adaptation and prospective validation, not as an already proven intervention.

Keywords: Critical illness, oral care, risk adaptation, oral assessment, toothbrushing, hyposalivation, aspiration, endotracheal intubation.

Introduction

Oral care in critical care is frequently described as a fixed bundle delivered at predetermined intervals. Standardization is valuable because it reduces omission and clarifies responsibility. However, a uniform intervention is not synonymous with standardized decision-making. Critically ill patients differ in airway status, level of consciousness, salivary

flow, bleeding risk, dental condition, mucosal integrity and capacity for self-care. These differences alter both the need for care and the safety of specific procedures.

The oral cavity is relevant to comfort, communication, nutrition, swallowing and local infection control. Dental plaque can harbor organisms with respiratory pathogenic potential, while salivary hypofunction weakens mechanical clearance and mucosal lubrication [1–5]. At the same time, pneumonia and other healthcare-associated infections are multifactorial outcomes. An oral care protocol should therefore support, rather than replace, broader measures such as dysphagia management, positioning, mobilization, sedation minimization and respiratory care [11,18].

Aim

To develop the scientific rationale and core structure of a risk-adapted oral care protocol for critically ill patients and to define priorities for future clinical validation.

Methods

A narrative analysis of prospective observational studies, randomized and cluster trials, instrument-development studies, systematic reviews and practice recommendations was conducted. Evidence was organized around four questions: which patient factors modify oral risk; which interventions address specific mechanisms; what safety constraints should alter care; and which outcomes are appropriate for prospective evaluation. The resulting model is conceptual and does not claim clinical effectiveness before validation.

Why risk adaptation is needed

A fixed protocol may under-treat severe dryness, device pressure and heavy plaque when oral care is performed too infrequently. Conversely, aggressive brushing or large-volume rinsing may be unsafe in a patient with active bleeding, an unstable tooth or uncontrolled aspiration risk. Risk adaptation aims to preserve the reproducibility of assessment and documentation while allowing the intervention to change according to clinical findings.

Dynamic reassessment is essential because oral status may deteriorate during the first days of intensive care even when the admission examination is acceptable. Prospective observations in adults and children have documented progression of plaque, mucosal abnormalities and functional impairment during critical illness [4,16]. Changes in ventilation, consciousness, hydration, medication and feeding should trigger reassessment rather than waiting for a fixed weekly review.

Risk domains

Table 1. Core domains for risk-adapted oral assessment

Domain	Key findings	Clinical implication
Physiological stability	Unstable oxygenation, hemodynamics or agitation	Delay non-urgent care or shorten the procedure
Airway and aspiration	Intubation, dysphagia, poor secretion control	Positioning, low fluid volume and suction readiness
Mucosal integrity	Dryness, erythema, bleeding, erosion or ulcer	Gentle technique, moisturization and cause-directed care
Salivary function	Scant, thick or stringy saliva	More frequent lubrication and secretion management
Dental and prosthetic status	Plaque, mobile tooth, sharp edge or contaminated denture	Mechanical cleaning and dental referral when needed
Self-care capacity	Alert and independent, partly dependent or fully dependent	Define who performs care and the level of assistance

Assessment-linked interventions

Mechanical plaque disruption remains the most direct method for controlling mature dental biofilm. Toothbrushing should be performed with a soft brush and limited pressure, with special attention to the gingival margin and posterior teeth. It should be modified or temporarily deferred when active oral bleeding, profound thrombocytopenia, unstable dentition or extensive painful ulceration creates unacceptable risk. Swabs may help moisturize or remove loose debris but should not be assumed to provide the same plaque disruption as a toothbrush.

Moisturizing care addresses a different mechanism. It supports mucosal lubrication, reduces friction and can improve comfort, but it does not remove established dental biofilm. Lips, tongue and oral mucosa should be assessed separately because

the required frequency may differ from toothbrushing. In patients receiving oxygen, products must be compatible with local fire-safety guidance. Fluids should be used sparingly when aspiration risk is high.

Device-pressure prevention is particularly important in orally intubated patients. The lips, commissures, tongue and mucosa in contact with the tube and fixation system should be inspected. When clinically feasible, pressure points should be redistributed according to airway-management policy. A localized lesion corresponding to the device position should not be treated solely as infectious mucositis; the mechanical cause must be removed or reduced.

Antiseptics require indication-based use. Evidence for chlorhexidine is heterogeneous across cardiac surgical and general critical-care populations, and concern has been raised regarding mucosal injury and uncertain patient-important benefit when it is used routinely in all patients [7,10,11]. More recent syntheses still suggest a potential reduction in ventilator-associated pneumonia in some comparisons. This uncertainty supports careful patient selection, standardized concentration and application, inspection for adverse effects, and avoidance of antiseptic use as a substitute for mechanical cleaning.

Table 2. Example action matrix for a three-level risk model

Risk level	Typical profile	Care priorities
Low	Moist intact mucosa, little plaque, safe swallow, cooperative patient	Support self-care, routine brushing, daily observation
Moderate	Intubation or dependency, visible plaque, mild dryness or gingival inflammation	Assisted brushing, scheduled moisturization, secretion control and closer reassessment
High	Severe dryness, ulcer, bleeding, device-pressure injury, mobile tooth or major aspiration risk	Individual plan, minimal-fluid technique, medical–dental review and frequent reassessment

A stepwise protocol

1. Confirm physiological stability and determine whether non-urgent oral care can be performed safely.
2. Assess consciousness, cooperation, swallowing and aspiration risk before introducing fluids or instruments.
3. Inspect the lips, tongue, gingiva, teeth, dentures, mucosa, saliva and all device-contact areas.
4. Assign a provisional oral risk level using the most severe relevant finding rather than an average score alone.
5. Select mechanism-specific actions: plaque disruption, moisturization, secretion management, pressure relief, denture care or indicated antiseptic treatment.
6. Document the findings, procedures, tolerance, bleeding, pain, device injury and any limitation that prevented complete care.
7. Reassess at a frequency determined by risk and after major clinical changes; refer to dental or other specialists when escalation criteria are met.

Referral and escalation

Dental referral should be available for a mobile tooth at risk of aspiration, suspected odontogenic infection, uncontrolled oral bleeding, sharp dental or prosthetic trauma, progressive ulceration, unexplained swelling, severe pain, or inability to provide adequate care because of structural disease. Speech and swallowing expertise is required when secretion control or oral intake is unsafe. Airway staff must be involved when pressure redistribution could affect tube security.

Implementation considerations

A protocol is only effective when staff can perform it. Implementation requires a small set of consistently available supplies, clear responsibility across shifts, short competency-based training, a documentation field and feedback on adherence. The protocol should be integrated into existing nursing and airway workflows rather than added as an isolated dental task. Local adaptation should specify contraindications, approved products, suction access and escalation contacts.

Risk scores should support clinical reasoning, not replace it. A single total score may hide a dangerous finding: a patient with otherwise acceptable oral status but a mobile tooth or deep pressure ulcer still requires high-risk management. For this reason, the proposed model combines an overall level with mandatory escalation triggers.

Table 3. Outcomes for prospective validation

Outcome domain	Candidate measures	Reason for inclusion
Oral hygiene	Plaque and tongue-coating scores	Direct response to mechanical care
Mucosal health	Moisture, erythema, ulceration and pressure injury	Captures lubrication and device-related harm
Safety	Bleeding, aspiration events, tube disturbance and intolerance	Tests whether adaptation prevents procedure-related harm
Patient experience	Dryness, pain and oral comfort when reportable	Reflects patient-important benefit
Process	Assessment completion, protocol adherence and referral time	Determines feasibility and implementation fidelity
Clinical outcomes	Pneumonia, ventilation duration and ICU stay	Important but multifactorial secondary outcomes

Research priorities

Prospective evaluation should compare the risk-adapted protocol with clearly described usual care. Cluster designs may be practical because staff behavior and unit workflow are central to the intervention. Baseline oral status, dentition, ventilation, antibiotics, bleeding risk and dysphagia should be recorded to reduce confounding. Outcome assessors should use reproducible instruments and distinguish oral intermediate outcomes from broader clinical outcomes.

Follow-up should be sufficiently frequent to capture early deterioration and should continue through extubation or transfer when possible. Adverse effects must be reported, especially mucosal injury, bleeding, aspiration and device disturbance. A protocol that reduces plaque but increases trauma cannot be considered successful. Economic evaluation should include staff time, supply use, dental consultation and avoidable treatment of oral complications.

Discussion

The proposed framework integrates two forms of standardization: a consistent assessment pathway and individualized intervention selection. This resolves the apparent tension between protocol-based care and clinical judgment. It also avoids reducing oral care to a single product. Toothbrushing, moisturizing, secretion control, pressure prevention and referral address different mechanisms and should be combined only when indicated.

The main limitation is that risk-adapted oral care has not yet been validated as a single unified intervention across heterogeneous critical-care populations. The framework is therefore a research-ready model derived from existing evidence, not a claim of proven superiority. Its value will depend on local feasibility, staff adherence, reliable measurement and transparent reporting of benefits and harms.

Conclusion

Risk-adapted oral care offers a clinically coherent approach to the heterogeneity of critical illness. The protocol should begin with physiological and oral assessment, classify risk using both overall findings and mandatory escalation triggers, and link each identified mechanism to a specific action. Mechanical plaque control, mucosal moisturization, aspiration-aware secretion management, device-pressure prevention and timely referral form the core of the model. Prospective clinical validation is required before effectiveness can be claimed, with oral health, safety, patient comfort, implementation fidelity and broader clinical outcomes evaluated separately.

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