

Prevention of Orthopaedic Implant Infection in Patients Undergoing Dental Procedures

William Watters III, MD
 Michael P. Rethman, DDS, MS
 Nicholas Buck Hanson, MPH
 Elliot Abt, DDS
 Paul A. Anderson, MD
 Karen C. Carroll, MD, FCAP
 Harry C. Futrell, DMD
 Kevin Garvin, MD
 Stephen O. Glenn, DDS
 John Hellstein, DDS, MS
 Angela Hewlett, MD, MS
 David Kolessar, MD
 Calin Moucha, MD
 Richard J. O'Donnell, MD
 John E. O'Toole, MD
 Douglas R. Osmon, MD
 Richard Parker Evans, MD
 Anthony Rinella, MD
 Mark J. Steinberg, DDS, MD
 Michael Goldberg, MD
 Helen Ristic, PhD
 Kevin Boyer
 Patrick Sluka, MPH
 William Robert Martin III, MD
 Deborah S. Cummins, PhD
 Sharon Song, PhD
 Anne Woznica, MLIS
 Leeaht Gross, MPH

J Am Acad Orthop Surg 2013;21:
180-189

[http://dx.doi.org/10.5435/
JAAOS-21-03-180](http://dx.doi.org/10.5435/JAAOS-21-03-180)

Copyright 2013 by the American
Academy of Orthopaedic Surgeons.

Abstract

The Prevention of Orthopaedic Implant Infection in Patients Undergoing Dental Procedures evidence-based clinical practice guideline was codeveloped by the American Academy of Orthopaedic Surgeons (AAOS) and the American Dental Association. This guideline replaces the previous AAOS Information Statement, "Antibiotic Prophylaxis in Bacteremia in Patients With Joint Replacement," published in 2009. Based on the best current evidence and a systematic review of published studies, three recommendations have been created to guide clinical practice in the prevention of orthopaedic implant infections in patients undergoing dental procedures. The first recommendation is graded as Limited; this recommendation proposes that the practitioner consider changing the long-standing practice of routinely prescribing prophylactic antibiotic for patients with orthopaedic implants who undergo dental procedures. The second, graded as Inconclusive, addresses the use of oral topical antimicrobials in the prevention of periprosthetic joint infections. The third recommendation, a Consensus statement, addresses the maintenance of good oral hygiene.

Overview and Rationale

This clinical practice guideline was approved by the American Academy of Orthopaedic Surgeons (AAOS) Board of Directors in December 2012 and by the American Dental Association (ADA) Council on Scientific Affairs in November 2012. The purpose of this clinical practice guideline is to help improve prevention and treatment based on the current best evidence.

The recommendations in this guideline are not intended to be a fixed protocol; and as with all evidence-based recommendations, practitioners must also rely on their clinical judgment as well as their patients' preferences and

values when making treatment decisions.

This clinical practice guideline was developed using a rigorous, standardized process, beginning with a systematic review of the available literature published from 1960 through July 2011 related to the prevention of orthopaedic implant infection in patients undergoing dental procedures. The systematic review demonstrates where there is good evidence, where evidence is lacking, and what topics future research could target to improve the prevention of orthopaedic implant infection in patients undergoing dental procedures.

The AAOS and ADA created this guideline as an educational tool to guide qualified physicians and dentists through a series of treatment de-

cisions in an effort to improve the quality and effectiveness of care. This guideline should not be construed as including all proper methods of care or as excluding methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment must be made in light of all circumstances presented by the patient and the

needs and resources particular to the locality or institution.

Potential Harms, Benefits, and Contraindications

The goal of prevention of orthopaedic implant infection in patients undergoing dental procedures is avoidance of serious complications resulting from

orthopaedic implant infection. Most treatments are associated with some known risks. In addition, contraindications vary widely based on the treatment administered. Therefore, discussion of available treatments applicable to the individual patient relies on mutual communication between the patient, dentist, and physician, weighing the potential risks and benefits for that patient.

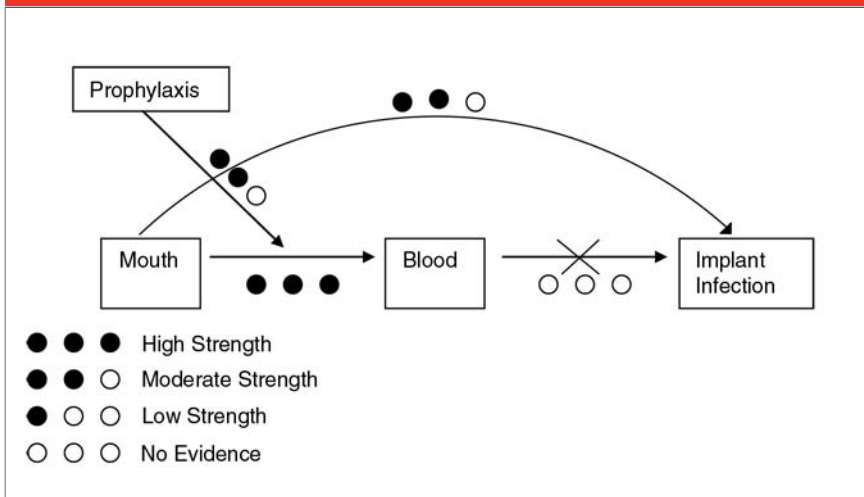
From the American Academy of Orthopaedic Surgeons (AAOS), Rosemont, IL (Dr. Watters, Dr. Moucha, Dr. O'Donnell, Dr. Evans, and Dr. Goldberg), the American Dental Association, Chicago, IL (Dr. Rethman, Dr. Abt, Dr. Futrell, Dr. Glenn, and Dr. Hellstein), the AAOS, Rosemont, and the Congress of Neurological Surgeons, Schaumburg, IL (Dr. Anderson), the College of American Pathologists, Northfield, IL (Dr. Carroll), the Knee Society, Rosemont (Dr. Garvin), the Society for Healthcare Epidemiology of America, Arlington, VA (Dr. Hewlett), the American Association of Hip and Knee Surgeons, Rosemont (Dr. Kolessar), the American Association of Neurological Surgeons, Rolling Meadows, IL, and the Congress of Neurological Surgeons, Schaumburg (Dr. O'Toole), the Musculoskeletal Infection Society, Rochester, MN (Dr. Osmon), the Scoliosis Research Society, Milwaukee, WI (Dr. Rinella), the American Association of Oral and Maxillofacial Surgeons, Rosemont (Dr. Steinberg), the Division of Science and Professional Affairs, the American Dental Association, Chicago (Dr. Ristic and Mr. Hanson), and the Department of Research and Scientific Affairs, the AAOS (Dr. Martin, Dr. Cummins, Dr. Song, Mr. Sluka, Mr. Boyer, Ms. Woznica, and Ms. Gross).

Dr. Watters or an immediate family member has received royalties from Stryker; has stock or stock options held in Intrinsic Orthopedics; and serves as a board member, owner, officer, or committee member of the American Board of Spine Surgery and the North American Spine Society (NASS). Dr. Rethman or an immediate family member serves as a paid consultant to Colgate-Palmolive; has stock or stock options held in Colgate-Palmolive and Pfizer; and serves as a board member, owner, officer, or committee member of the American Dental Association Foundation. Dr. Anderson or an immediate family member has received royalties from Pioneer and Stryker; serves as a paid consultant to Aesculap and Pioneer Surgical; serves as an unpaid consultant to Expanding Orthopedics, SI Bone, Spatatec, and Titan Surgical; has stock or stock options held in Pioneer Surgical, SI Bone, Spartec, and Titan Surgical; and serves as a board member, owner, officer, or committee member of the American Academy of Orthopaedic Surgeons (AAOS), American Society for Testing and Materials, NASS, Spine Arthroplasty Society, and the Spine Section of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons. Dr. Carroll or an immediate family member serves as a board member, owner, officer, or committee member of the American Society for Microbiology. Dr. Garvin or an immediate family member has received royalties from Biomet, and serves as a board member, owner, officer, or committee member of the AAOS, American Orthopaedic Association, and The Knee Society. Dr. Glenn or an immediate family member serves as a board member, owner, officer, or committee member of the American Dental Association and the Oklahoma Dental Association. Dr. Hellstein or an immediate family member serves as a board member, owner, officer, or committee member of the American Academy of Oral and Maxillofacial Pathology, American Board of Oral and Maxillofacial Pathology, and the Basal Cell Carcinoma Nevus Syndrome Life Support Network. Dr. Hewlett or an immediate family member serves as a board member, owner, officer, or committee member of the Society for Healthcare Epidemiology of America. Dr. Kolessar or an immediate family member has stock or stock options held in Zimmer. Dr. Moucha or an immediate family member is a member of a speakers' bureau or has made paid presentations on behalf of 3M; has stock or stock options held in Auxillium; and serves as a board member, owner, officer, or committee member of the AAOS. Dr. O'Donnell or an immediate family member serves as a board member, owner, officer, or committee member of the Musculoskeletal Tumor Society, the National Comprehensive Cancer Network, the Northern California Chapter of the Western Orthopaedic Association, the Orthopaedic Surgical Osseointegration Society, and the Sarcoma Alliance. Dr. O'Toole or an immediate family member has received royalties from Globus Medical; serves as a paid consultant to Globus Medical and Pioneer Surgical; and serves as an unpaid consultant to Medtronic. Dr. Osmon or an immediate family member serves as a board member, owner, officer, or committee member of the Musculoskeletal Infection Society. Dr. Evans or an immediate family member is a member of a speakers' bureau or has made paid presentations on behalf of Johnson & Johnson and Smith & Nephew. Dr. Steinberg or an immediate family member serves as a board member, owner, officer, or committee member of the American Association of Oral and Maxillofacial Surgeons. Dr. Goldberg or an immediate family member serves as a board member, owner, officer, or committee member of the AAOS. Dr. Martin or an immediate family member serves as a board member, owner, officer, or committee member of the National Board of Medical Examiners. None of the following authors or any immediate family member has received anything of value from or has stock or stock options held in a commercial company or institution related directly or indirectly to the subject of this article: Dr. Rinella, Mr. Hanson, Dr. Abt, Dr. Futrell, Dr. Ristic, Mr. Boyer, Mr. Sluka, Dr. Cummins, Dr. Song, Ms. Woznica, and Ms. Gross.

This clinical practice guideline was approved by the American Academy of Orthopaedic Surgeons on December 7, 2012.

The complete evidence-based guideline, American Academy of Orthopaedic Surgeons and the American Dental Association *Prevention of Orthopaedic Implant Infection in Patients Undergoing Dental Procedures Clinical Practice Guideline*, includes all tables, figures, and appendices, and is available at <http://www.aaos.org/guidelines>.

Figure 1



Overview of the evidence. Just one study (represented by the arching arrow) was identified in the literature search as providing direct evidence of moderate strength and considered for the guideline. The results of this study show that dental procedures are not risk factors for subsequent implant infection and furthermore that antibiotic prophylaxis does not reduce the risk of subsequent infection.

Background

In 2010, more than 302,000 hip replacements and 658,000 knee replacements were performed in the United States. Based on the studies reviewed for this guideline, the mean rate of hip, knee, and spine implant infections was 2%; management typically requires further surgery and prolonged antibiotic treatment.¹⁻¹³ Causes included entry of microbes into the wound during surgery, hematogenous spread, recurrence of sepsis in a previously infected joint, and contiguous spread of infection from a local source.¹⁴

In light of the significant morbidity associated with orthopaedic implant infections, preventing such infections in patients undergoing dental procedures is highly desirable. However, prophylactic antibiotics also entail risks to individual patients and, if widely used, are plausible contributors to the growing problem of bacterial resistance resulting from antibiotic overuse.

Methods

The guideline was developed based on a rigorous, standardized process commensurate with Institute of Medicine standards.^{15,16} The AAOS-ADA work group held an introductory meeting on November 20 and 21, 2010, to establish the scope of the guideline and the search terms for the systematic review. At the introductory meeting, the work group constructed preliminary recommendations which specified “[what] should be done in [whom], [when], [where], and [how often or how long].” The preliminary recommendations functioned as research questions for the systematic review, not as final recommendations or conclusions. Upon completing the systematic review, the work group participated in a 2-day recommendation meeting on October 15 and 16, 2011, at which time the final recommendations and rationales were edited, written, and voted on. The lan-

guage and grade of each recommendation was directly influenced by the best available evidence. Economical and adverse outcomes were not formally considered in creating these recommendations, per AAOS policy. This guideline was created with the best available evidence as it relates to antibiotic prophylaxis, dental procedures, and orthopaedic implant infections.

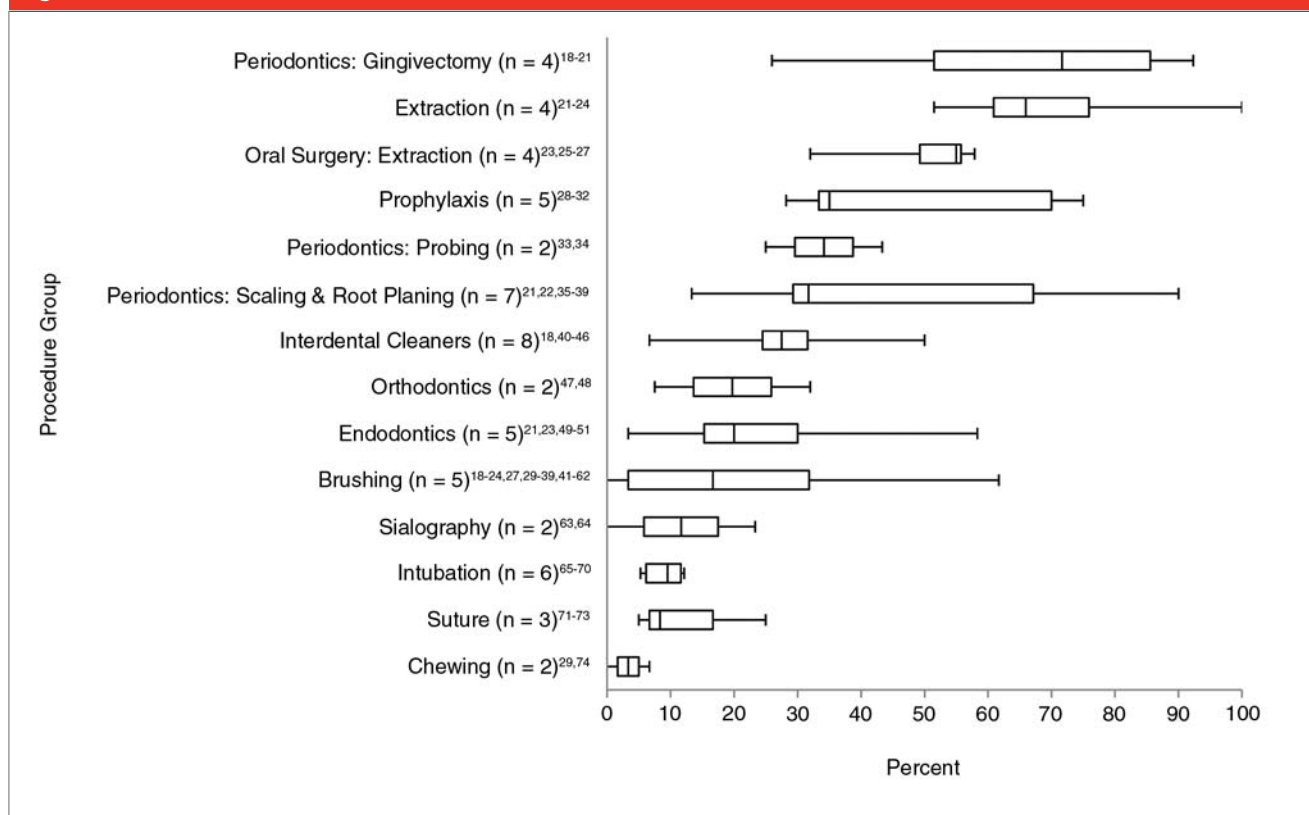
Forty-seven outside organizations were solicited to provide peer reviewers for this guideline. The draft was sent to the 17 review organizations that responded to the solicitation. The disposition of all non-editorial peer review comments was documented and accompanied this guideline through the public commentary and the AAOS/ADA guideline approval process. The full guideline, along with all supporting documentation and workgroup disclosures, is available on the AAOS Website, www.aaos.org/guidelines

Results

The best available evidence published in studies that met the inclusion criteria was considered for this guideline. The following is a summary of this evidence. As illustrated in Figure 1, the quality of evidence that explains the proposed association between dental procedures and orthopaedic implant infection varies. Only one study that provided direct evidence of moderate strength was identified by the literature search and considered for this guideline. The results of this study show that dental procedures are not risk factors for subsequent implant infection and, furthermore, that antibiotic prophylaxis does not reduce the risk of subsequent infection.¹⁷

However, a multitude of indirect evidence was included in this guideline that investigates particular com-

Figure 2



Incidence of bacteremia by procedure group. n = the number of studies pooled

ponents of this complex mechanism. Multiple high-strength studies link oral procedures to bacteremia, a surrogate measure of risk for orthopaedic implant infection. Some low-strength studies investigate potential risk factors for these bacteremias. In addition, multiple moderate-strength studies suggest that prophylaxis decreases the incidence of post-dental procedure bacteremia. But no studies explain the microbiological relationship between bacteremia and orthopaedic implant infection.

Rates of bacteremia after dental procedures varied significantly by and within dental procedure group. Median incidence rates range from approximately 5% for chewing to upwards of 65% for simple tooth extraction and gingivectomy (Figure 2). As expected, the more invasive oral procedures produced the highest me-

dian incidence of bacteremia, but common daily habits such as flossing (ie, interdental cleaners), tooth brushing, and even chewing resulted in bacteremia in some cases.

Instances of bacteremia following dental procedures may be modified by individual risk factors. While the strength of the evidence is low, several prognostic studies have addressed a multitude of patient characteristics as potential risk factors for developing bacteremia from dental procedures. These low-strength studies report on oral health indicators and general patient characteristics such as age and sex. The results, which are often contradictory, vary across and within procedure groups (see the full guideline for details).^{18,25,26,28-30,33,34,40,52-59,65,75-79} No conclusions about risk factors could be drawn from these studies.

We recognize the diversity of opinion concerning the clinical importance of bacteremia as a surrogate outcome for orthopaedic implant infection, and understand the clinician's concern and rationale for wanting to prevent bacteremia. Therefore, we conducted two independent network meta-analyses on the efficacy of antibiotic and topical antimicrobial prophylaxis for bacteremia post simple tooth extraction. Other studies exist that investigate different dental procedures, but the most robust data reside in tooth extraction studies. Several studies of moderate strength were included in these analyses. These studies investigated the effect of many different antibiotic drugs and topical antimicrobials. Twenty-one antibiotic studies^{22,31,53,57,60,80-95} and 13 topical oral antimicrobial studies^{22,55,96-106}

Table 1

Number Needed to Treat (NNT) to Prevent Bacteremia Post Tooth Extraction: Antibiotics^a

Treatment	NNT
Amoxicillin	1.8
Penicillin	2.5
Erythromycin	5.0
Clindamycin	3.0
Josamycin	14.0
Moxifloxacin	1.9
Cefaclor	9.3
IV tetracycline	1.5
IV cefuroxime	2.1
IM teicoplanin	2.2
Topical amoxicillin	4.0
Antiseptic rinse	3.2
IM penicillin or IV erythromycin or oral or IV amoxicillin	3.7

IM = intramuscular, IV = intravenous
^a The table represents a conversion of odds ratio from a forest plot of indirect (network) comparisons of antibiotics versus placebo/no treatment

Table 2

Number Needed to Treat (NNT) to Prevent Bacteremia Post Tooth Extraction: Topical Antimicrobials^a

Treatment	NNT
Saline rinse	70.0
Chlorhexidine rinse	2.5
Povidone-iodine rinse	2.3
Chloramine-T rinse/brush	2.5
Lugol solution rinse	11.7
Hydrogen peroxide rinse	3.9
Sodium perborate-ascorbic acid rinse	2.5
Phenolated rinse	2.8
Placebo rinse	N/A
Operative field isolation	1.8
Isolation + iodine rinse	1.8
Isolation + chlorhexidine rinse	1.5

N/A = not applicable
^a The table represents a conversion of odds ratio from a forest plot of indirect (network) comparisons of topical antimicrobials versus no treatment

Recommendations

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 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.

were included in our network meta-analyses. The majority of the results from the individual studies and the overall effect of these prophylactic agents according to our analyses were favorable and clinically meaningful (Tables 1 and 2).

While there was no direct evidence to explain the proposed association between bacteremia and orthopaedic implant infection, we summarized the microbiological information pertaining to cases and rates of bacteremia and implant infection, when available, based on our included literature. According to orthopaedic implant cohort studies,¹⁻¹³ approximately 53% of organisms responsible for the infections were *Staphylococcus* species. The overall rate of infection was approximately 1.5%. Of the studies that distinguished early from late infections,^{1,4,5,8-11,13} we were able to calculate rates of 0.4% and 0.9%, respectively. According to

orthopaedic implant infection case series,^{17,107-122} approximately 64% of the infections were *Staphylococcus* species. Of the studies that distinguished early from late infections, 36.7% were early and 63.3% were late.^{17,107-111,113-117,120} Dental-related bacteremia varied greatly by procedure and study, as did the organism responsible for the bacteremia.^{19,22-}

24,28,29,33,35,37-42,44-48,50,51,62,64,65,67-73,89,91,93, 123-139 No clear association between the organisms found in the prosthetic implant infections and bacteremia exists. However, the majority of the organisms found in implant infections are *Staphylococcus*, and the majority of the organisms found as the cause of bacteremias are *Streptococcus*.

Considering all of the above information in accordance with AAOS clinical practice guideline protocol, the workgroup created the following recommendations:

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 empirical evidence that meets the 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.

Discussion

Direct support for recommendation 1 comes from a single well-conducted case-control study. Study enrollment consisted of 339 patients with prosthetic hip or knee infections (cases) and 339 patients with hip or knee arthroplasties without infection (controls) hospitalized on an orthopaedic service during the same time period. The comparison between these groups was for differences in dental visits (exposure) in terms of high- and low-risk dental procedures, with and without antibiotic prophylaxis. Results reported as odds ratios with 95% CI demonstrate no statistically significant differences between groups. Neither dental procedures nor antibiotic prophylaxis before dental procedures were associated with risk of prosthetic hip or knee infections. The authors performed a sample size calculation and withdrawals were low, thus minimizing attrition bias. The prospective nature of this study minimized recall bias. Additionally, blinding of the treatment group to those assessing outcomes limits detection bias. Although

this one study of direct evidence was of moderate strength, it did have limitations. The authors conducted covariate analysis on some subgroups of higher risk patients. The number of patients in these subgroups, however, was relatively small, and there are insufficient data to suggest that these patients are at higher risk of experiencing hematogenous infections.

Indirect evidence was also considered for recommendation 1. There is high-strength evidence that demonstrates the occurrence of bacteremia with dental procedures. Historically, there has been a suggestion that bacteremias can cause hematogenous seeding of total joint implants, both in the early postoperative period and for many years following implantation. Two years post joint arthroplasty was previously considered the critical period for prophylaxis. In addition, bacteremias may occur during normal daily activities, such as chewing and tooth brushing. It is likely that these daily activities induce many more bacteremias than do dental procedure-associated bacteremias. While evidence supports a strong association between certain dental procedures and bacteremia, there is no evidence to demonstrate a direct link between dental procedure-associated bacteremia and infection of prosthetic joints or other orthopaedic implants. Multiple studies of moderate- and high-strength evidence suggest that antibiotic prophylaxis decreases the risk of dental procedure-associated bacteremias. However, dental-procedure-associated bacteremia is a surrogate outcome for prosthetic joint infection. There is no evidence that these bacteremias are related to prosthetic joint infections. Surrogate outcomes may or may not relate to a clinically relevant patient outcome. A positive surrogate outcome (eg, reduced bacteremias), however, could mask a negative patient-centered outcome

(eg, implant infection).

Recommendation 1 is limited to patients with hip and knee prostheses because the single study of direct evidence included only patients with these types of orthopaedic implants. There is no direct evidence that met our inclusion criteria for patients with other types of orthopaedic implants.

Evidence for recommendation 2 is sparse. There was no direct evidence to support or refute the use of prophylaxis (topical antimicrobials) before dental procedures. The same indirect evidence discussed above relating to dental procedures and bacteremia was considered for recommendation 2. There is conflicting evidence regarding the effect of antimicrobial mouth rinse on the incidence of bacteremia post dental procedures. One high-strength study reports no difference in the incidence of bacteremia following antimicrobial mouth rinsing in patients undergoing dental extractions. Conversely, numerous studies suggest that topical antimicrobial prophylaxis decreases the incidence of dental procedure-associated bacteremia. However, there is no evidence that application of antimicrobial mouth rinses before dental procedures prevents infection of prosthetic joints or other orthopaedic implants. Due to the lack of direct evidence, the contradictory nature of the indirect evidence pertaining to topical oral antimicrobials, and continued concern with surrogate outcomes, recommendation 2 is Inconclusive. The work group is unable to recommend for or against the use of topical oral antimicrobials.

Recommendation 3 is an opinion statement due to the lack of evidence relating oral hygiene measures to prosthetic joint or other orthopaedic implant infections. Oral hygiene measures are low cost, provide potential benefit, are consistent with current practice, and are in accor-

dance with good oral health. There is evidence of the relationship of oral microflora to bacteremia. This bacteremia may be associated with poor oral hygiene. This implies that improvement of oral hygiene (or maintenance of good oral hygiene) may be beneficial in reducing bacteremia.

These recommendations are not intended to stand alone. Treatment decisions should be made in light of all circumstances presented by the patient. Treatments and procedures applicable to the individual patient rely on mutual communication between patient, physician, dentist, and other healthcare practitioners in accordance with evidence-based medicine applicability. (See the full guideline at http://www.aaos.org/research/guidelines/PUDP/dental_guideline.asp)

References

- Ainscow DA, Denham RA: The risk of haematogenous infection in total joint replacements. *J Bone Joint Surg Br* 1984; 66(4):580-582.
- Choong PF, Dowsey MM, Carr D, Daffy J, Stanley P: Risk factors associated with acute hip prosthetic joint infections and outcome of treatment with a rifampin-based regimen. *Acta Orthop* 2007;78(6): 755-765.
- Goodman SB, Oh KJ, Imrie S, Hwang K, Shegog M: Revision total hip arthroplasty in juvenile chronic arthritis: 17 revisions in 11 patients followed for 4-12 years. *Acta Orthop* 2006;77(2): 242-250.
- Hamilton H, Jamieson J: Deep infection in total hip arthroplasty. *Can J Surg* 2008;51(2):111-117.
- Klenerman L, Seal D, Sullens K: Combined prophylactic effect of ultraclean air and cefuroxime for reducing infection in prosthetic surgery. *Acta Orthop Belg* 1991;57(1):19-24.
- Mont MA, Yoon TR, Krackow KA, Hungerford DS: Clinical experience with a proximally porous-coated second-generation cementless total hip prosthesis: Minimum 5-year follow-up. *J Arthroplasty* 1999;14(8):930-939.
- Petrie RS, Hanssen AD, Osmon DR, Ilstrup D: Metal-backed patellar component failure in total knee arthroplasty: A possible risk for late infection. *Am J Orthop (Belle Mead NJ)* 1998;27(3):172-176.
- Sancheti KH, Laud NS, Bhende H, Reddy G, Pramod N, Mani JN: The INDUS knee prosthesis: Prospective multicentric trial of a posteriorly stabilized high-flex design: 2 years follow-up. *Indian J Orthop* 2009;43(4): 367-374.
- Smith JA, Dunn HK, Manaster BJ: Cementless femoral revision arthroplasty. 2- to 5-year results with a modular titanium alloy stem. *J Arthroplasty* 1997; 12(2):194-201.
- Soultanis K, Mantelos G, Pagiatakis A, Soucacos PN: Late infection in patients with scoliosis treated with spinal instrumentation. *Clin Orthop Relat Res* 2003;411:116-123.
- Uçkay I, Lübbecke A, Emonet S, et al: Low incidence of haematogenous seeding to total hip and knee prostheses in patients with remote infections. *J Infect* 2009;59(5):337-345.
- Wagner M, Wagner H: Medium-term results of a modern metal-on-metal system in total hip replacement. *Clin Orthop Relat Res* 2000;379:123-133.
- Wimmer C, Nogler M, Frischhut B: Influence of antibiotics on infection in spinal surgery: A prospective study of 110 patients. *J Spinal Disord* 1998; 11(6):498-500.
- Della Valle CJ, Zuckerman JD, Di Cesare PE: Periprosthetic sepsis. *Clin Orthop Relat Res* 2004;420:26-31.
- Institute of Medicine: *Clinical Practice Guidelines We Can Trust*. Washington, DC, National Academies Press, 2011.
- Institute of Medicine: *Finding What Works in Health Care: Standards for Systematic Reviews*. Washington, DC, National Academies Press, 2011.
- Berberi EF, Osmon DR, Carr A, et al: Dental procedures as risk factors for prosthetic hip or knee infection: A hospital-based prospective case-control study. *Clin Infect Dis* 2010;50(1):8-16.
- Lineberger LT, De Marco TJ: Evaluation of transient bacteremia following routine periodontal procedures. *J Periodontol* 1973;44(12):757-762.
- Rogosa M, Hampp EG, Nevin TA, Wagner HN Jr, Driscoll EJ, Baer PN: Blood sampling and cultural studies in the detection of postoperative bacteremias. *J Am Dent Assoc* 1960;60: 171-180.
- Wada K, Tomizawa M, Sasaki I: Study on bacteremia in patients with pyorrhea alveolaris caused by surgical operations. *J Nihon Univ Sch Dent* 1968;10(2):52-57.
- Bender IB, Seltzer S, Tashman S, Meloff G: Dental procedures in patients with rheumatic heart disease. *Oral Surg Oral Med Oral Pathol* 1963;16:466-473.
- Casolari C, Neglia R, Forabosco A, Galetti R, Fabio U: Incidence of oral bacteremia and antimicrobial prophylaxis. *J Chemother* 1989;1(4 suppl):968-971.
- Heimdahl A, Hall G, Hedberg M, et al: Detection and quantitation by lysis-filtration of bacteremia after different oral surgical procedures. *J Clin Microbiol* 1990;28(10):2205-2209.
- Khairat O: The non-aerobes of post-extraction bacteremia. *J Dent Res* 1966; 45(4):1191-1197.
- Enabulele OI, Aluyi HS, Omokao O: Incidence of bacteraemia following teeth extraction at the dental clinic of the University of Benin Teaching Hospital, Benin city, Nigeria. *Afr J Biotechnol* 2008;7(10):1390-1393.
- Takai S, Kuriyama T, Yanagisawa M, Nakagawa K, Karasawa T: Incidence and bacteriology of bacteremia associated with various oral and maxillofacial surgical procedures. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2005;99(3):292-298.
- Josefsson K, Heimdahl A, von Konow L, Nord CE: Effect of phenoxymethylpenicillin and erythromycin prophylaxis on anaerobic bacteraemia after oral surgery. *J Antimicrob Chemother* 1985;16(2): 243-251.
- Cherry M, Daly CG, Mitchell D, Highfield J: Effect of rinsing with povidone-iodine on bacteraemia due to scaling: A randomized-controlled trial. *J Clin Periodontol* 2007;34(2):148-155.
- Forner L, Larsen T, Kilian M, Holmstrup P: Incidence of bacteremia after chewing, tooth brushing and scaling in individuals with periodontal inflammation. *J Clin Periodontol* 2006; 33(6):401-407.
- De Leo AA, Schoenknecht FD, Anderson MW, Peterson JC: The incidence of bacteremia following oral prophylaxis on pediatric patients. *Oral Surg Oral Med Oral Pathol* 1974;37(1):36-45.
- Hall G, Hedström SA, Heimdahl A, Nord CE: Prophylactic administration of penicillins for endocarditis does not reduce the incidence of postextraction bacteremia. *Clin Infect Dis* 1993;17(2): 188-194.
- Forner L, Nielsen CH, Bendtzen K, Larsen T, Holmstrup P: Increased plasma levels of IL-6 in bacteremic periodontitis patients after scaling. *J Clin Periodontol* 2006;33(10):724-729.
- Daly CG, Mitchell DH, Highfield JE, Grossberg DE, Stewart D: Bacteremia

- due to periodontal probing: A clinical and microbiological investigation. *J Periodontol* 2001;72(2):210-214.
34. Daly C, Mitchell D, Grossberg D, Highfield J, Stewart D: Bacteraemia caused by periodontal probing. *Aust Dent J* 1997;42(2):77-80.
 35. Morozumi T, Kubota T, Abe D, Shimizu T, Komatsu Y, Yoshie H: Effects of irrigation with an antiseptic and oral administration of azithromycin on bacteremia caused by scaling and root planing. *J Periodontol* 2010;81(11):1555-1563.
 36. Lofthus JE, Waki MY, Jolkovsky DL, et al: Bacteremia following subgingival irrigation and scaling and root planing. *J Periodontol* 1991;62(10):602-607.
 37. Waki MY, Jolkovsky DL, Otomo-Corgel J, et al: Effects of subgingival irrigation on bacteremia following scaling and root planing. *J Periodontol* 1990;61(7):405-411.
 38. Lafaurie GI, Mayorga-Fayad I, Torres MF, et al: Periodontopathic microorganisms in peripheral blood after scaling and root planing. *J Clin Periodontol* 2007;34(10):873-879.
 39. Lucartorto FM, Franker CK, Maza J: Postscaling bacteremia in HIV-associated gingivitis and periodontitis. *Oral Surg Oral Med Oral Pathol* 1992;73(5):550-554.
 40. Crasta K, Daly CG, Mitchell D, Curtis B, Stewart D, Heitz-Mayfield LJ: Bacteraemia due to dental flossing. *J Clin Periodontol* 2009;36(4):323-332.
 41. Ramadan AE, Zaki SA, Nour ZM: A study of transient bacteremia following the use of dental floss silk and interdental stimulators. *Egypt Dent J* 1975;21(4):19-28.
 42. Berger SA, Weitzman S, Edberg SC, Casey JJ: Bacteremia after the use of an oral irrigation device: A controlled study in subjects with normal-appearing gingiva. Comparison with use of toothbrush. *Ann Intern Med* 1974;80(4):510-511.
 43. Oral irrigation and bacteremia. *J N C Dent Soc* 1972;55(2):23-24.
 44. Romans AR, App GR: Bacteremia, a result from oral irrigation in subjects with gingivitis. *J Periodontol* 1971;42(12):757-760.
 45. Felix JE, Rosen S, App GR: Detection of bacteremia after the use of an oral irrigation device in subjects with periodontitis. *J Periodontol* 1971;42(12):785-787.
 46. Wank HA, Levison ME, Rose LF, Cohen DW: A quantitative measurement of bacteremia and its relationship to plaque control. *J Periodontol* 1976;47(12):683-686.
 47. Gürel HG, Basciftci FA, Arslan U: Transient bacteremia after removal of a bonded maxillary expansion appliance. *Am J Orthod Dentofacial Orthop* 2009;135(2):190-193.
 48. Erverdi N, Kadir T, Ozkan H, Acar A: Investigation of bacteremia after orthodontic banding. *Am J Orthod Dentofacial Orthop* 1999;116(6):687-690.
 49. Savarrio L, Mackenzie D, Riggio M, Saunders WP, Bagg J: Detection of bacteraemias during non-surgical root canal treatment. *J Dent* 2005;33(4):293-303.
 50. Baumgartner JC, Hegggers JP, Harrison JW: The incidence of bacteremias related to endodontic procedures: I. Nonsurgical endodontics. *J Endod* 1976;2(5):135-140.
 51. Baumgartner JC, Hegggers JP, Harrison JW: Incidence of bacteremias related to endodontic procedures: II. Surgical endodontics. *J Endod* 1977;3(10):399-402.
 52. Bhanji S, Williams B, Sheller B, Elwood T, Mancl L: Transient bacteremia induced by toothbrushing: a comparison of the Sonicare toothbrush with a conventional toothbrush. *Pediatr Dent* 2002;24(4):295-299.
 53. Wahlmann U, Al-Nawas B, Jütte M, Wagner W: Clinical and microbiological efficacy of single dose cefuroxime prophylaxis for dental surgical procedures. *Int J Antimicrob Agents* 1999;12(3):253-256.
 54. Roberts GJ, Watts R, Longhurst P, Gardner P: Bacteremia of dental origin and antimicrobial sensitivity following oral surgical procedures in children. *Pediatr Dent* 1998;20(1):28-36.
 55. Lockhart PB: An analysis of bacteremias during dental extractions: A double-blind, placebo-controlled study of chlorhexidine. *Arch Intern Med* 1996;156(5):513-520.
 56. Okabe K, Nakagawa K, Yamamoto E: Factors affecting the occurrence of bacteremia associated with tooth extraction. *Int J Oral Maxillofac Surg* 1995;24(3):239-242.
 57. Coulter WA, Coffey A, Saunders ID, Emmerson AM: Bacteremia in children following dental extraction. *J Dent Res* 1990;69(10):1691-1695.
 58. Trivedi DN: Bacteraemia due to operative procedure. *J Indian Dent Assoc* 1984;56(12):447-452.
 59. Silver JG, Martin AW, McBride BC: Experimental transient bacteraemias in human subjects with varying degrees of plaque accumulation and gingival inflammation. *J Clin Periodontol* 1977;4(2):92-99.
 60. Lockhart PB, Brennan MT, Sasser HC, Fox PC, Paster BJ, Bahrani-Mougeot FK: Bacteremia associated with toothbrushing and dental extraction. *Circulation* 2008;117(24):3118-3125.
 61. Sconyers JR, Albers DD, Kelly R: Relationship of bacteremia to toothbrushing in clinically healthy patients. *Gen Dent* 1979;27(3):51-52.
 62. Sconyers JR, Crawford JJ, Moriarty JD: Relationship of bacteremia to toothbrushing in patients with periodontitis. *J Am Dent Assoc* 1973;87(3):616-622.
 63. Nixon PP, Littler P, Davies K, Krishnam MS: Does sialography require antibiotic prophylaxis? *Br J Radiol* 2009;82(981):732-734.
 64. Lamey PJ, Macfarlane TW, Patton DW, Samaranyake LP, Ferguson MM: Bacteraemia consequential to sialography. *Br Dent J* 1985;158(6):218-220.
 65. Valdés C, Tomás I, Alvarez M, Limeres J, Medina J, Diz P: The incidence of bacteraemia associated with tracheal intubation. *Anaesthesia* 2008;63(6):588-592.
 66. Ali MT, Tremewen DR, Hay AJ, Wilkinson DJ: The occurrence of bacteraemia associated with the use of oral and nasopharyngeal airways. *Anaesthesia* 1992;47(2):153-155.
 67. Dinner M, Tjeuw M, Artusio JF Jr: Bacteremia as a complication of nasotracheal intubation. *Anesth Analg* 1987;66(5):460-462.
 68. Berry FA Jr, Blankenbaker WL, Ball CG: Comparison of bacteremia occurring with nasotracheal and orotracheal intubation. *Anesth Analg* 1973;52(6):873-876.
 69. Onçağ O, Cökmez B, Aydemir S, Balcioglu T: Investigation of bacteremia following nasotracheal intubation. *Paediatr Anaesth* 2005;15(3):194-198.
 70. Hansen CP, Westh H, Brok KE, Jensen R, Bertelsen S: Bacteraemia following orotracheal intubation and oesophageal balloon dilatation. *Thorax* 1989;44(8):684-685.
 71. King RC, Crawford JJ, Small EW: Bacteremia following intraoral suture removal. *Oral Surg Oral Med Oral Pathol* 1988;65(1):23-28.
 72. Wampole HS, Allen AL, Gross A: The incidence of transient bacteremia during periodontal dressing change. *J Periodontol* 1978;49(9):462-464.
 73. Brown AR, Papasian CJ, Shultz P, Theisen FC, Shultz RE: Bacteremia and intraoral suture removal: Can an antimicrobial rinse help? *J Am Dent Assoc* 1998;129(10):1455-1461.

74. Murphy AM, Daly CG, Mitchell DH, Stewart D, Curtis BH: Chewing fails to induce oral bacteraemia in patients with periodontal disease. *J Clin Periodontol* 2006;33(10):730-736.
75. Barbosa M, Carmona IT, Amaral B, et al: General anesthesia increases the risk of bacteremia following dental extractions. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010;110(6):706-712.
76. Ashare A, Stanford C, Hancock P, et al: Chronic liver disease impairs bacterial clearance in a human model of induced bacteremia. *Clin Transl Sci* 2009;2(3):199-205.
77. Lockhart PB, Brennan MT, Thornhill M, et al: Poor oral hygiene as a risk factor for infective endocarditis-related bacteremia. *J Am Dent Assoc* 2009;140(10):1238-1244.
78. Tomás I, Pereira F, Llucian R, Poveda R, Diz P, Bagán JV: Prevalence of bacteraemia following third molar surgery. *Oral Dis* 2008;14(1):89-94.
79. Brennan MT, Kent ML, Fox PC, Norton HJ, Lockhart PB: The impact of oral disease and nonsurgical treatment on bacteremia in children. *J Am Dent Assoc* 2007;138(1):80-85.
80. Lockhart PB, Brennan MT, Kent ML, Norton HJ, Weinrib DA: Impact of amoxicillin prophylaxis on the incidence, nature, and duration of bacteremia in children after intubation and dental procedures. *Circulation* 2004;109(23):2878-2884.
81. Aitken C, Cannell H, Sefton AM, et al: Comparative efficacy of oral doses of clindamycin and erythromycin in the prevention of bacteraemia. *Br Dent J* 1995;178(11):418-422.
82. Cannell H, Kerawala C, Sefton AM, et al: Failure of two macrolide antibiotics to prevent post-extraction bacteraemia. *Br Dent J* 1991;171(6):170-173.
83. Diz Dios P, Tomás Carmona I, Limeres Posse J, Medina Henríquez J, Fernández Feijoo J, Alvarez Fernández M: Comparative efficacies of amoxicillin, clindamycin, and moxifloxacin in prevention of bacteremia following dental extractions. *Antimicrob Agents Chemother* 2006;50(9):2996-3002.
84. Hall G, Heimdahl A, Nord CE: Effects of prophylactic administration of cefaclor on transient bacteremia after dental extraction. *Eur J Clin Microbiol Infect Dis* 1996;15(8):646-649.
85. Hall G, Nord CE, Heimdahl A: Elimination of bacteraemia after dental extraction: Comparison of erythromycin and clindamycin for prophylaxis of infective endocarditis. *J Antimicrob Chemother* 1996;37(4):783-795.
86. Head TW, Bentley KC, Millar EP, deVries JA: A comparative study of the effectiveness of metronidazole and penicillin V in eliminating anaerobes from postextraction bacteremias. *Oral Surg Oral Med Oral Pathol* 1984;58(2):152-155.
87. Jokinen MA: Bacteremia following dental extraction and its prophylaxis. *Suom Hammaslaak Toim* 1970;66(3):69-100.
88. Khairat O: An effective antibiotic cover for the prevention of endocarditis following dental and other post-operative bacteraemias. *J Clin Pathol* 1966;19(6):561-566.
89. Maskell JP, Carter JL, Boyd RB, Williams RJ: Teicoplanin as a prophylactic antibiotic for dental bacteraemia. *J Antimicrob Chemother* 1986;17(5):651-659.
90. Roberts GJ, Radford P, Holt R: Prophylaxis of dental bacteraemia with oral amoxycillin in children. *Br Dent J* 1987;162(5):179-182.
91. Shanson DC, Shehata A, Tadayon M, Harris M: Comparison of intravenous teicoplanin with intramuscular amoxycillin for the prophylaxis of streptococcal bacteraemia in dental patients. *J Antimicrob Chemother* 1987;20(1):85-93.
92. Shanson DC, Akash S, Harris M, Tadayon M: Erythromycin stearate, 1.5 g, for the oral prophylaxis of streptococcal bacteraemia in patients undergoing dental extraction: Efficacy and tolerance. *J Antimicrob Chemother* 1985;15(1):83-90.
93. Shanson DC, Cannon P, Wilks M: Amoxycillin compared with penicillin V for the prophylaxis of dental bacteraemia. *J Antimicrob Chemother* 1978;4(5):431-436.
94. Vergis EN, Demas PN, Vaccarello SJ, Yu VL: Topical antibiotic prophylaxis for bacteremia after dental extractions. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2001;91(2):162-165.
95. deVries J, Francis LE, Lang D: Control of post-extraction bacteraemias in the penicillin-hypersensitive patient. *J Can Dent Assoc (Tor)* 1972;38(2):63-66.
96. Jokinen MA: Prevention of postextraction bacteremia by local prophylaxis. *Int J Oral Surg* 1978;7(5):450-452.
97. Macfarlane TW, Ferguson MM, Mulgrew CJ: Post-extraction bacteraemia: Role of antiseptics and antibiotics. *Br Dent J* 1984;156(5):179-181.
98. Rahn R, Schneider S, Diehl O, Schäfer V, Shah PM: Preventing post-treatment bacteremia: Comparing topical povidone-iodine and chlorhexidine. *J Am Dent Assoc* 1995;126(8):1145-1149.
99. Scopp IW, Orvieto LD: Gingival degerming by povidone-iodine irrigation: Bacteremia reduction in extraction procedures. *J Am Dent Assoc* 1971;83(6):1294-1296.
100. Sweet JB, Gill VJ, Chusid MJ, Elin RJ: Nitroblue tetrazolium and Limulus assays for bacteremia after dental extraction: Effect of topical antiseptics. *J Am Dent Assoc* 1978;96(2):276-281.
101. Tomás I, Alvarez M, Limeres J, et al: Effect of a chlorhexidine mouthwash on the risk of postextraction bacteremia. *Infect Control Hosp Epidemiol* 2007;28(5):577-582.
102. Cutcher JL, Goldberg JR, Lilly GE, Jones JC: Control of bacteremia associated with extraction of teeth: II. *Oral Surg Oral Med Oral Pathol* 1971;31(5):602-605.
103. Francis LE, DeVries J, Lang D: An oral antiseptic for the control of post-extraction bacteraemia. *J Can Dent Assoc (Tor)* 1973;39(1):55-57.
104. Jones JC, Cutcher JL, Goldberg JR, Lilly GE: Control of bacteremia associated with extraction of teeth. *Oral Surg Oral Med Oral Pathol* 1970;30(4):454-459.
105. Nasif AS: The incidence of post-extraction bacteremia after irrigation of the gingival sulcus with hydrogen peroxide solution. *Egypt Dent J* 1977;23(3):51-55.
106. Yamalik MK, Yücesat S, Abbasoğlu U: Effects of various antiseptics on bacteremia following tooth extraction. *J Nihon Univ Sch Dent* 1992;34(1):28-33.
107. Chiu FY, Chen CM: Surgical débridement and parenteral antibiotics in infected revision total knee arthroplasty. *Clin Orthop Relat Res* 2007;461:130-135.
108. Cordero-Ampuero J, Esteban J, García-Cimbreló E: Oral antibiotics are effective for highly resistant hip arthroplasty infections. *Clin Orthop Relat Res* 2009;467(9):2335-2342.
109. Cordero-Ampuero J, Esteban J, García-Cimbreló E, Munuera L, Escobar R: Low relapse with oral antibiotics and two-stage exchange for late arthroplasty infections in 40 patients after 2-9 years. *Acta Orthop* 2007;78(4):511-519.
110. Crockarell JR, Hanssen AD, Osmon DR, Morrey BF: Treatment of infection with débridement and retention of the components following hip arthroplasty. *J Bone Joint Surg Am* 1998;80(9):1306-1313.
111. Fink B, Makowiak C, Fuerst M, Berger I, Schäfer P, Frommelt L: The value of

- synovial biopsy, joint aspiration and C-reactive protein in the diagnosis of late peri-prosthetic infection of total knee replacements. *J Bone Joint Surg Br* 2008; 90(7):874-878.
112. Hoad-Reddick DA, Evans CR, Norman P, Stockley I: Is there a role for extended antibiotic therapy in a two-stage revision of the infected knee arthroplasty? *J Bone Joint Surg Br* 2005;87(2):171-174.
113. Insall JN, Thompson FM, Brause BD: Two-stage reimplantation for the salvage of infected total knee arthroplasty. *J Bone Joint Surg Am* 1983;65(8):1087-1098.
114. Jerosch J, Schneppenheim M: Management of infected shoulder replacement. *Arch Orthop Trauma Surg* 2003;123(5):209-214.
115. Mont MA, Waldman B, Banerjee C, Pacheco IH, Hungerford DS: Multiple irrigation, debridement, and retention of components in infected total knee arthroplasty. *J Arthroplasty* 1997;12(4):426-433.
116. Muñoz-Mahamad E, García S, Bori G, et al: Comparison of a low-pressure and a high-pressure pulsatile lavage during debridement for orthopaedic implant infection. *Arch Orthop Trauma Surg* 2011;131(9):1233-1238.
117. Rao N, Crossett LS, Sinha RK, Le Frock JL: Long-term suppression of infection in total joint arthroplasty. *Clin Orthop Relat Res* 2003;414:55-60.
118. Rodríguez D, Pigrau C, Euba G, et al; REIPI Group (Spanish Network for Research in Infectious Disease): Acute haematogenous prosthetic joint infection: Prospective evaluation of medical and surgical management. *Clin Microbiol Infect* 2010;16(12):1789-1795.
119. Soriano A, Gómez J, Gómez L, et al: Efficacy and tolerability of prolonged linezolid therapy in the treatment of orthopedic implant infections. *Eur J Clin Microbiol Infect Dis* 2007;26(5):353-356.
120. Waldman BJ, Hosten E, Mont MA, Hungerford DS: Infected total knee arthroplasty treated by arthroscopic irrigation and débridement. *J Arthroplasty* 2000;15(4):430-436.
121. Windsor RE, Insall JN, Urs WK, Miller DV, Brause BD: Two-stage reimplantation for the salvage of total knee arthroplasty complicated by infection: Further follow-up and refinement of indications. *J Bone Joint Surg Am* 1990;72(2):272-278.
122. Wroblewski BM: One-stage revision of infected cemented total hip arthroplasty. *Clin Orthop Relat Res* 1986;211:103-107.
123. Lucas V, Roberts GJ: Odontogenic bacteremia following tooth cleaning procedures in children. *Pediatr Dent* 2000;22(2):96-100.
124. Silver JG, Martin AW, McBride BC: Experimental transient bacteraemias in human subjects with clinically healthy gingivae. *J Clin Periodontol* 1979;6(1):33-36.
125. Marzoni FA, Kelly DR: Bacteremia following cleft palate repair: A prospective study. *Ann Plast Surg* 1983; 10(6):473-474.
126. Piñeiro A, Tomás I, Blanco J, Alvarez M, Seoane J, Diz P: Bacteraemia following dental implants' placement. *Clin Oral Implants Res* 2010;21(9):913-918.
127. Winslow MB, Kobernick SD: Bacteremia after prophylaxis. *J Am Dent Assoc* 1960;61:69-72.
128. Debelian GJ, Olsen I, Tronstad L: Bacteremia in conjunction with endodontic therapy. *Endod Dent Traumatol* 1995;11(3):142-149.
129. Rahn R, et al: The effect of topical Povidone-Iodine and Chlorhexidine on the incidence of bacteremia following dental treatment procedures. *Hygiene + Medizin* 1994;19(3):128-131.
130. Flood TR, Samaranyake LP, MacFarlane TW, McLennan A, MacKenzie D, Carmichael F: Bacteraemia following incision and drainage of dento-alveolar abscesses. *Br Dent J* 1990;169(2):51-53.
131. Martin WJ, Schirger A: Prevention of bacteremia after oral surgery. *Minn Med* 1964;47:1519-1523.
132. Burden DJ, Coulter WA, Johnston CD, Mullally B, Stevenson M: The prevalence of bacteraemia on removal of fixed orthodontic appliances. *Eur J Orthod* 2004;26(4):443-447.
133. Conner HD, Haberman S, Collings CK, Winford TE: Bacteremias following periodontal scaling in patients with healthy appearing gingiva. *J Periodontol* 1967;38(6):466-472.
134. Gutverg M: Studies on bacteremia following oral surgery: Some prophylactic approaches to bacteremia and the results of tissue examination of excised gingiva. *J Periodontol* 1962;33:105.
135. Kinane DF, Riggio MP, Walker KF, MacKenzie D, Shearer B: Bacteraemia following periodontal procedures. *J Clin Periodontol* 2005;32(7):708-713.
136. Giglio JA, Rowland RW, Dalton HP, Laskin DM: Suture removal-induced bacteremia: A possible endocarditis risk. *J Am Dent Assoc* 1992;123(8):65-66, 69-70.
137. Soliman NA, el-Batawy YA, Abdallah AK: Bacteriologic study of the systemic disturbances accompanying primary teething. *Egypt Dent J* 1977;23(2):111-113.
138. Crawford JJ, Sconyers JR, Moriarty JD, King RC, West JF: Bacteremia after tooth extractions studied with the aid of prerduced anaerobically sterilized culture media. *Appl Microbiol* 1974; 27(5):927-932.
139. Peterson LJ, Peacock R: The incidence of bacteremia in pediatric patients following tooth extraction. *Circulation* 1976;53(4):676-679.