

Quality Resource Guide

Contemporary Approaches to Antibiotic Prophylaxis in Dental Practice

Author Acknowledgements

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Educational Objectives

Following this unit of instruction, the learner should be able to:

1. Understand the rationale for antibiotic prophylaxis in dentistry.
2. Describe the most recent guidelines for antibiotic prophylaxis in patients with cardiac conditions.
3. Select the appropriate antibiotic regimen for those patients who have a clinical indication for infective endocarditis prophylaxis.
4. Describe the most recent guidelines for antibiotic prophylaxis in patients with prosthetic joints.
5. Understand the rationale behind the changes in antibiotic prophylaxis in patients with prosthetic joints.

MetLife designates this activity for 1.0 **continuing education credits** for the review of this Quality Resource Guide and successful completion of the post test.

Dr Sollecito is Immediate Past President of the American Board of Oral Medicine.

Dr. Stoopler is Immediate Past President of the American Academy of Oral Medicine and a consultant for the ADA Council of Scientific Affairs.

The following commentary highlights fundamental and commonly accepted practices on the subject matter. The information is intended as a general overview and is for educational purposes only. This information does not constitute legal or medical advice, which can only be provided by an attorney.

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Introduction

With life expectancy in the United States on the rise, patients with complex medical problems will continue to require dental care. It is estimated that the number of patients 65 years and older will rise to 94.6 million by the year 2060, while those over the age of 85 will increase to over 19 million.¹ Forty percent of these patients will have chronic conditions, including heart disease and arthritis, that limit daily activities.² Many of these patients will be prescribed multiple medications to treat their ailments.³ Dental treatment has become increasingly complex, often requiring multiple appointments of long duration. Today's dentist will be required to have significant medical

training in order to serve the growing needs of the population. Dentists will need to recognize deviations from normal health that may alter dental treatment, including the decision to use prophylactic antibiotics. Since antibiotic use is associated with risks of allergy, opportunistic infections and societal risk of resistance, antimicrobial stewardship is critical. However, there are various clinical situations when prophylactic antibiotics may be appropriately used prior to dental treatment. For example, practitioners will consider administering antibiotic prophylaxis if their patients are significantly immunosuppressed or severely neutropenic.^{4,5}

There are also times when the dentist will need to make informed decisions regarding the risk of dental procedures for a patient without using prophylactic antibiotics versus the risk of using an antibiotic prophylactically, and identify the need for medical consultation when the underlying conditions are unclear.

The scope of this Quality Resource Guide will include the consideration of using antibiotic prophylaxis in patients with cardiac valvular disease and with prosthetic joints.

Rationale for Antibiotic Prophylaxis in Dentistry

A dentist is often faced with the decision whether to use antibiotics prior to dental procedures to prevent a distant site infection (DSI). The rationale for use is based in biologic plausibility as bacteria from the mouth have been implicated in severe infections in other parts of the body, specifically in cardiac valves and prosthetic joints. Studies over the years have used bacteremia as a surrogate risk factor for developing DSI.⁵ Of concern is that transient bacteremia has been proven to occur after normal physiologic activities, such as eating. However, this bacteremia will usually clear quickly after the activity.⁶ Likewise, tooth-brushing results in transient bacteremia in many cases. The risk of transient bacteremia during certain dental procedures is also very likely. Lockhart, *et. al.*, in 2008 studied bacteremia associated with tooth brushing and dental extraction and noted that although amoxicillin had a significant impact on bacteremia resulting from a single-tooth extraction, given the greater frequency for oral hygiene, tooth brushing may be a greater threat for individuals at risk for infective

endocarditis (IE).⁷ In another study, he noted that oral hygiene and gingival disease indexes were associated significantly with IE-related bacteremia after tooth brushing. In this study, 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. Furthermore, the presence of generalized bleeding after tooth brushing was associated with an almost eightfold increase in risk of developing bacteremia.⁸ Since bacteremia has been suggested as a flawed surrogate for risk of DSI,⁹ and antibiotics have both individual and societal side effects, especially when used repeatedly (as in antibiotic prophylaxis),⁵ serious questions remain:

- Does dental treatment-induced bacteremia cause distant site infections?
- If so which patients are at greatest risk?
- Does antibiotic prophylaxis prevent these bacteremic events?
- What is the risk / benefit ratio in using antibiotic prophylaxis?

Although medical consultation is a means for obtaining the necessary information to make decisions and render treatment, it does not exonerate dentists from responsibility.¹⁰ Since dentists remain legally accountable for the care they provide, an evidence-based approach should guide care.

So, dentists are often faced with the important question: is antibiotic prophylaxis necessary for my patient?

Prevention of Endocarditis

Guidelines from the American Heart Association

Infective Endocarditis (IE) is a microbial infection of the heart valves or endocardium. It is important for dentists to recognize patients at risk for IE. Current data indicates the incidence of IE in the U.S. is 12.7 cases per 100,000 persons per year.¹¹ IE is more common in men with a mean age of diagnosis of 60.8 years old. Endocarditis has become more common in the elderly with 50% of all cases occurring in patients over 50. It has been suggested that this trend maybe due to an aging population, increased prevalence of cardiac valvular disease or an increasing population having in-dwelling devices.^{12,13} Infective endocarditis is commonly divided into native valve endocarditis (NVE) and prosthetic valve endocarditis (PVE). NVE can be subdivided into acute and subacute categories while PVE could be divided into early and late varieties. Acute NVE usually develops quickly and is most often caused by *Staphylococcus aureus* while subacute NVE progresses over weeks to months and is

usually caused by a viridans group *streptococci* (VGS) or *enterococci*.¹¹ The incidence of subacute NVE also increases in susceptible populations, such as those patients with a previous history of structural cardiac or cardiac valve abnormality.^{11,12} Subacute NVE caused by VGS is the type of IE that has been associated with dental procedures. Symptoms of bacterial endocarditis caused by VGS usually can be seen within 2 weeks of the precipitating event. However, most cases of IE are not related temporally to medical/dental procedures. Furthermore, there are numerous conflicting studies regarding effectiveness of antibiotic prophylaxis.^{13,14} Although there are a very small number of cases of endocarditis temporally associated with medical/dental procedures and limited data demonstrating the effectiveness of antibiotic prophylaxis, antibiotic prophylaxis prior to dental procedures has been used since 1955 with various periodic updates and modifications.

The American Heart Association (AHA) produced guidelines [endorsed by the American Dental Association (ADA)] outlining when to use prophylactic

antibiotics and to which cohort of patients (those at the highest risk of an adverse outcome from IE) antibiotics should be administered.^{14,15} (See **Table 1** and **Table 2**)

The evidence supporting this guideline was reviewed in 2021 and additional suggestions were made, including adding patients with left ventricular assist devices and implantable prosthetic heart to the “high risk” group.¹⁵

The AHA also has specific antibiotic regimens.¹⁵ Of note, the 2021 AHA scientific statement on prevention of infective endocarditis no longer recommends use of clindamycin due to potential serious side effects and introduced doxycycline as an alternative to patients allergic to penicillins, including amoxicillin (See **Table 3**). Mindful that it is not possible to make suggestions for AP that deal with every possible circumstance/situation, clinical judgment and shared decision making with the patient are important. The AHA also offered guidance on some special circumstances that should also be considered. (See **Table 4**)

Antibiotics Prior to Dental Procedures in Patients with Prosthetic Joints

There are more than 1 million total joint arthroplasties performed annually in the United States.¹⁶ Many of these procedures were performed on older patients and estimates suggest increasing numbers of patients with prosthetic joints can be expected given the aging population. By 2030, total hip arthroplasties and total knee arthroplasties are estimated at 635,000 and 935,000 procedures, respectively.¹⁷ Infection rates for such operations range from 0.8% to 2.2%, and can be caused by the seeding of bacteria at the time of surgery, from hematogenous seeding (bacteremia), or

spread of infection from an adjacent site.¹⁸⁻²⁰ Infections of total joint replacements can result in significant cost, morbidity and even mortality. Prosthetic joint infections will usually occur within 1-2 years post replacement.¹⁸⁻²⁰ *Staphylococcus* bacteria are the most common pathogen implicated in prosthetic joint infections.²¹ However, there have been prosthetic joint infections caused by streptococcal infections, which were thought to originate from the mouth. In fact, the identification of oral bacterial DNA in synovial fluid of arthritis patients with native and failed prosthetic joints has been reported.²²

Given biologic plausibility, antibiotic prophylaxis prior to dental procedures has been considered.

Advisory statements, information statements and evidence based guidelines regarding antibiotic prophylaxis preceding dental therapy for patients previously receiving a prosthetic joint or other orthopedic implant were created and distributed between 2003 and 2012 by the ADA and the American Academy of Orthopedic Surgeons (AAOS).²³⁻²⁵ These documents continued to modify clinical approaches as higher quality evidence emerged.

In 2014, the ADA Council on Scientific Affairs produced an evidence-based clinical practice guideline for dental practitioners regarding the use of prophylactic antibiotics prior to dental procedures in patients with prosthetic joints.²⁶ Given a moderate grade of evidence, they concluded:

In general, for patients with prosthetic joint implants, prophylactic antibiotics are not recommended prior to dental procedures to prevent prosthetic joint infection.

- Evidence fails to demonstrate:
 - An association between dental procedures and prosthetic joint infections
 - Effectiveness of antibiotic prophylaxis
- Mindful of the potential harm from antibiotic use, using antibiotics before dental procedures is not recommended to prevent prosthetic joint infection
- Additional case control studies are needed to increase the level of certainty in the evidence to a level higher than moderate

Furthermore, antibiotic resistance, adverse drug reactions and cost must also be considered when deciding for or against antibiotic prophylaxis. Repeated exposure to antibiotics is a risk factor for the development of resistant bacteria. Emergence of resistant bacteria poses a serious risk to society. Prolonged treatment with antibiotics is also associated with candidiasis. Although a single dose of antibiotics for prophylaxis of prosthetic joint infection is unlikely to cause a *Clostridioides* (formerly *Clostridium*) *difficile* infection, comprehensive dental care often involves multiple appointments. This additional exposure to patients who may have taken antibiotics for other medical conditions will increase the risk of experiencing changes in the gastrointestinal flora, leading to pseudomembranous colitis. A recent study estimated that in a single year

there were approximately 462,000 people with *C. difficile* infections (slightly decreased from 2012 to 2017),²⁷ while the CDC estimates those infections result in nearly 12,800 deaths in 2017 and costing approximately over 1 billion dollars in healthcare costs.^{28,29} Investigators have identified clindamycin and cephalosporins (both considered useful in antibiotic prophylaxis) as possible *C. difficile* infection-inducing medications.³⁰ Lastly, the annual cost of amoxicillin administered to patients with hip and knee prostheses before dental procedures in the United States may exceed \$50 million.³¹

Barbari and colleagues,³² identified prosthetic joint infection risk factors **independent of dental procedures**, including:

- Post-arthroplasty wound dehiscence
- Post-arthroplasty wound hematoma
- Post-arthroplasty wound infection

There were also some additional preoperative factors/conditions with significant odds ratios for prosthetic joint infections **independent of dental procedures**, including prior operation/arthroplasty on the index joint, diabetes mellitus, and/or being immunocompromised (defined as rheumatoid arthritis or current use of systemic steroids/immunosuppressive drugs or diabetes mellitus or presence of a malignancy or a history of chronic kidney disease).

Because the available evidence is not detailed enough to apply to the full range of patients in everyday practice, the AAOS completed work on an **Appropriate Use Criteria (AUC)** www.orthoguidelines.org/go/auc in the fall of 2016.^{18,33} The AUC is a **decision-support tool** to help clinicians in their judgment regarding antibiotic prophylaxis for patients with a prosthetic joint. The AUC was generated to provide further input as to when/if there are some SPECIAL circumstances, in higher risk populations, when there may be some rationale in using antibiotic prophylaxis. It is based on **expert opinion**.

The AUC takes into consideration various scenarios including:

- Planned dental procedure
- Immunocompromised status
- Glycemic control
- History of peri-prosthetic or deep prosthetic joint infection of the hip or knee that required an operation
- Time since hip or knee joint replacement procedure

By applying various different scenarios, the AUC can help a clinician determine when antibiotic prophylaxis is *rarely appropriate*, *may be appropriate* or *is appropriate* in special patient circumstances.

It is important to understand that these scenarios may indeed have some added risk of developing prosthetic joint infections in a small number of patients, but they are independent of dental treatment, since there is no evidence to support an association between dental procedures and risk of experiencing prosthetic joint infections.^{18,34}

Discussion of available treatment options applicable to each individual patient relies on obtaining a proper medical history, open communication between the patient, dentist, and orthopedic surgeon, and weighing the potential risks and benefits for that specific patient. It is appropriate for the dentist to make the final judgment to use antibiotic prophylaxis for patients potentially at higher risk of experiencing prosthetic joint infection using the AUC as a guide, without consulting the orthopedic surgeon.¹⁹

Conclusion

This report is intended to assist practitioners with making decisions about the use of prophylactic antibiotics. The considerations in this document are not intended to define a standard of care and should be integrated with the practitioner's professional judgment and the patient's needs and preference. The practitioner should also be diligent in keeping up to date regarding any changes to guidelines, or new clinical practices guidelines, updating recommendations for use of antibiotic prophylaxis prior to dental procedures. The ADA Website (<http://www.ada.org/en/member-center/oral-health-topics/antibiotic-prophylaxis>) is a good site to review any updates.

Table 1¹⁵ - Dental procedures for which endocarditis prophylaxis is reasonable in high risk patients

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** antibiotic prophylaxis:

- Routine anesthetic injections through non-infected tissue
- Taking dental radiographs
- Placement of removable prosthodontics or orthodontic appliances
- Adjustment of orthodontic appliances
- Placement of orthodontic brackets
- Shedding of deciduous teeth
- Bleeding from trauma to the lips or oral mucosa.

* Adapted from Reference 15

Table 2¹⁵ - Underlying Cardiac Conditions for Which Antibiotic Prophylaxis Is Suggested

Prosthetic cardiac valve or material

- Presence of cardiac prosthetic valve
- Transcatheter implantation of prosthetic valves
- Cardiac valve repair with devices, including annuloplasty, rings, or clips
- Left ventricular assist devices or implantable heart

Previous, relapse, or recurrent IE

CHD

- Unrepaired cyanotic congenital CHD, including palliative shunts and conduits.
- Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by transcatheter during the first 6 months after the procedure
- Repaired CHD with residual defects at the site of or adjacent to the site of a prosthetic patch or prosthetic device
- Surgical or transcatheter pulmonary artery valve or conduit placement such as Melody valve and Contegra conduit

Cardiac transplant recipients who develop cardiac valvulopathy

* Adapted from Reference 15

Table 3¹⁵ - Antibiotic regimens for a dental procedure*

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	2g 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 penicillin or ampicillin - oral	Cephalexin* OR	2 g	50 mg/kg
	Azithromycin or clarithromycin OR	500 mg	15 mg/kg
	Doxycycline	100 mg	<45 kg, 2.2 mg/kg >45 kg, 100 mg
Allergic to penicillin or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone†	1 g IM or IV	50 mg/kg IM or IV

Clindamycin is no longer recommended for antibiotic prophylaxis for a dental procedure.

Macrolide antibiotics should be used with caution in patients who are known to have a prolonged QTc interval.

IM indicates intramuscular; and IV, intravenous.

* Or other first- or second-generation oral cephalosporin in equivalent adult or pediatric dosing.

† Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticarial with penicillin or ampicillin.

* Adapted from Reference 15

Table 4¹⁵ - Special Considerations

- Patients who are at risk for IE can receive any indicated dental care.
- Coronary artery bypass graft (CABG) or coronary artery stents (after endothelialization) do not routinely require antibiotic prophylaxis prior to dental treatment.
- If the dosage of antibiotic is inadvertently not administered before the procedure, the dosage may be administered up to two hours after the procedure.
- If a patient is already receiving antibiotic therapy with an antibiotic that is also recommended for IE prophylaxis, it is prudent to select an antibiotic from a different class rather than to increase the dosage of the current antibiotic, or preferably delay dental treatment for 10 days after completion of the antibiotic therapy to allow time for the usual oral flora to be re-established.
- In patients undergoing multiple sequential dental appointments, if possible, it is preferable to delay the next procedure for 10 days after the last dose of antibiotic therapy.
- In patients who are receiving parenteral antimicrobial therapy for IE or other infections and require a dental procedure, the same parenteral antibiotic may be continued through the dental procedure.
- For all patients with an increased risk of or from VGS IE, a plan for responding to IE symptoms should be reinforced at every health care contact.
- Current scientific data suggest that maintaining good oral health care in patients at risk of or from VGS IE has a major impact on preventing bacteremia with VGS from routine daily activities such as toothbrushing

* Adapted from Reference 15

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POST-TEST

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(1.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. **Bacteremia from an oral source has been associated with:**
 - a. Invasive dental treatment
 - B. Eating
 - C. Tooth brushing
 - D. All of the above

2. **Bacteremia from daily tooth brushing maybe a greater threat for individuals at risk for infective endocarditis (IE) than a single tooth extraction. This statement is accurate:**
 - a. True
 - b. False

3. **According to the 2007 AHA guidelines and the 2021 scientific statement, cardiac conditions associated with the highest risk of adverse outcome from endocarditis for which prophylaxis with dental procedures is recommended include:**
 - a. Previous episode of infective endocarditis
 - B. Patients that have had a coronary artery bypass graft (CABG)
 - C. Patients with a pacemaker
 - D. None of the above conditions are considered associated with the highest risk of adverse outcome from endocarditis and therefore antibiotic prophylaxis with dental procedures not needed

4. **Which regimen(s) is/are recommended and acceptable by the 2021 American Heart Association (AHA) scientific statement to prevent infective endocarditis in susceptible adult dental patients?**
 - a. Doxycycline 100 mg by mouth 30 - 60 minutes prior to dental procedure, if the patient is penicillin allergic.
 - b. Amoxicillin 2 grams by mouth 30 – 60 minutes prior to dental procedure.
 - c. Clarithromycin 500 milligrams by mouth 30 - 60 minutes prior to dental procedure, if the patient is allergic to amoxicillin.
 - d. All of the above

5. **According to the 2007 AHA guidelines and the 2021 scientific statement, which of the following dental procedures is indicated for endocarditis prophylaxis for a susceptible patient?**
 - a. Routine anesthetic injections through non-infected tissue
 - B. Placement of orthodontic brackets
 - C. Periodontal scaling / root planning
 - D. All of the above

6. **In general, for patients with prosthetic joint implants, prophylactic antibiotics (PA) are not recommended prior to dental procedures to prevent prosthetic joint infection. The above statement is:**
 - a. True
 - b. False

7. **The AUC is a decision-support tool to supplement clinicians in their judgment regarding antibiotic prophylaxis for patients with a prosthetic joint who are undergoing dental procedures. Please select the correct answer:**
 - a. The AUC supports using antibiotic prophylaxis for ALL patients
 - b. The AUC eliminates the need to take an appropriate medical history
 - c. It is appropriate for the dentist to make the final judgment to use antibiotic prophylaxis for patients potentially at higher risk of experiencing prosthetic joint infection (independent of dental treatment) using the AUC as a guide, without consulting the orthopedic surgeon
 - d. The AUC is supported by a strong base of scientific evidence

8. **The clinical practice guideline recommendations in: The use of prophylactic antibiotics prior to dental procedures in patients with prosthetic joints: Evidence-based clinical practice guideline for dental practitioners. J Am Dent Assoc 2015;146:11-16e7 are not intended to define a standard of care and rather should be integrated with the practitioner’s professional judgment and the patient’s needs and preferences. The above statement is:**
 - a. True
 - b. False

9. **Please choose the correct statement:**
 - a. The benefits of using antibiotics ALWAYS outweighs the risks
 - B. There is evidence that antibiotics taken before dental procedures PREVENT prosthetic joint infections
 - C. There is evidence that dental procedures are NOT associated with prosthetic joint infections
 - D. When in doubt, ALWAYS offer antibiotic prophylaxis

10. **The CDC has determined that *Clostridioides difficile* infections:**
 - a. In a single year affected over 460,000 people
 - B. Resulted in over 12,000 deaths per year
 - C. Costs over 1 billion dollars in healthcare costs
 - D. All of the above

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1. How well did this course meet its stated educational objectives?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. How would you rate the quality of the content?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Please rate the effectiveness of the author.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. Please rate the written materials and visual aids used.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. The use of evidence-based dentistry on the topic when applicable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> N/A
6. How relevant was the course material to your practice?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. The extent to which the course enhanced your current knowledge or skill?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8. The level to which your personal objectives were satisfied.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9. Please rate the administrative arrangements for this course.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

10. How likely are you to recommend MetLife's CE program to a friend or colleague? *(please circle one number below:)*

10	9	8	7	6	5	4	3	2	1	0
extremely likely				neutral						not likely at all

What is the primary reason for your 0-10 recommendation rating above?

11. Please identify future topics that you would like to see:

Thank you for your time and feedback.



To complete the program traditionally, please mail your post test and registration/evaluation form to:
MetLife Dental Quality Initiatives Program | 501 US Highway 22 | Bridgewater, NJ 08807