Abstract
In 2009 the American Academy of Orthopaedic Surgeons (AAOS) website published a statement calling for universal antibiotic prophylaxis (AP). This statement was in conflict with the former joint guidelines published by the American Dental Association (ADA) and the AAOS. The ADA was not consulted prior to publishing the 2009 statement on the AAOS website. The event led to a call from many organizations to conduct a systematic review of the literature to establish evidence-based guidelines regarding the efficacy of AP to prevent prosthetic joint infection (PJI). Those guidelines were published December 2012 on the AAOS website and suggested practitioners reconsider the decision to call for AP in patients with hip and knee joint replacements. Maintenance of oral health was recommended as a measure to reduce the magnitude (number of microorganisms) of bacteremia.

Educational Objectives
At the end of this self-instructional education activity the participant will be able to:
1. Consider the scientific basis supporting the efficacy of antibiotic prophylaxis for preventing infection in a prosthetic joint.
2. List the three recommendations included in the December 2012 American Dental Association/American Academy of Orthopaedic Surgeons guideline document for patients with a prosthetic joint receiving dental care.
3. Identify the types of joint replacements which may not need antibiotic prophylaxis coverage prior to oral procedures.
4. Discuss levels of evidence in the guideline document and the impact on clinical decisions for antibiotic prophylaxis when a prosthetic joint exists.

Author Profiles
Frieda Atherton Pickett has taught dental hygiene and directed dental hygiene programs for more than 30 years. She received the Distinguished Alumnus Award from the Alumni Association at Baylor College of Dentistry, Dallas TX. She has received awards for teaching excellence and currently mentors graduate dental hygiene students, preparing them to be the next generation of dental hygiene educators. Mrs. Pickett has a commitment to using evidence based research in all professional writings and has published over 20 papers in both dental hygiene, dental and medical journals. Her research on developing a table to determine patients needing referral for medical evaluation of blood pressure was judged to be among the top ten research papers in 2009 by a journal in pediatric medicine. She can be contacted at pickfrie@isu.edu.

Author Disclosure
Frieda Atherton Pickett has no commercial ties with the sponsors or providers of the unrestricted educational grant for this course.

This educational activity was developed by PennWell's Dental Group with no commercial support. This course was written for dentists, dental hygienists and assistants, from novice to skilled. Educational Methods: This course is a self-instructional journal and web activity. Educational Disclaimer: Information shared in this CE course is not intended to be used in place of the advice of a patient’s dentist. PennWell designates this activity for 1 continuing educational credit.
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Abstract
In 2009 the American Academy of Orthopaedic Surgeons (AAOS) website published a statement calling for universal antibiotic prophylaxis (AP). This statement was in conflict with the former joint guidelines published by the American Dental Association (ADA) and the AAOS. The ADA was not consulted prior to publishing the 2009 statement on the AAOS website. The event led to a call from many organizations to conduct a systematic review of the literature to establish evidence-based guidelines regarding the efficacy of AP to prevent prosthetic joint infection (PJI). Those guidelines were published December 2012 on the AAOS website and suggested practitioners reconsider the decision to call for AP in patients with hip and knee joint replacements. They are also available on the ADA Clinical Recommendations website at http://ebd.ada.org/ClinicalRecommendations.aspx. Maintenance of oral health was recommended as a measure to reduce the magnitude (number of microorganisms) of bacteremia.

Introduction
Individuals and groups responsible for monitoring the scientific support for clinical practices in healthcare have questioned the effectiveness of antibiotic prophylaxis (AP) to prevent infective endocarditis (IE) and prosthetic joint infection (PJI). In the United Kingdom the lack of scientific support for effectiveness led to the official statement of the National Institute for Health and Clinical Excellence (NICE guidelines) and decision to stop recommending (and the health division to stop paying for) AP to prevent infection. This decision was recently found to be valid regarding AP for IE as a follow-up of the incidence of IE revealed no increase in the two year period since the NICE guidelines were enacted. A similar study evaluating admissions to hospitals in the United States found no increase in admissions for IE since the 2007 American Heart Association guidelines reducing the conditions indicated for AP were published. No study comparing the hospital admissions for prosthetic joint infection before the 1997 joint guidelines (when all individuals with prosthetic joints were advised to have AP prior to dental treatment) compared with time since the guidelines were published has been reported. The 1997 joint guidelines greatly reduced the number of people with prosthetic joints indicated for AP. A study of this type would help to clarify if AP was beneficial in reducing PJI after having oral procedures.

Official Guidelines for AP
The discussion regarding the benefits versus the harms of AP led the American Dental Association to collaborate with the AAOS to establish situations in which AP might be beneficial to prevent PJI. The first joint guideline was published in 1997. This policy was updated in 2003 with few changes other than a clarification specifying immunocompromised conditions. The policy identified conditions having the greatest risk for developing a PJI and called for AP prior to dental treatment only in those conditions at high risk for PJI. These included the first two years following joint replacement, having a joint infection in the past, and being immunocompromised. The updated 2003 guideline policy was followed until 2009 when a statement was posted on the AAOS website advising all individuals with a prosthetic joint to have AP prior to receiving dental care. The rationale for the 2009 statement was based on the potential adverse outcomes and cost of treating an infected joint replacement, as well as the suspicion that bacteremia was the cause of infection in the prosthetic joint replacement.

2009 Statement on American Academy of Orthopaedic Surgeons website
A Safety Committee was appointed by AAOS to investigate the role of AP in preventing prosthetic joint infection. The outcome was an opinion statement calling for universal AP prior to receiving dental treatment when an individual has a prosthetic joint (i.e. everyone with a prosthetic joint should receive AP prior to dental procedures). The publication of this statement, without the consultation of the ADA, led to international outrage and a call for a systematic review of the evidence related to AP and PJI. The issues of objection related to the risks and potential harm in taking antibiotics, that taking antibiotics unnecessarily is thought to be a prime reason for the rise in antibiotic resistance, there is no established proof that bacteremia leads to PJI, and no proof exists that prophylactic antibiotics are effective to prevent prosthetic joint infection. Bacteremia is a surrogate measure of risk for PJI. Studies have questioned the use of surrogate measures that have not been validated. Bacteremia is a surrogate measure since no direct evidence exists linking bacteremia to PJI. To be scientifically and academically consistent, the current antibiotic prophylaxis guideline should use PJI, and not bacteremia, as the primary measurement of evidence.

2012 ADA/AAOS Guidelines for AP in Patient with Prosthetic Joint
A systematic review was completed by a variety of groups interested in evidence for the efficacy of AP to prevent PJI. These included the ADA Council on Scientific Affairs, representatives from
RECOMMENDATIONS FOR ANTIBiotic prophylaxis, prostHETIC JOINTS AND DENTAL TREATMENT

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

- 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.

- 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.


AAOS, the Infectious Disease Society, the American Academy of Oral and Maxillofacial Surgeons, and other interested groups. The initial draft report was circulated to a wide variety of professional association groups for comment, the final report was approved by members representing the ADA and AAOS. Guidelines based on the systematic review were published December 21, 2012. The guideline document contains three recommendations (Fig. 1). The recommendations begin with a statement that they were developed using systematic evidence-based processes designed to combat bias, enhance transparency, and promote reproducibility.14

Recommendation 1. The first recommendation states, “The practitioner might consider discontinuing the practice of routinely prescribing prophylactic antibiotics for patients with hip and knee prosthetic joint implants undergoing dental procedures.”14 The statement included only hip and knee prosthetic joint implants as no specific data are available covering joint replacements in the finger, elbow, ankle, or shoulder. This statement is followed by a grade for the recommendation which is limited. The grade is defined as “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.”14 The discussion of the recommendation includes a statement “all users of this clinical practice guideline are cautioned that an absence of evidence is not evidence of ineffectiveness.”14 One could have the opposite view that no evidence is available to prove effectiveness of AP to prevent PJI. Professional clinicians should use the best evidence to guide clinical decisions. The clinical application section follows the definition and states, “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.”14 The ADA/AAOS developed a mechanism to involve the patient in the decision of whether to take antibiotics prior to receiving oral care. This was called “A Shared Decision Making Tool.” The Shared Decision Making Tool would engage patients in a decision-making process by providing information to further clarify risks during oral procedures, as well as perceived benefits of AP. Alternatives to consider prior to treatment are also included. The use of this form promotes the collaborative decision-making between patient and clinician to decide the best treatment strategy. It is an additional tool and supplements — but does not replace — informed consent procedures.

Although the recommendation suggests discontinuing the practice of prescribing antibiotic prophylaxis for individuals with a knee or hip prosthetic joint prior to receiving dental procedures, the fact that the recommendation had only one study of moderate quality to support the guideline, plus the clinical application statement urging caution in deciding to follow a recommendation based on limited evidence, suggests the issue of whether AP is necessary may still not be settled. The one study supporting the first recommendation was a prospective case control study by Berberi et al. The study examined the association between dental procedures with or without antibiotic prophylaxis and in subjects with prosthetic hip or knee infection. A single-center, prospective case-control study during the period of 2001–2006 was performed. Case patients were patients hospitalized with total hip or knee infection. Control subjects were patients who underwent a total hip or knee replacement but without a prosthetic joint infection who were hospitalized during the same period on the same orthopedic floor. Data regarding demographic features and potential risk factors of subjects in the study were collected and a reliable statistical test was used to assess the association of variables with the probability of infection.

Results: The study enrolled a total of 339 case patients and 339 control subjects. There was no increased risk of prosthetic hip or knee infection for patients undergoing a high-risk (extraction) or low-risk (restoration) dental procedure who were not administered antibiotic prophylaxis (adjusted odds ratio [OR], 0.8; 95% confidence interval [CI], 0.4–1.6). An odds ratio of 1 means no association exists between the experimental group and the control group. The odds ratio less than one (0.8) supports the lack of risk for PJI after dental procedures. This was compared with the risk for patients not undergoing a dental procedure (adjusted OR, 0.6; 95% CI, 0.4–1.1) respectively. Antibiotic prophylaxis in high-risk or low-risk dental procedures did not decrease the risk of subsequent total hip or knee infection (adjusted OR, 0.9 [95% CI, 0.5–1.6] and 1.2 [95% CI, 0.7–2.2], respectively). The authors concluded dental procedures were not risk factors for subsequent total hip or knee infection. In addition, the use of antibiotic prophylaxis prior to dental procedures did not decrease the risk of subsequent total hip or knee infection. In the executive summary explaining the use of the official
Recommendations, the application of recommendation 1 to only hip and knee joint replacements was verified.\(^\text{16}\)

**Recommendation 2.** The second recommendation is a statement which does not recommend use of antimicrobial rinses, such as chlorhexidine, to prevent infection in any prosthetic joint. It states “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.”\(^\text{14}\) The grade for the recommendation is inconclusive. The definition of this grade is described as “a lack of compelling evidence resulting in an unclear balance between benefits and potential harm.”\(^\text{14}\) The studies examined reported conflicting results so no recommendation could be made for or against. Since past recommendations for AP to prevent IE suggested chlorhexidine could be used to reduce bacteremia, the group included this evidence statement in an attempt to clarify this issue. Practitioners were advised to consider this recommendation when making product recommendations.

**Recommendation 3.** The third recommendation summarized the literature review regarding the impact of oral health on prevention of PJI. It states “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.”\(^\text{14}\) The grade for this recommendation was consensus. The definition for this grade means “that expert opinion supports the guideline recommendation even though there is no available empirical evidence that meets the inclusion criteria.”\(^\text{14}\) Expert opinion is a low level of evidence support but it was judged that no harm could come from advising patients with a prosthetic joint to maintain good oral health. The clinical implication listed for this recommendation is “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.”\(^\text{14}\)

**Risk Factors for Increased Risk of Infection**

In the 2003 joint guideline increased risk for PJI was judged to be during the first two years after joint replacement surgery, having a previous infection in the joint and being immunocompromised.\(^\text{9}\) In the executive summary of the 2012 guideline document the results of the review of evidence on increased risk factors for bacteremia were explained.\(^\text{16}\) Instances of bacteremia following dental procedures may be modified by individual risk factors. Although the strength of the evidence is low, a multitude of patient characteristics as potential risk factors for developing bacteremia from dental procedures were investigated. These low strength studies report on oral health indicators and general patient characteristics such as age, gender, etc. The results were often contradictory and varied across and within procedure groups. Therefore no conclusions about risk factors could be drawn from these studies. A table of risk factors was included in the 137 page guideline document, but since no recommendation was made that addressed risk factors for PJI, it should be understood that this issue is unsettled. The editorial on the AAOS website noted that there is no research proving that bacteremia increases the risk for infection in a prosthetic joint.\(^\text{17}\) So, this is another unsettled issue in the evaluation of the scientific support for the speculation that bacteremia is the mechanism for infection in late prosthetic joint infection (infection that occurs months to years after the joint replacement).

**Summary and Conclusions**

The 2012 ADA/AAOS guidelines for AP prior to dental procedures in a client with a prosthetic joint, along with an editorial explaining the formation of the guidelines and an executive summary providing additional explanation on the application of the guidelines are all available on the AAOS website.\(^\text{18}\) The clinician should read these documents and consider the explanations of how the guidelines were developed and the clinical implications for the guidelines. The three recommendations may not resolve the issue regarding if individuals with a prosthetic joint would benefit from taking prophylactic antibiotics, rinsing with chlorhexidine or maintaining oral health. The evidence is meager and most studies were judged to be of low level. It is clear that additional research needs to be completed to answer the question using multiple high to moderate level studies. The low level of studies did not allow guideline committee members to identify risk factors that increase the probability for PJI following oral procedures. For the clinician, the final decision for AP before dental procedures should be considered on a case by case basis since few high level studies exist to provide direction.

**References**


Author Profile
Frieda Atherton Pickett has taught dental hygiene and directed dental hygiene programs for more than 30 years. She received the Distinguished Alumnus Award from the Alumni Association at Baylor College of Dentistry, Dallas TX. She has received awards for teaching excellence and currently mentors graduate dental hygiene students, preparing them to be the next generation of dental hygiene educators. Mrs. Pickett has a commitment to using evidence based research in all professional writings and has published over 20 papers in both dental hygiene, dental and medical journals. Her research on developing a table to determine patients needing referral for medical evaluation of blood pressure was judged to be among the top ten research papers in 2009 by a journal in pediatric medicine. She can be contacted at pickfrie@isu.edu.

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Questions

1. The 2012 joint guidelines of the American Dental Association and the American Academy of Orthopaedic Surgeons recommend abandoning antibiotic prophylaxis before dental treatment in which of the following patients?
   a. All individuals with a prosthetic joint
   b. Individuals with hip or knee replacements.
   c. Individuals with a high risk for infection in the prosthesis

2. The 2012 joint guidelines of the American Dental Association and the American Academy of Orthopaedic Surgeons recommends which of the following antimicrobial products prior to oral procedures?
   a. Chlorhexidine
   b. Povidone iodine
   c. Neither of these

3. Oral health was judged to be a _____ factor in determining the risk for prosthetic joint infection associated with oral procedures.
   a. Minor
   b. Major
   c. Limited evidence

4. The recommendation regarding the evidence of whether antibiotics prevent prosthetic joint infection is based on what type of studies?
   a. Multiple randomized controlled trials
   b. One moderate level case control study
   c. Multiple case reports

5. It was found that bacteremia is a(an) _____ factor in the etiology of prosthetic joint infection.
   a. Moderate
   b. Major
   c. Unproven

6. The 2012 ADA/AAOS guideline document defines the level of evidence considered in formulation of the first recommendation to abandon prescribing antibiotic prophylaxis in selected patients prior to dental procedures as _________.

   a. Limited
   b. Consensus level
   c. By expert opinion
   d. None of these

7. In 2009, what group changed the American Academy of Orthopaedic Surgeons’ statement regarding the use of antibiotic prophylaxis prior to dental treatment in individuals with a prosthetic joint?
   a. Scientific Council
   b. Safety Committee
   c. House of Delegates of the professional association

8. The 2009 AAOS statement was made in conjunction with which professional group?
   a. The American Dental Association
   b. The Infectious Disease Society
   c. The American Academy of Oral Medicine
   d. None of these

9. In the 2009 AAOS statement, the recommendation regarding antibiotic prophylaxis prior to dental procedures in individuals with a prosthetic joint was _________.
   a. Provide universal antibiotic prophylaxis.
   b. Provide antibiotic prophylaxis only to patients at high risk for joint infection.
   c. Provide antibiotic prophylaxis along with an antimicrobial rinse prior to all dental treatment.
   d. None of these

10. The Berbari prospective study used in establishing the 2012 guidelines for antibiotic prophylaxis found that _________.
    a. Antibiotic prophylaxis prevented infection in prosthetic joints.
    b. An increased risk of prosthetic hip or knee infection existed for patients undergoing a high-risk dental procedure.
    c. Antibiotic prophylaxis in high-risk or low-risk dental procedures did not decrease the risk of subsequent total hip or knee infection.
    d. Dental procedures placed the patient with a prosthetic joint at increased risk for a PJI.

11. High risk dental procedures include all of the following except one. Which is the exception?
    a. Endodontic procedures
    b. Tooth extraction
    c. Periodontal debridement

12. An odds ratio of 1 means:
    a. The association between two conditions is 100% higher between the experimental group and the control group.
    b. There is a weak but statistically significant association between the experimental group and the control group.
    c. There is no difference between the experimental group and the control group.

13. The Berbari case control study found that dental procedures ______ the risk for prosthetic hip or knee joint infection.
    a. Increased
    b. Decreased
    c. Did not affect

14. An “inconclusive” recommendation is professional guidelines means:
    a. there is a lack of compelling evidence resulting in an unclear balance between benefits and potential harm of the recommendation.
    b. evidence does not support, and may include potential harms, for the recommendation.
    c. the group developing the recommendations could not come to a conclusion to make a recommendation.
    d. None of these defines the term.

15. Which of the following grades for recommendations is based on “expert opinion”? 
    a. Limited
    b. Inconclusive
    c. consensus
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Prosthetic Joints and Antibiotic Prophylaxis

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Educational Objectives
1. Consider the scientific basis supporting the efficacy of antibiotic prophylaxis for preventing infection in prosthetic joint.
2. List the recommendations included in the December 2012 American Dental Association/American Academy of Orthopaedic Surgeons guideline document for patients with a prosthetic joint receiving dental care.
3. Identify joint replacements in which routine antibiotic prophylaxis is covered prior to dental procedures.
4. Discuss levels of evidence in the guideline document and the impact on clinical decisions for antibiotic prophylaxis when a prosthetic joint exists.

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