

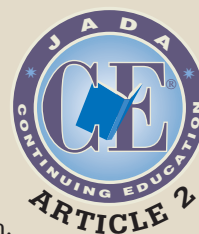
Poor oral hygiene as a risk factor for infective endocarditis–related bacteremia

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In 1909, Horder¹ emphasized that “oral sepsis” was an important factor in the genesis of infective endocarditis (IE). Since that time, however, the focus has been on prevention of bacteremia that results from invasive procedures. Traditionally, it has been recommended that people with a spectrum of medical conditions and devices receive antibiotic prophylaxis (AP) before dental, gastrointestinal, genitourinary and other invasive procedures.² There is, however, an emerging consensus that bacteremia resulting from invasive procedures is, at most, a rare cause of IE, which is itself a rare disease, and that AP poses a greater risk than benefit to patients.^{3,4}

Recently, there have been major changes in recommendations from experts on this issue. Since 2007, American Heart Association (AHA) guidelines focus only on dental procedures for patients with cardiac conditions whom the AHA defines as being at “higher” risk of experiencing morbidity and mortality resulting from IE, largely because most of the case reports and studies of bacteremia relate to dental rather

ABSTRACT



Background. Infective endocarditis (IE) often is caused by bacteria that colonize teeth. The authors conducted a study to determine if poor oral hygiene or dental disease are risk factors for developing bacteremia after toothbrushing or single-tooth extraction.

Methods. One hundred ninety-four participants in a study were in either a toothbrushing group or a single-tooth extraction with placebo group. The authors assessed the participants' oral hygiene, gingivitis and periodontitis statuses. They assayed blood samples obtained before, during and after the toothbrushing or extraction interventions for IE-associated bacteria.

Results. The authors found that oral hygiene and gingival disease indexes were associated significantly with IE-related bacteremia after toothbrushing. Participants with mean plaque and calculus scores of 2 or greater were at a 3.78- and 4.43-fold increased risk of developing bacteremia, respectively. The presence of generalized bleeding after toothbrushing was associated with an almost eightfold increase in risk of developing bacteremia. There was no significant association between any of the measures of periodontal disease and the incidence of bacteremia after toothbrushing. The oral hygiene or disease status of a tooth was not significantly associated with bacteremia after its extraction.

Conclusion. Bacteremia after toothbrushing is associated with poor oral hygiene and gingival bleeding after toothbrushing.

Clinical Implications. Improvements in oral hygiene may reduce the risk of developing IE.

Key Words. Bacteremia; bacteria; infective endocarditis; heart valves; risk factors.

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than nondental procedures.³ In the United Kingdom, the 2008 National Institute for Health and Clinical Excellence guidelines recommended the complete abandonment of AP for all patients with cardiac conditions undergoing any invasive procedures.⁴ Although the recommendations for the prevention of IE have a greater focus on improved oral health, there are no data from prospective clinical studies to demonstrate that poor oral health is a risk factor for IE.

Gingivitis and periodontitis are inflammatory diseases of the gingiva and supporting structures of the teeth. They are caused by specific bacterial species. There is evidence that the surface of inflamed and ulcerated gingival crevicular tissue around teeth is the portal of entry for the viridans streptococci bacteria that cause as much as 50 percent of the IE cases in the United States annually.⁵⁻⁸ Some of these cases are found commonly or almost exclusively in the oral cavity (for example, *Streptococcus mitis*, *Streptococcus mutans*). Mansur and colleagues⁹ estimated that *Streptococcus* species cause as much as 56 percent of recurrent endocarditis cases.

Although hundreds of bacterial species have been reported to enter a person's systemic circulation during dental procedures, we have found that toothbrushing is a more common source of bacteremia caused by IE-causing oral pathogens.^{10,11} We could not, however, find a study in the literature in which the investigators identified a relationship between specific dental hygiene or gingival disease parameters and bacteremia resulting from routine daily events such as toothbrushing. We theorized that if such a relationship exists, it could lead to a more evidence-based, effective and universally accepted focus on preventing cases of IE caused by oral pathogens. This approach would target and benefit all patients at risk of developing IE, rather than focusing on administering AP before specific invasive procedures and to the small percentage of patients defined by the AHA as being at "higher" risk of experiencing a bad outcome from IE.

The main focus of our study was to determine if specific measures of oral hygiene, gingival disease or both would be risk factors for bacteremia caused by IE-associated oral species after toothbrushing or single-tooth extraction.

PARTICIPANTS AND METHODS

We initiated a double-blind, randomized, placebo-controlled study and enrolled patients who came

to our hospital-based dental service and who needed to have at least one erupted tooth extracted. We excluded patients if they had fewer than 10 teeth; had taken a systemic antibiotic agent within the previous two weeks; needed AP on the basis of AHA guidelines; had an active viral infection, poorly controlled systemic disease, penicillin allergy, temperature greater than 100.5°F or facial cellulitis; had eaten or brushed their teeth within one hour before the study; or were immunocompromised by virtue of disease or medications. All participants provided written informed consent. We informed those who met the inclusion criteria about the study, which received Carolinas Medical Center's Institutional Review Board–approved consent.

Over a three-year study, we screened 600 patients and randomly assigned 290 to one of three groups: toothbrushing, single-tooth extraction with AP or single-tooth extraction with a placebo that was identical in look, feel, taste and so forth to AP, as described previously.¹⁰ The results of some aspects of this study have been published previously.¹⁰⁻¹² We excluded from the results participants who were in the single-tooth extraction with AP group because we were interested only in the impact of oral hygiene and disease indexes on bacteremia.

We obtained demographic information and medical histories from the participants and conducted thorough clinical and radiographic examinations of their teeth and periodontia at baseline. We assessed oral hygiene and gingivitis statuses at four sites per tooth by using common dental plaque,¹³ calculus¹⁴ and gingivitis¹⁵ indexes. We assessed periodontal status by means of probing depths, which we measured to the nearest whole millimeter at six sites per tooth by using a manual probe. We used tooth mobility¹⁶ scores as a second, indirect measure of periodontal status. We scored dental caries as clinically present or absent for each tooth. We examined radiographs to determine the presence and depth of caries. We assigned a score of 0 if there were no caries or if the lesion was limited to the enamel or dentin. We assigned a score of 1 if there was gross caries or caries involving the tooth pulp. We determined the presence and depth of dental caries only for the teeth that were to be extracted. Also, for the

ABBREVIATION KEY. **AHA:** American Heart Association. **AP:** Antibiotic prophylaxis. **CDC:** Centers for Disease Control and Prevention. **IE:** Infective endocarditis.

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