

Antibiotic Prophylaxis for Dental Patients at Risk for Infection

Review Council

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Latest Revision

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Purpose

The American Academy of Pediatric Dentistry (AAPD) recognizes that numerous medical conditions predispose patients to bacteremia-induced infections. Because it is not possible to predict when a susceptible patient will develop an infection, prophylactic antibiotics are recommended when these patients undergo procedures that are at risk for producing bacteremia. These recommendations are intended to help practitioners make decisions regarding antibiotic prophylaxis for dental patients at risk.

Methods

Recommendations on antibiotic prophylaxis for dental patients at risk for infection were developed by the Clinical Affairs Committee and adopted in 1990. This document is a revision of the previous version, last revised in 2011, and based on a review of current dental and medical literature pertaining to post procedural bacteremia-induced infections. This revision included database searches using key terms: infective endocarditis (IE), bacteremia, antibiotic prophylaxis, and dental infection. Articles were evaluated by title and/or abstract and relevance to dental care for children, adolescents, and those with special health care needs. Thirty-one citations were chosen from this method and from references within selected articles. When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians. In addition, "Prevention of infective endocarditis: Guidelines from the American Heart Association"^{1,2} and "Prevention of orthopedic implant infection in patients undergoing dental procedures: Guidelines from the American Academy of Orthopedic Surgeons (AAOS) and American Dental Association (ADA)"^{3,4} were reviewed.

Background

Bacteremia, bacteria in the bloodstream, is anticipated following invasive dental procedures.^{5,6} Infective endocarditis is an uncommon but life-threatening complication resulting from bacteremia. The incidence of infections such as IE ranges from 5.0 to 7.9 per 100,000 person-years with a significant increasing trend among women.⁷ Only a limited number of bacterial species have been implicated in resultant postoperative infections. Viridans group streptococci, *Staphylococcus*

aureus, enterococcus, pseudomonas, serratia, and candida are some of the microorganisms implicated with IE.^{1,2} The vast majority of cases of IE caused by oral microflora can result from bacteremia associated with routine daily activities such as toothbrushing, flossing, and chewing.^{1,2} However, antibiotic prophylaxis is recommended with certain dental procedures.^{1,2,5,6} An effective antibiotic regimen should be directed against the most likely infecting organism, with antibiotics administered shortly before the procedure. When procedures involve infected tissues or are performed on a patient with a compromised host response, additional doses or a prescribed postoperative regimen of antibiotics may be necessary.

Antibiotic usage may result in the development of resistant organisms.^{1,2,5,6,8,9} Utilization of antibiotic prophylaxis for patients at risk does not provide absolute prevention of infection. Post-procedural symptoms of acute infection (e.g., fever, malaise, weakness, lethargy) may indicate antibiotic failure and need for further medical evaluation.

The decision to use antibiotic prophylaxis should be made on an individual basis. Some medical conditions that may predispose patients to post-procedural infections are discussed below. This is not intended to be an exhaustive list; rather, the categorization should help practitioners identify children who may be at increased risk. If a patient reports a syndrome or medical condition with which the practitioner is not familiar, it is appropriate to contact the child's physician to determine susceptibility to bacteremia-induced infections.

In 2007, the American Heart Association (AHA) released its newly revised guidelines for the prevention of IE and reducing the risk for producing resistant strains of bacteria.^{1,2} The AAPD, acknowledging the AHA's expertise and efforts to produce evidenced-based recommendations, continues to endorse the AHA guideline for antibiotic prophylaxis, titled *Prevention of Infective Endocarditis*.

The significant reasons for the revision include^{1,2}:

- "IE is much more likely to result from frequent exposure

ABBREVIATIONS

AAOS: American Academy of Orthopedic Surgeons. **AAPD:** American Academy Pediatric Dentistry. **ADA:** American Dental Association. **AHA:** American Heart Association. **CHD:** Congenital heart disease. **CIED:** Cardiovascular implantable electronic device. **IE:** Infective endocarditis.

to random bacteremias associated with daily activities than from bacteremia caused by a dental, GI tract, or GU tract procedure.¹¹ (Daily activities would include toothbrushing, flossing, chewing, using toothpicks, using water irrigation devices, and other activities.)

- “Prophylaxis may prevent an exceedingly small number of cases of IE if any, in individuals who undergo a dental, GI tract, or GU tract procedure.
- The risk of antibiotic-associated adverse events exceeds the benefit, if any, from prophylactic antibiotic therapy.
- Maintenance of optimal oral health and hygiene may reduce the incidence of bacteremia from daily activities and is more important than prophylactic antibiotics for a dental procedure to reduce the risk of IE.”¹¹

The 2007 AHA revision was intended to clarify when antibiotic prophylaxis is/is not recommended and to provide more uniform global recommendations. Major changes from the 1997 version^{1,2,8} include:

- “The Committee concluded that only an extremely small number of cases of infective endocarditis might be prevented by antibiotic prophylaxis for dental procedures even if such prophylactic therapy were 100 percent effective.
- Infective endocarditis prophylaxis for dental procedures is reasonable only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from infective endocarditis.
- For patients with these underlying cardiac conditions, prophylaxis is reasonable for all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa.
- Prophylaxis is not recommended based solely on an increased lifetime risk of acquisition of infective endocarditis.”¹¹

Recommendations

The conservative use of antibiotics is indicated to minimize the risk of developing resistance to current antibiotic regimens.^{1-4,7,8} Given the increasing number of organisms that have developed resistance to current antibiotic regimens, as well as the potential for an adverse anaphylactic reaction to the drug administered, it is best to be judicious in the use of antibiotics for the prevention of IE^{1,2} and other distant-site infections.⁹

Patients with cardiac conditions

Dental practitioners should consider prophylactic measures to minimize the risk of IE in patients with underlying cardiac conditions. The risk of developing IE can arise from a combination of high-risk patients and dental procedures. However, at-risk patients with poor oral hygiene and gingival bleeding after routine activities (e.g., toothbrushing) also have shown an increased potential for developing complications of IE.^{1,2,12,13} It, therefore, is recommended to encourage daily good oral hygiene practices to reduce gingivitis as part of the prophylactic regimen.^{1,2,11,12} These patients and/or parents need to be educated and motivated to maintain personal oral

hygiene through daily plaque removal, including flossing.^{1,2} Greater emphasis should be placed on improved access to dental care and oral health in patients with underlying cardiac conditions at high risk for IE and less focus on a dental procedure and antibiotic coverage.^{1,2,10-12} Professional prevention strategies should be based upon the individual’s assessed risk for caries and periodontal disease.

Specific recommendations from the 2007 AHA guideline on prevention of IE are included in the following tables. The AHA recommends antibiotic prophylaxis only for those whose underlying cardiac conditions are associated with the highest risk of adverse outcome^{1,2} (see Table 1). Such conditions include prosthetic heart valves or prosthetic material used for cardiac valve repair, a previous history of IE unrepaired or incompletely repaired cyanotic congenital heart disease (CHD) including palliative shunts and conduits, completely repaired congenital heart defect with prosthetic material or device (whether placed by surgery or by catheter intervention) during the first six months after the procedure, and repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or device, and cardiac transplantation recipients who develop cardiac valvulopathy such as valve regurgitation due to a structurally abnormal valve.^{1,2,14} After the 2007 AHA revised guidelines were published, there were concerns by healthcare providers that there may be an increase in cases of viridans group streptococci IE due to the decrease in the numbers of patients requiring antibiotic prophylactic coverage for dental procedures.¹⁵ A population based review of definitive and possible cases of IE demonstrated no observed increase in viridans group streptococci IE after publication of the 2007 AHA endocarditis prevention guidelines.¹⁵ In addition to those diagnoses listed in the AHA guidelines, patients with a reported history of injection drug use may be considered at risk for developing IE in the absence of cardiac anomalies.¹³ Although quite rare, complications from intraoral tongue piercing can include IE among patients with a pre-existing cardiac valvular condition and/or history of injection drug use.¹⁶⁻¹⁸ Consultation with the patient’s physician may be necessary to determine susceptibility to bacteremia-induced infections.

Antibiotics are recommended for all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa for cardiac patients with the highest risk^{1,2} (see Table 1 and 2). Specific antibiotic regimens can be found in Table 3. Practitioners and patients/parents can review the entire AHA guidelines in the AHA *Circulation* archives, “<http://circ.ahajournals.org/cgi/content/full/116/15/1736>” for additional background information as well as discussion of special circumstances (e.g., patients already receiving antibiotic therapy, patients on anti-coagulant therapy).

Patients with compromised immunity

Patients with a compromised immune system may not be able to tolerate a transient bacteremia following invasive dental procedures.¹⁰ These non-cardiac factors can place a patient

Table 1. CARDIAC CONDITIONS ASSOCIATED WITH THE HIGHEST RISK OF ADVERSE OUTCOME FROM ENDOCARDITIS FOR WHICH PROPHYLAXIS WITH DENTAL PROCEDURES IS REASONABLE

- Prosthetic cardiac valve or prosthetic material used for cardiac valve repair
- Previous infective endocarditis
- Congenital heart disease (CHD)*
 - Unrepaired cyanotic CHD, including palliative shunts and conduits
 - Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first six months after the procedure †
 - Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
- Cardiac transplantation recipients who develop cardiac valvulopathy

* Except for the conditions listed above, antibiotic prophylaxis is no longer recommended for any other form of CHD.
 † Prophylaxis is reasonable because endothelialization of prosthetic material occurs within six months after the procedure.
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Table 2. DENTAL PROCEDURES FOR WHICH ENDOCARDITIS PROPHYLAXIS IS REASONABLE FOR PATIENTS IN TABLE 1

All dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa**

* The following procedures and events do not need prophylaxis: routine anesthetic injections through non-infected tissue, taking dental radiographs, placement of removable prosthodontic or orthodontic appliances, adjustment of orthodontic appliances, placement of orthodontic brackets, shedding of deciduous teeth, and bleeding from trauma to the lips or oral mucosa.

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Table 3. REGIMENS FOR A DENTAL PROCEDURE

Regimen: Single Dose 30 to 60 min Before Procedure			
Situation	Agent	Adults	Children
Oral	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Ampicillin OR	2 g IM or IV	50 mg/kg IM or IV
	Cefazolin or ceftriaxone	1 g IM or IV	50 mg/kg IM or IV
Allergic to penicillins or ampicillin—oral	Cephalexin*† OR	2 g	50 mg/kg
	Clindamycin OR	600 mg	20 mg/kg
	Azithromycin or clarithromycin	500 mg	15 mg/kg
Allergic to penicillin or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone† OR	1 g IM or IV	50 mg/kg IM or IV
	Clindamycin	600 mg IM or IV	20 mg/kg IM or IV

IM indicates intramuscular; IV, intravenous.
 * Or other first- or second-generation oral cephalosporin in equivalent adult or pediatric dosage.
 † Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticaria with penicillins or ampicillin.

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Table 4. AAOS/ADA PREVENTION OF ORTHOPAEDIC IMPLANT INFECTION CLINICAL PRACTICE GUIDELINE PROTOCOL RECOMMENDATIONS^{3,4}

Recommendation 1

The practitioner might consider discontinuing the practice of routinely prescribing prophylactic antibiotics for patients with hip and knee prosthetic joint implants undergoing dental procedures.

Grade of Recommendation: Limited

A Limited recommendation means the quality of the supporting evidence that exists is unconvincing, or that well-conducted studies show little clear advantage to one approach versus another. Practitioners should be cautious in deciding whether to follow a recommendation classified as Limited, and should exercise judgment and be alert to emerging publications that report evidence. Patient preference should have a substantial influencing role.

Recommendation 2

We are unable to recommend for or against the use of topical oral antimicrobials in patients with prosthetic joint implants or other orthopaedic implants undergoing dental procedures.

Grade of Recommendation: Inconclusive

An Inconclusive recommendation means that there is a lack of compelling evidence resulting in an unclear balance between potential benefits and potential harm. Practitioners should feel little constraint in deciding whether to follow a recommendation labeled as Inconclusive and should exercise judgment and be alert to future publications that clarify existing evidence for determining balance of benefits versus potential harm. Patient preference should have a substantial influencing role.

Recommendation 3

In the absence of reliable evidence linking poor oral health to prosthetic joint infection, it is the opinion of the work group that patients with prosthetic joint implants or other orthopaedic implants maintain appropriate oral hygiene.

Grade of Recommendation: Consensus

A Consensus recommendation means that expert opinion supports the guideline recommendation even though there is no available evidence that meets inclusion criteria. Practitioners should be flexible in deciding whether to follow a recommendation classified as Consensus, although they may set boundaries on alternatives. Patient preference should have a substantial influencing role.

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with compromised immunity at risk for distant-site infection from a dental procedure.¹⁰ This category includes, but is not limited to, patients with the following medical conditions¹⁰:

1. Immunosuppression secondary to:
 - a. human immunodeficiency virus (HIV);
 - b. severe combined immunodeficiency (SCIDS);
 - c. neutropenia;
 - d. cancer chemotherapy; and
 - e. hematopoietic stem cell or solid organ transplantation.
2. Head and neck radiotherapy.
3. Autoimmune disease (e.g., juvenile arthritis, systemic lupus erythematosus).
4. Sickle cell anemia.¹⁹
5. Asplenicism or status post splenectomy.
6. Chronic steroid usage.
7. Diabetes.
8. Bisphosphonate therapy.^{20,21}

Consultation with the child's physician is recommended for management of patients with a compromised immune system. Discussion of antibiotic prophylaxis for patients undergoing chemotherapy, irradiation, and hematopoietic cell transplantation appears in a separate AAPD guideline.²²

Patients with shunts, indwelling vascular catheters, or medical devices

The AHA recommends that antibiotic prophylaxis for non-valvular devices, including indwelling vascular catheters (e.g., central lines) and cardiovascular implantable electronic devices (CIED), is indicated only at the time of placement of these devices in order to prevent surgical site infection.^{10,23-25} The AHA found no convincing evidence that microorganisms associated with dental procedures cause infection of CIED and nonvalvular devices at any time after implantation.^{10,23-25} The infections occurring after device implantation most often are caused by *Staphylococcus aureus* and coagulase negative staphylococci or other microorganisms that are non-oral in origin but are associated with surgical implantation or other active infections.²⁴⁻²⁶ The AHA further states that immunosuppression is not an independent risk factor for nonvalvular device infections; immunocompromised hosts who have those devices should receive antibiotic prophylaxis as advocated for immunocompetent hosts.^{10,23-25} Consultation with the child's physician is recommended for management of patients with nonvalvular devices.

Ventriculoatrial (VA), ventriculocardiac (VC), or ventriculovenous (VV) shunts for hydrocephalus are at risk of bacteremia-induced infections due to their vascular access.^{10,23} In contrast, ventriculoperitoneal (VP) shunts do not involve any vascular structures and, consequently, do not require

antibiotic prophylaxis.^{10,23} Consultation with the child's physician is recommended for management of patients with vascular shunts.

Patients with prosthetic joints

For patients with a history of total joint arthroplasty, deep hematogenous infections can lead to life threatening complications such as a loss of the prosthetic joint or even increased morbidity and mortality.^{27,28} A 2012 information statement published by the AAOS recommends that dentists consider antibiotic prophylaxis for at-risk joint replacement patients who are undergoing an invasive procedure.²⁸ Patients with an increased risk of hematogenous total joint infection are all patients with a prosthetic joint replacement, previous prosthetic joint infection, inflammatory arthropathies (e.g., rheumatoid arthritis, systemic lupus erythematosus), megaprosthesis, hemophilia, malnourishment, and compromised immunity (see examples in previous section).²⁸ However, AAOS states that clinical judgment must consider the potential benefit of antibiotic prophylaxis versus the risks of adverse reactions for each patient.^{3,4,28} The AAPD recognizes recommendations from AAOS and the ADA with regards to antibiotic prophylaxis for patients with joint replacement. A joint collaboration of the AAOS and the ADA developed evidence based recommendations on antibiotic prophylaxis for patients at a high risk for implant infection undergoing dental procedures (Table 4).^{3,4,28}

Currently, the AAPD endorses the 2012 recommendations of the ADA and the AAOS for management of patients with prosthetic joints.^{3,4,28} Antibiotic prophylaxis has not shown a significant reduction in the risk of developing joint infections subsequent to dental procedures.^{27,29} Therefore, antibiotic prophylaxis is not indicated for dental patients with pins, plates, screws, or other hardware that is not within a synovial joint nor is it indicated routinely for most dental patients with total joint replacements.^{28,30}

Consultation with the child's physician may be necessary for management of at-risk patients as well as patients with other implanted devices (e.g., Harrington rods, external fixation devices).^{10,27-30}

Acceptance by dental practitioners of AHA guidelines for antibiotic prophylaxis

The revised 2007 AHA guidelines provided a significant reduction in patients requiring antibiotic prophylaxis prior to invasive dental procedures. In a survey sent to U.S. dentists, 71 percent of the respondents reported they were satisfied with the current guidelines.³¹ The survey also demonstrated that 70 percent of the dentists reported a majority of patients previously receiving antibiotic prophylaxis no longer required prophylaxis.³¹ However, the same percentage of respondents also indicated that a significant number of these patients were still receiving antibiotic prophylaxis regardless of the AHA revised guidelines.³¹

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