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# Gingival and plaque decontamination: Can we take a bite out of VAP?

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## Expanded Abstract

### Citation

Fourrier F, Dubois D, Pronnier P, Herbecq P, Leroy O, Desmettre T, Pottier-Cau E, Boutigny H, Di Pompeo C, Durocher A, Roussel-Delvallez M: Effect of gingival and dental plaque antiseptic decontamination on nosocomial infections acquired in the intensive care unit: a double-blind placebo-controlled multicenter study. Crit Care Med 2005, 33:1728-1735 [1].

### Background

Poor oral hygiene and colonization of dental plaque is likely to play an important role in the development of ventilator-associated pneumonia (VAP) in many critically ill patients. Preliminary observations have suggested that dental plaque antiseptic decontamination (PAD) may reduce the frequency of VAP and ICU acquired bacteremia.

### Methods

**Design and setting:** Prospective, multi-center, double-blind, placebo-controlled trial in six French ICUs.

**Objective:** To document the effect of gingival and dental plaque antiseptic decontamination on the rate of nosocomial bacteremias and respiratory infections acquired in the ICU.

**Patients and intervention:** 228 non-edentulous patients requiring endotracheal intubation and mechanical ventilation with an anticipated ICU length of stay > 5 days were randomized to receive 0.2% chlorhexidine gel or placebo applied to dental and gingival surfaces three times daily for the duration of their ICU stay until day 28.

**Outcomes:** The primary end point was the composite incidence of bacteremia, bronchitis and VAP acquired in the ICU. Secondary endpoints included ICU mortality, length of stay and medical and nursing care loads. Changes in bacterial colonization were evaluated in a subset of randomized patients.

### Results

All baseline characteristics were similar between the treated and the placebo groups. The trial was stopped based on an interim analysis showing statistical futility. The incidence of nosocomial infections was 17.5% (13.2 per 1000 ICU days) in the placebo group and 18.4% (13.3 per 1000 ICU days) in the plaque antiseptic decontamination group (p=NS). No difference was observed in the incidence of ventilator-associated pneumonia per ventilator or intubation days, mortality, length of stay, and care loads. On day 10, the number of positive dental plaque cultures was significantly lower in the treated group (29% vs. 66%; p<0.05). Highly resistant Pseudomonas, Acinetobacter, and Enterobacter species identified in late-onset ventilator-associated pneumonia and previously cultured from dental plaque were not eradicated by the antiseptic decontamination. No side effect was reported.

### Conclusion

Gingival and dental plaque antiseptic decontamination significantly decreased the oropharyngeal colonization by aerobic pathogens in ventilated patients. However, its efficacy was insufficient to reduce the incidence of respiratory infections due to multiresistant bacteria.

## Commentary

VAP remains a major cause of morbidity, mortality, and increased costs in the ICU [2]. Recent clinical practice guidelines recommend a variety of preventative measures, including orotracheal (rather than endotracheal) intubation, closed suctioning systems, weekly changes of heat and moisture exchangers, semi-recumbent positioning, and subglottic secretion drainage [3]. Although evidence from more than 50 clinical trials and ten meta-analyses demonstrate that selective decontamination of the digestive tract (SDD) using topical *antibiotics* (+/- systemic antibiotics) is associated with decreased incidence of VAP, routine implementation of SDD has not been adopted by most intensivists because of concerns about the emergence of antibiotic-resistant pathogens. Topical application of an *antiseptic,* such as chlorhexidine, could be an attractive alternative for oropharyngeal decontamination. For example, chlorhexidine oral decontamination reduced the incidence of VAP in a low-risk population of cardiac surgical patients [4] and, recently, in mechanically ventilated medical-surgical ICU patients [5].

Colonization of the oropharynx by pathogenic bacteria is a key step in the development of VAP. Poor oral hygiene and excess dental plaque are particularly troublesome sources of nosocomial infection. Notably, a single $mm^3$ of dental plaque contains $\geq 10^8$ bacteria! Preliminary observations indicate that dental plaque antiseptic decontamination (PAD), in which an antiseptic is applied directly to dental and gingival surfaces, may reduce the frequency of VAP and ICU-acquired bacteremia [6].

In this randomized controlled trial by Fourrier and colleagues [1], PAD with 0.2% chlorhexidine gel had no apparent impact on the incidence of VAP, bronchitis, or bacteremia. While eradication of bacteria from these areas might be expected to reduce oropharyngeal colonization and subsequent pneumonia, a number of methodological limitations may have reduced the likelihood of showing an impact for the intervention. Because rates of VAP were much lower than anticipated, the study was underpowered. Two-thirds of the subjects were considered infected at the time of ICU admission (primarily bronchitis and community-acquired pneumonia) and prior antibiotic usage was not an exclusionary criterion for entry into the study, making interpretation of rates of new respiratory infections challenging at best. Failure to employ adjunctive mechanical debridement of dental plaque (i.e., tooth brushing) and to standardize recommended VAP prevention measures may have further obscured any potentially beneficial effect of PAD.

Despite the negative results of this study, some interesting and potentially important observations emerged. These observations serve to emphasize the potential role of poor dental hygiene in the pathogenesis of VAP. Poor dental hygiene was apparent in 90% of the patients at the time of enrollment into the study. Of the 50% of dental plaque cultures that were positive for bacterial growth at the time of entry, approximately one third grew pathogenic aerobic Gram-negative rods. There was good concordance of dental plaque isolates with lung cultures in those who developed respiratory infection. These findings add to the growing body of evidence implicating poor oral hygiene as an important risk factor in the development of VAP in critically ill patients [7,8] and should serve to refocus our attention on the teeth and oropharynx as a reservoir for bacterial pathogens in transit to the lungs. Though the authors were not able to show a meaningful clinical benefit in this study, reducing bacterial colonization through PAD may still have the potential to favorably impact VAP, perhaps when coupled with other VAP preventative measures.

Further clinical investigations are needed to address a number of outstanding questions and issues related to oral hygiene and VAP prevention. The development of simple and reproducible methods and tools to assess and define the state of dentition, oral hygiene, and bacterial burden would be of great value not only for research purposes but also for the integration of oropharyngeal care into routine clinical practice. Endotracheal tube fixation devices should be designed not only to enhance tube security but also to allow for easy access to the oropharynx without the need for removing them each time oral hygiene care is administered. Additional prospective studies are needed to identify oral hygiene strategies that are the most effective in taking a bite out of VAP!

## Recommendation

Though the authors failed to show a benefit for chlorhexidine-based PAD, other randomized controlled studies have established that oral decontamination with topical antiseptics reduces the incidence of VAP [4,5,9]. Interventions to establish and maintain good oral hygiene in intubated patients should be part of a multifaceted approach to the prevention VAP.

## Competing interests

The authors declare no competing interests.

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