Premedication for Invasive Dental Procedures
Prevention of Aspiration Pneumonia

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- Employee of Delta Dental of Michigan, Ohio, and Indiana
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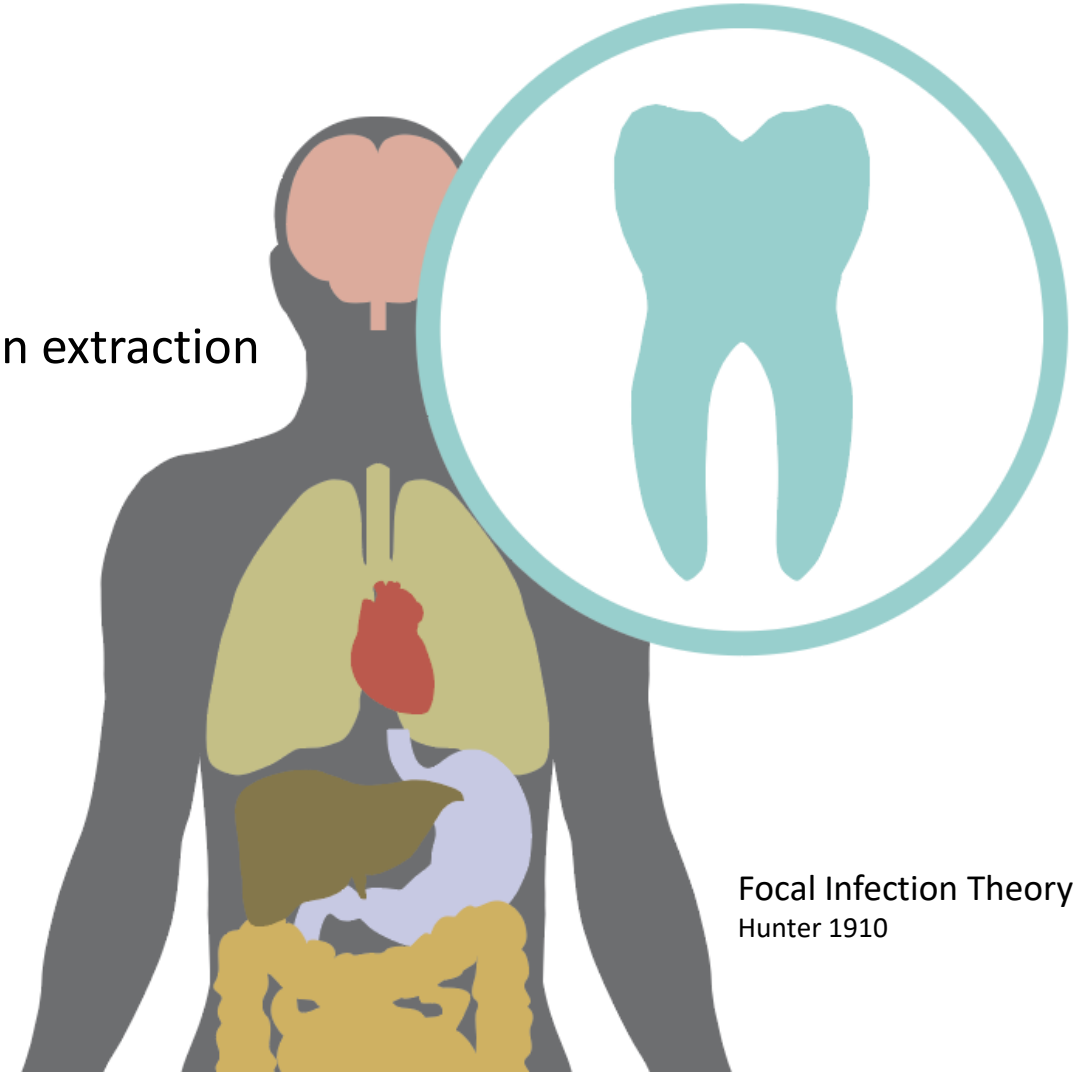
- No financial interest in any products or techniques

Objectives

- Pathophysiology of the 2 most common oral diseases
- Effect of the oral health on general health
- Review the mechanisms of periodontal-systemic interactions
- Review Infective Endocarditis, Prosthetic Joint Infections
- Discuss the current recommendations for IE and PJI antibiotic prophylaxis
- Aspiration Pneumonia and oral hygiene

The Mouth Is Attached to the Body

Hippocrates (460 – 370 BC)
Claimed to have cured arthritis with an extraction



Focal Infection Theory
Hunter 1910

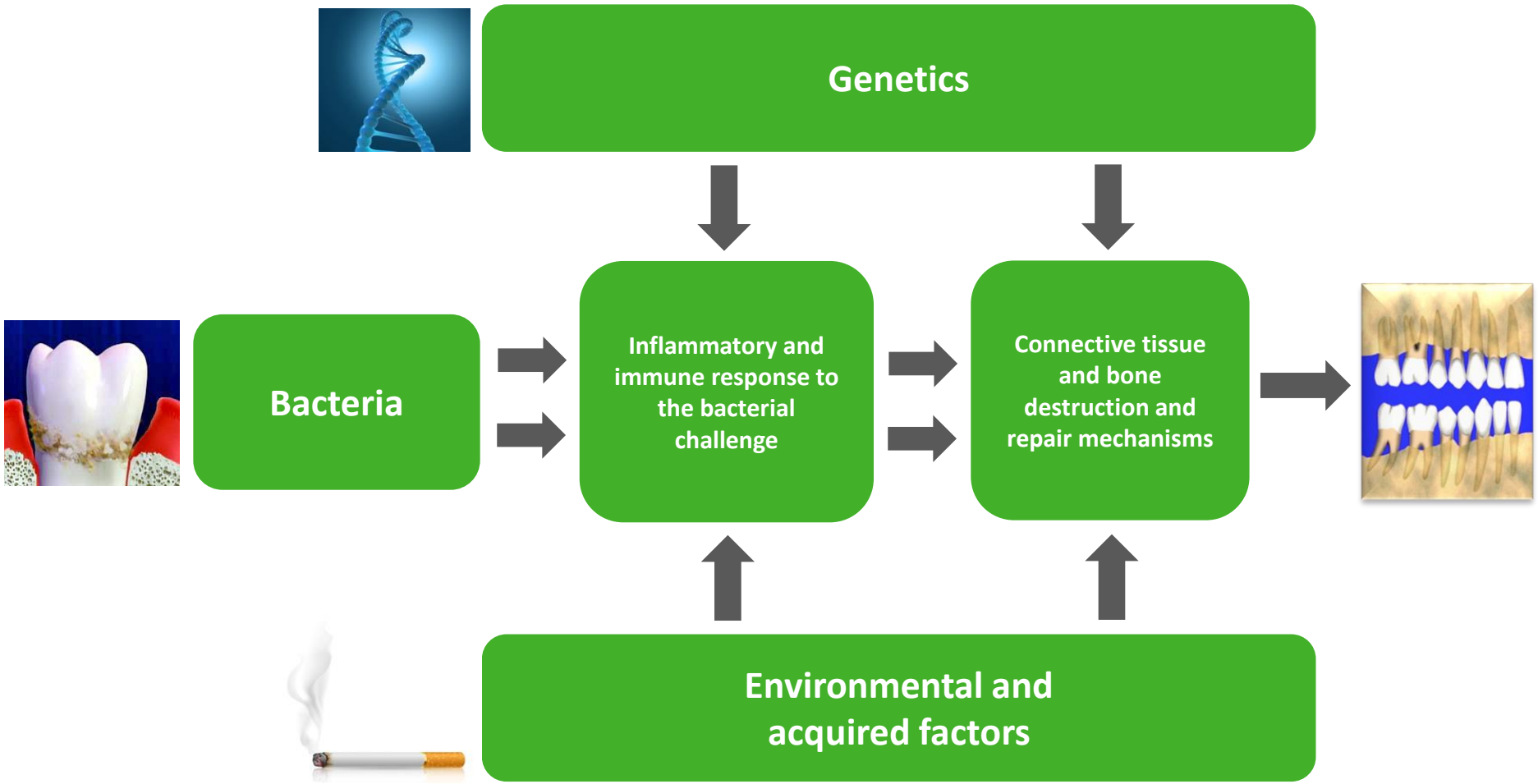
How Do These Oral Problems Affect Your Health?

Periodontitis (Gum Disease)

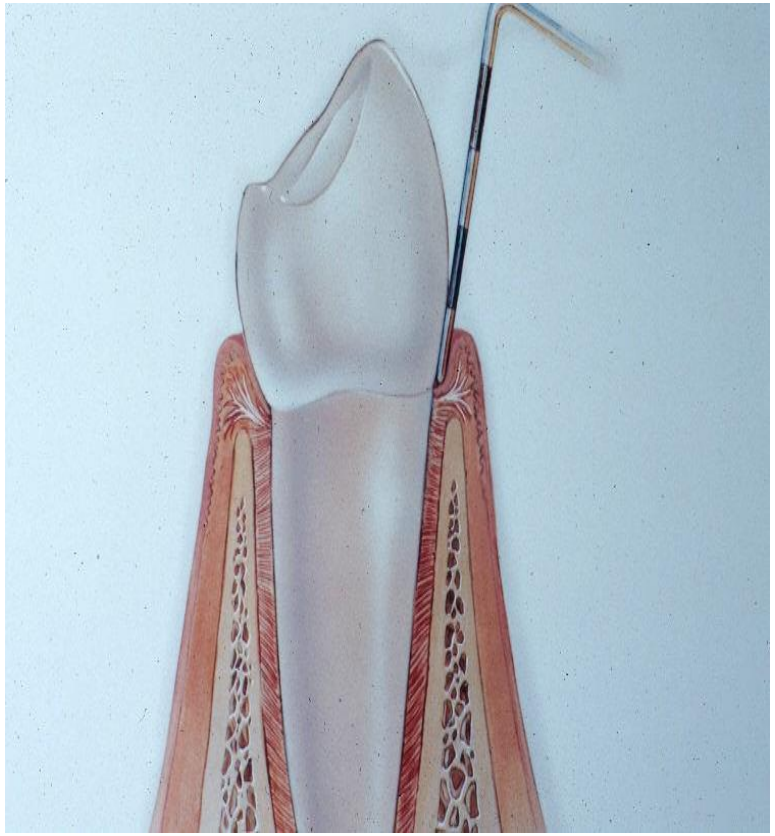
Caries (Cavities)

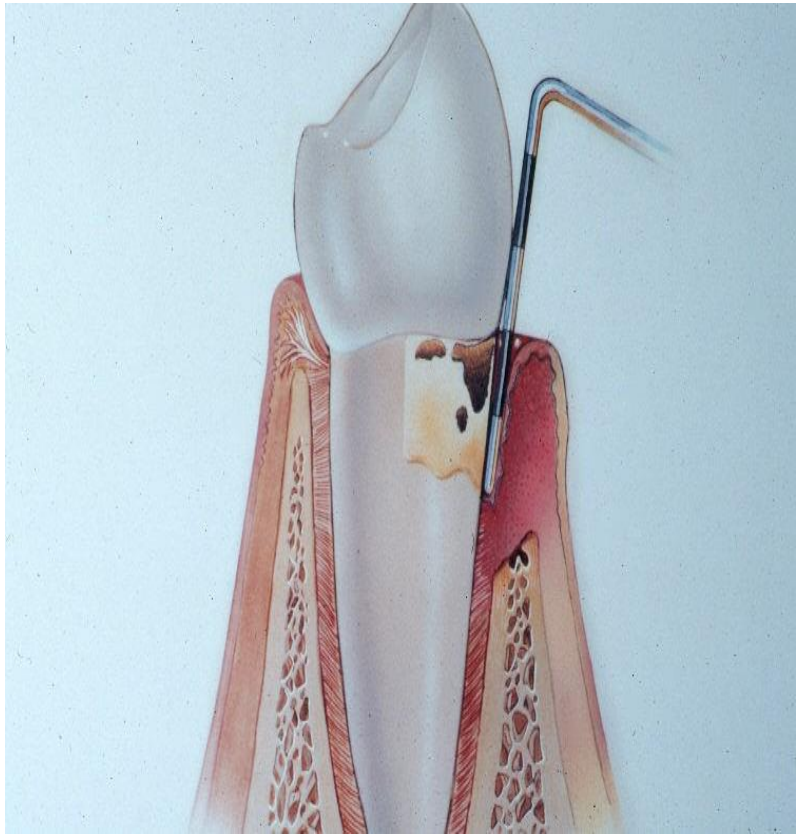
Squamous Cell Carcinoma (Cancer)

Periodontitis Is a Multifactorial Complex Disease



Periodontitis (Gum Disease, Pyorrhea)

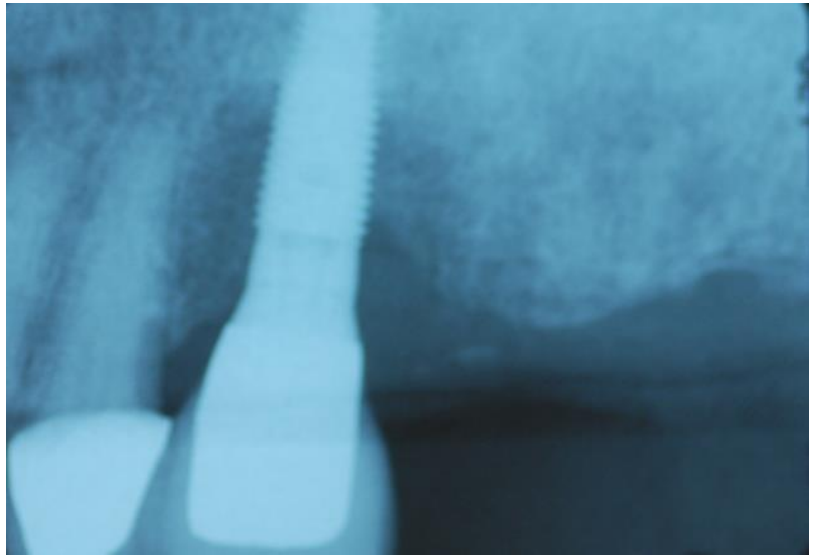


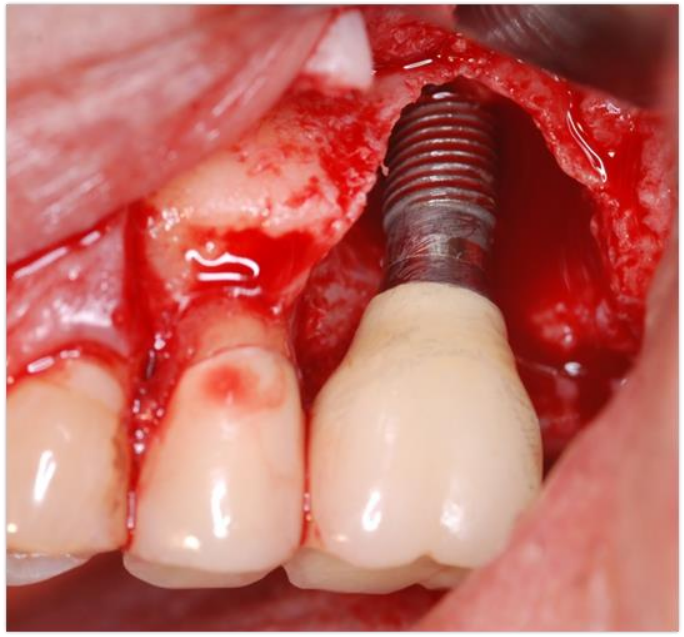


Surface Area of Ulcerated Tissue

Moderate periodontitis
5–7 mm = 3,810 sq. mm or 6 sq. inches

About the same as this ulcer
ResearchGate





Classification of Periodontal and Per-Implant Diseases and Conditions 2017

Periodontal Diseases and Conditions

Periodontal Health and Gingival Diseases and Conditions

- Periodontal and Gingival Health:
- Gingivitis — Dental Biofilm Induced
- Gingival Diseases — Non-dental Biofilm Induced

Periodontitis

- Necrotizing Periodontal Diseases
- Periodontitis as a Manifestation of Systemic Conditions
- Periodontitis

Other Conditions Affecting the Periodontium

- Systemic Diseases or Conditions Affecting the Periodontium
- Other Periodontal Diseases and Conditions:
- Periodontal Abscesses and Endodontic-Periodontal Lesions
- Mucogingival Deformities and Conditions
- Traumatic Occlusal Forces
- Tooth and Prosthesis Related Factors

Peri-Implant Disease and Conditions

- Peri-Implant Health
- Peri-Implant Mucositis
- Peri-Implantitis
- Peri-Implant Soft and Hard Tissue Deficiencies

Staging of periodontitis

Stage I (initial)

(minimal bone loss and pocketing-no previous tooth loss from periodontal disease)

Stage II (moderate)

(maximum bone loss <33 % ; PD < 6 mm-no previous tooth loss from periodontal disease)

Staging of periodontitis

Stage III

(bone loss < 33 %; PD > 5 mm class II/III furcations. < 5 teeth lost due to periodontal disease)

Stage IV

(bone loss > 33 %; PD > 5 mm class II/III furcations. > 4 teeth lost due to periodontal disease)

Sensitivity: STRICTLY CONFIDENTIAL

PERIODONTITIS: GRADING

Grading aims to indicate the rate of periodontitis progression, responsiveness to standard therapy, and potential impact on systemic health.

Clinicians should initially assume grade B disease and seek specific evidence to shift to grade A or C.
See **perio.org/2017wwdc** for additional information.

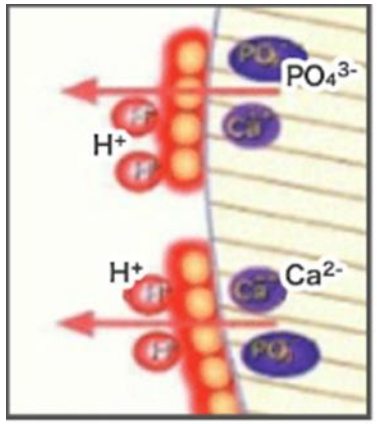
	Progression		Grade A: Slow rate	Grade B: Moderate rate	Grade C: Rapid rate
Primary criteria *Whenever available, direct evidence should be used.*	Direct evidence of progression	Radiographic bone loss or CAL	No loss over 5 years	<2 mm over 5 years	≥2 mm over 5 years
	Indirect evidence of progression	% bone loss / age	<0.25	0.25 to 1.0	>1.0
		Case phenotype	Heavy biofilm deposits with low levels of destruction	Destruction commensurate with biofilm deposits	Destruction exceeds expectations given biofilm deposits; specific clinical patterns suggestive of periods of rapid progression and/or early onset disease
Grade modifiers	Risk factors	Smoking	Non-smoker	<10 cigarettes/day	≥10 cigarettes/day
		Diabetes	Normoglycemic/no diagnosis of diabetes	HbA1c <7.0% in patients with diabetes	HbA1c ≥7.0% in patients with diabetes

Sensitivity: STRICTLY CONFIDENTIAL

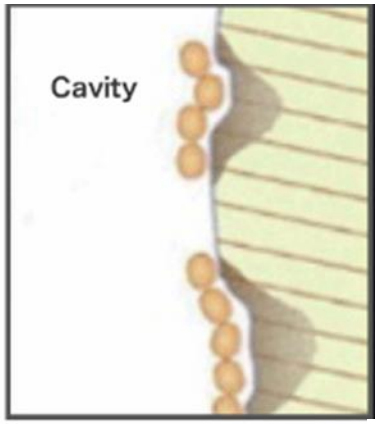
Periodontitis and Systemic Inflammatory Markers

- Higher levels of systemic inflammatory markers such as:
- Interleukin-6 (IL-6)
- C-Reactive Protein (CRP)
- Tumor Necrosis Factor (TNF)

Caries (Cavity)

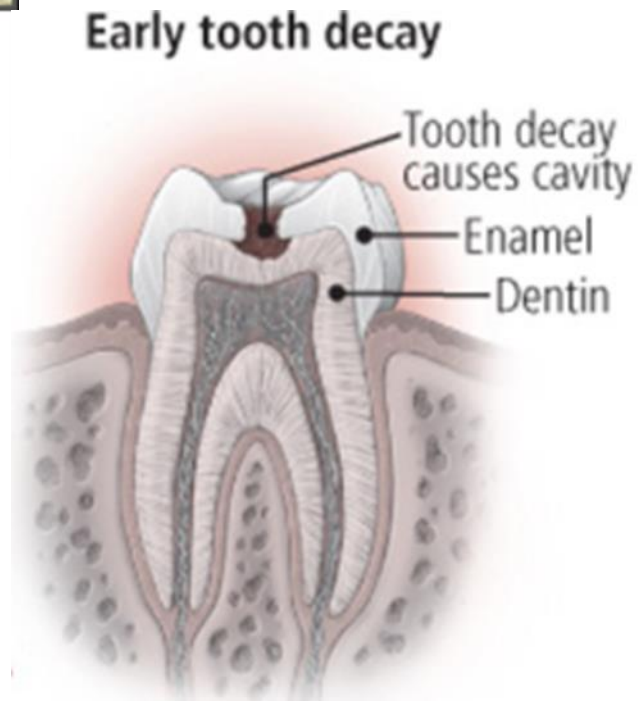


Decalcification due to acid produced by cariogenic bacteria

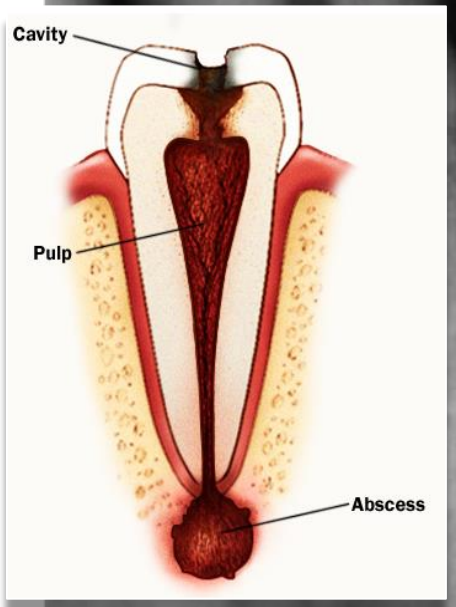


Cavity formation

$Ca_{10}(PO_4)_6(OH,F,Cl)_2$

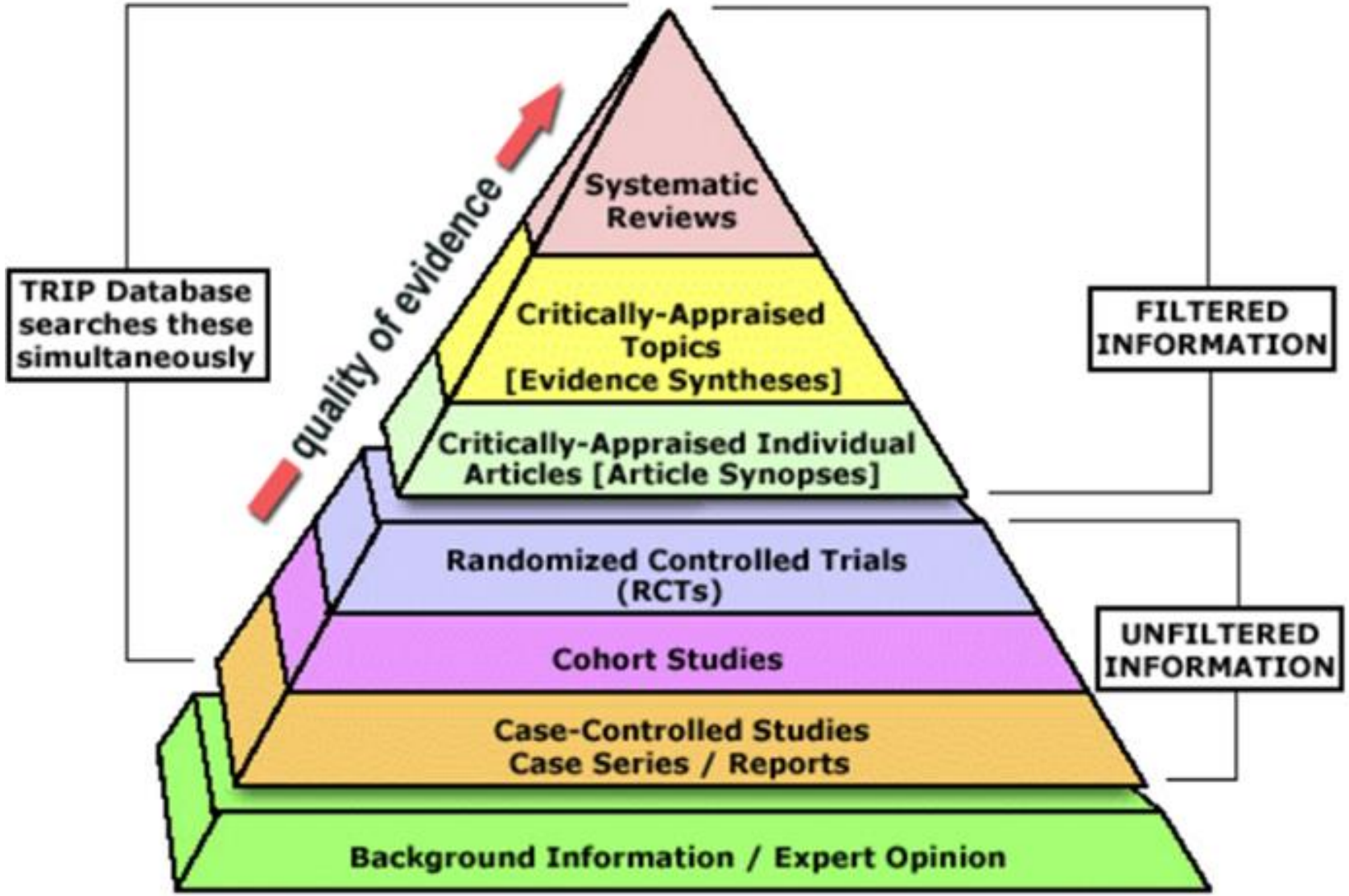


Cavities Lead to Abscess (focal osteomyelitis)



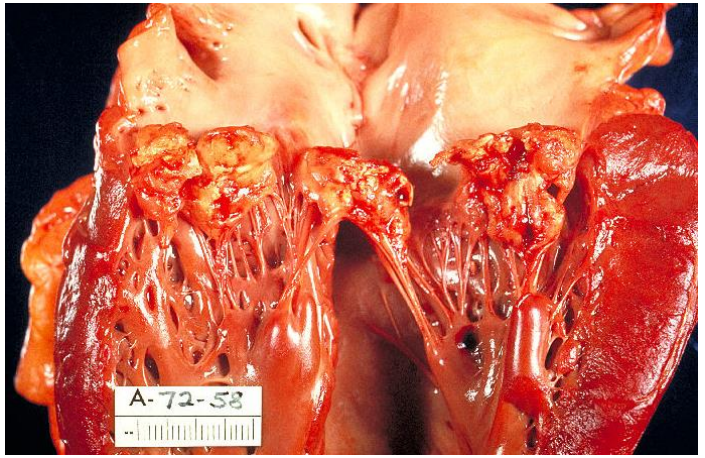
Mayo foundation for medical education and research

Studyblue.com



Infective Endocarditis

- Cost $54,281.00
- Incidence higher in elderly population, males
- Incidence increasing due to drug dependency
- 25% death rate (range 16 – 45%)
- The annual incidence of IE between 1970 and 2000 was estimated at approximately 5 to 7 cases per 100,000 person-years



https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5015881/

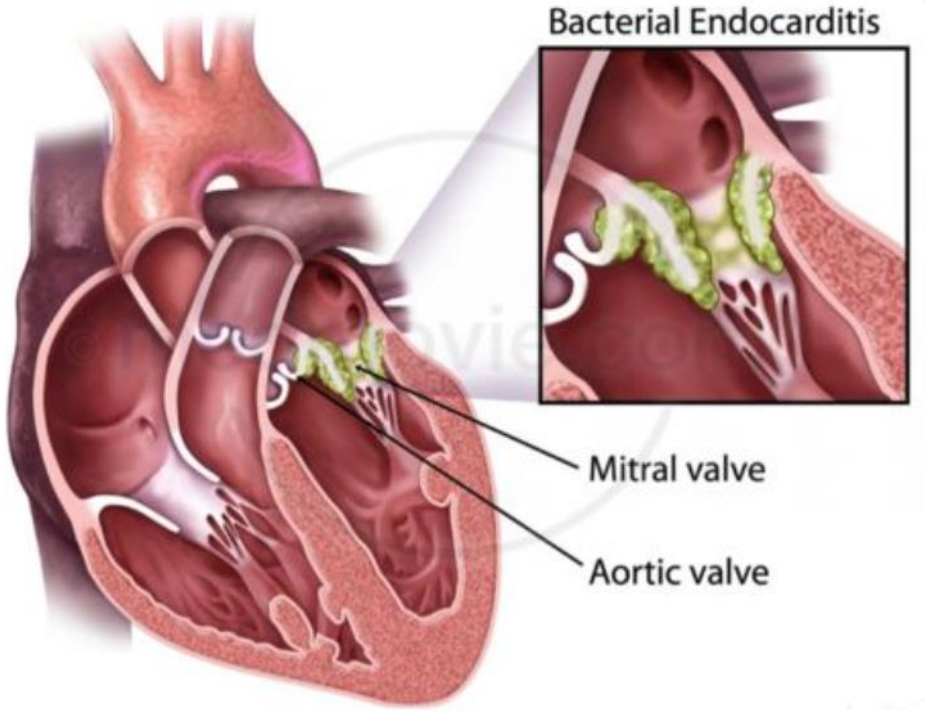
https://www.cdc.gov/mmwr/volumes/66/wr/mm6622a1.htm

https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0060033

Ambrosioni J, Hernandez-Meneses M, Téllez A, Pericàs J, Falces C, Tolosana JM, Vidal B, Almela M, Quintana E, Llopis J, Moreno A, Miro JM (May 2017). "The Changing Epidemiology of Infective Endocarditis in the Twenty-First Century". Current Infectious Disease Reports. 19 (5): 21. doi:10.1007/s11908-017-0574-9. PMID 28401448.

Habib G,Hoen B,Tornos P,et al.Guidelines on the prevention, diagnosis, and treatment of infective endocarditis (new version 2009): the Task Force on the Prevention, Diagnosis, and Treatment of Infective Endocarditis of the European Society of Cardiology (ESC). Eur Heart J.2009;30(19):2369–2413

History



- 1616: Lazare Riviére first described infective endocarditis affecting the aortic valve
- 1878: Theodor Klebs first suggested a microbial origin
- 1909: William Osler noted that heart valves that experienced degeneration had a higher risk of being affected
- 1944: First successful use of penicillin to treat a case of infective endocarditis

Hubers SA, DeSimone DC, Gersh BJ, Anavekar NS (May 2020). "Infective Endocarditis: A Contemporary Review". Mayo Clinic Proceedings. 95 (5): 982–997.

Pathogenesis of IE

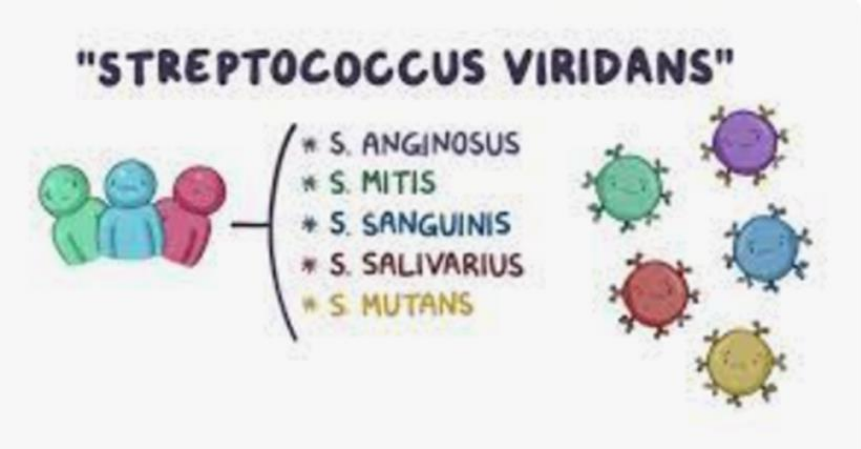
- Interaction between the bloodstream pathogen with matrix molecules and platelets at sites of endocardial cell damage
- Formation of nonbacterial thrombotic endocarditis (NBTE) on the cardiac valve or where endothelial damage occurs
- Adherence of the bacteria to NBTE, and proliferation of bacteria within a vegetation
- Turbulent blood flow such as flow from a high- to a low-pressure chamber or across a narrowed orifice, traumatizes the endothelium
- Predisposition for deposition of platelets and fibrin which results in NBTE
- Microbial species (viridans group streptococci) colonization then results in IE

Fun Facts

- Viridans group streptococci cause at least 50% of cases of IE
- Association between surgical procedures and IE began in 1885
- Poor oral hygiene and bacteremia were associated in 1935
- 30% of the flora of the gingival crevice is streptococci, predominantly of the viridans group

Fun Facts

- Risk of IE is more likely the result of daily activities (brushing/flossing/toothpicks/ water irrigation devices) rather than episodic bacteremias from dental procedures
- Most patients with IE have not had a dental procedure within 2 weeks before the onset of symptoms of IE
- Visible bleeding during a dental procedure is a reliable predictor of bacteremia



Clinical Features

Older Terminology:

- Subacute: infections that were from 6 weeks to 3 months in duration
- Acute: patients who died in less than 6 weeks
- Chronic: signs and symptoms persist for more than three months

Current terminology:

- Short incubation (less than about six weeks)
- Long incubation (greater than about six weeks) are preferred

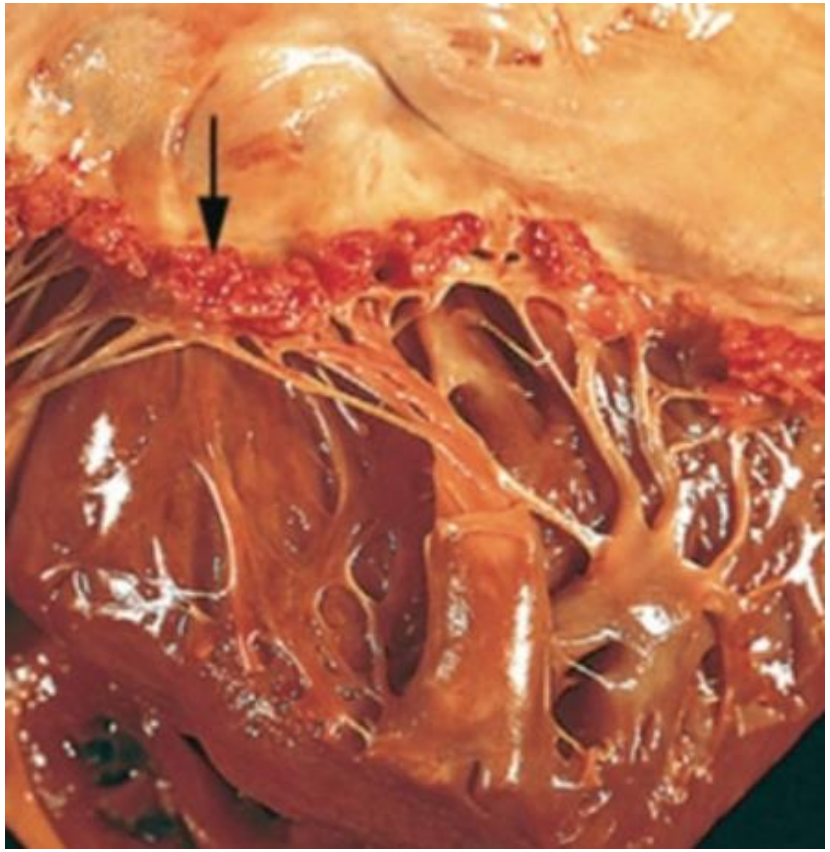
- Fever is the most common symptom and sign (97%)
- Malaise (90%)
- Anorexia, weight loss, and nocturnal hyperhidrosis
- Skin, conjunctiva, or oral mucosal petechiae
- Splenomegaly

Hubers SA, DeSimone DC, Gersh BJ, Anavekar NS (May 2020). "Infective Endocarditis: A Contemporary Review". Mayo Clinic Proceedings. 95 (5): 982–997.

Morris AM (January 2006). "How best to deal with endocarditis". Current Infectious Disease Reports. 8 (1): 14–22.

Pathologic Features of IE

- Vegetations on the valve cusps or leaflets
- The mitral valve is most frequently affected
- The aortic valve is the next most commonly involved



Fungal Endocarditis (FE)

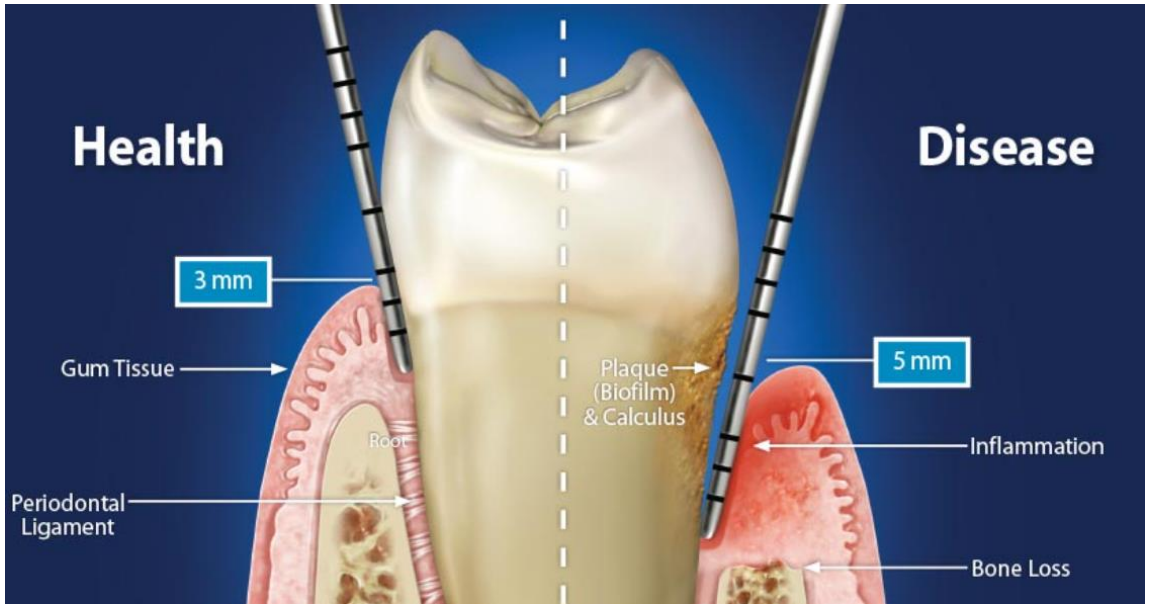
- Often fatal (50%)
- Candida albicans (24-46%)
- Histoplasma capsulatum
- Aspergillus (25%)

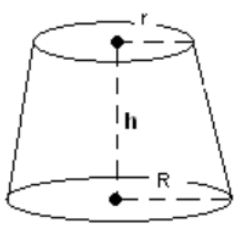
Yuan SM (2016). "Fungal Endocarditis". Brazilian Journal of Cardiovascular Surgery. 31 (3): 252–255.

Lamas CC, Eykyn SJ (March 2003). "Blood culture negative endocarditis: analysis of 63 cases presenting over 25 years". Heart. 89 (3): 258–62.

Efficacy of AB Prophylaxis

- Efficacy of AB on reducing bacteremias and IE is not known
- No data to show that such a reduction as a result of amoxicillin therapy reduces the risk of or prevents IE
- Unlikely that topical antiseptics are effective to significantly reduce bacteremias associated with a dental procedure





$$\text{Area} = \pi (R + r) \sqrt{(R - r)^2 + h^2}$$

$$\text{Volume} = \frac{\pi}{3} h (R^2 + r^2 + R * r)$$

Lack of Evidence

- A placebo-controlled, multicenter, randomized, double-blinded study to evaluate the efficacy of IE prophylaxis in patients who undergo a dental, GI, or GU tract procedure has not been done
- Retrospective or prospective case-control studies are limited by the following:
  - The low incidence of IE requires a large “n” for statistical significance
  - The wide variation and severity of underlying cardiac conditions, which would require a large “n” with specific matched control subjects for each cardiac condition
  - The variety of invasive dental procedures and dental disease states, which would be difficult to standardize for control groups

Let’s Try to Avoid……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Attorney Mark Bernstein
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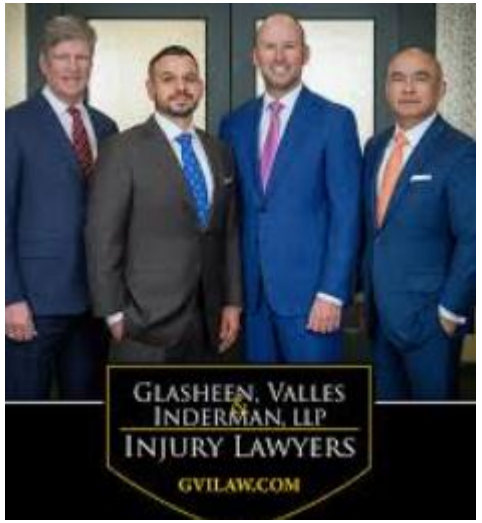
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& INDERMAN, LLP
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Risk of IE

- Absolute risk for IE from a dental procedure is unknown
- Estimates are:
  - MVP, 1 per 1.1 million procedures
  - CHD, 1 per 475,000
  - RHD, 1 per 142,000
  - Cardiac valve, 1 per 114,000
  - Previous IE, 1 per 95,000 dental procedures

Pallasch TJ. Antibiotic prophylaxis: problems in paradise. Dent Clin North Am. 2003; 47: 665–679

Idsoe O, Guthe T, Willcox RR, de Weck AL. Nature and extent of penicillin side-reactions, with particular reference to fatalities from anaphylactic shock. Bull World Health Organ. 1968; 38: 159–188.

Risks of AB prophylaxis

- Rash, diarrhea, and GI upset
- Fatal anaphylactic reactions estimated to occur in 15 to 25 individuals per 1 million patients who receive a dose of penicillin
- *Clostridium difficile* colitis

Ahlstedt S. Penicillin allergy: can the incidence be reduced? Allergy. 1984; 39: 151–164.

Idsoe O, Guthe T, Willcox RR, de Weck AL. Nature and extent of penicillin side-reactions, with particular reference to fatalities from anaphylactic shock. Bull World Health Organ. 1968; 38: 159–188.

IE Prophylaxis Recommendations

First recommendations published in 1955, revised 8 times, last revision 2017

Indications and AB regimens have decreased over the past 50 years

Recommendations based mainly on expert opinion, not evidence

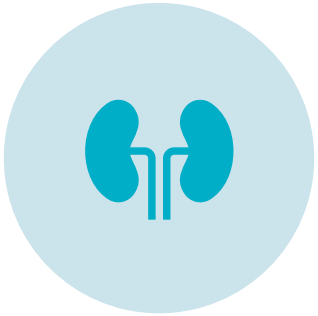
Effectiveness of prophylaxis is not clear

IE is much more likely to result from frequent exposure to random bacteremias associated with daily activities than from bacteremia caused by a dental, GI tract, or GU tract procedure

AHA recommendations are guidelines, not standard of care

American Heart Association guidelines (2017 updated with a scientific statement in 2021)

Risk of adverse reactions to antibiotics and resistant strains generally outweigh the benefits of prophylaxis for many patients



The guidelines note that people who are at risk for infective endocarditis are regularly exposed to oral bacteria during basic daily activities such as brushing or flossing

Emphasized need to promote good oral / periodontal health

AHA Recommendations 2021
Prevention of Viridians Group Streptococcal Infective Endocarditis A Scientific Statement From the American Heart Association Circulation. 2021;143:e963–e978
https://www.ahajournals.org/doi/pdf/10.1161/CIR.0000000000000969

Indications

- Prosthetic cardiac valves, including transcatheter-implanted prostheses and homografts
- Prosthetic material used for cardiac valve repair, such as annuloplasty rings and chords
- A history of infective endocarditis
- A cardiac transplant with valve regurgitation due to a structurally abnormal valve
- The following congenital heart diseases:
  - Unrepaired cyanotic congenital heart disease, including palliative shunts and conduits
  - Any repaired congenital heart defect with residual shunts or valvular regurgitation at the site of or adjacent to the site of a prosthetic patch or a prosthetic device

Pediatric Patients

- Cyanotic congenital heart disease (birth defects with oxygen levels lower than normal), that has not been fully repaired, including children who have had a surgical shunts and conduits
- A congenital heart defect that's been completely repaired with prosthetic material or a device for the first six months after the repair procedure
- Repaired congenital heart disease with residual defects, such as persisting leaks or abnormal flow at or adjacent to a prosthetic patch or prosthetic device

Prophylaxis is recommended for the patients identified in the previous section for all dental procedures that involve manipulation of gingival tissue or the periapical region of the teeth, or perforation of the oral mucosa.

Antibiotic Considerations

- First choice amoxicillin or ampicillin
- If allergic, cephalexin (or other first- or second-generation cephalosporins), azithromycin, clarithromycin, or doxycycline
- Cephalosporins should not be used in an individual with a history of anaphylaxis, angioedema, or urticaria with penicillin or ampicillin
- For patients unable to take oral medication: cefazolin or ceftriaxone
- No longer recommends use of clindamycin as an oral or parenteral alternative to amoxicillin or ampicillin in individuals with allergies

Table 5. Antibiotic Regimens for a Dental Procedure Regimen: Single Dose 30 to 60 Minutes Before Procedure

Situation	Agent	Adults	Children
Oral	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Ampicillin OR	2 g IM or IV	50 mg/kg IM or IV
	Cefazolin or ceftriaxone	1 g IM or IV	50 mg/kg IM or IV
Allergic to 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

Prevention of Viridians Group Streptococcal Infective Endocarditis A Scientific Statement From the American Heart Association Circulation. 2021;143:e963–e978
https://www.ahajournals.org/doi/pdf/10.1161/CIR.0000000000000969

Prosthetic Joints

- 1 million hip and knee replacements are performed annually in the US
- 7 million people are living with a total joint replacement

Kremers HM, Larson DR, Crowson CS, et al. Prevalence of total hip and knee replacement in the United States. J Bone Joint Surg Am. 2015;97(17):1386-1397.

- Conflicting guidelines from the American Academy of Orthopedic Surgeons (AAOS) and the American Dental Association (ADA) has led many orthopedic surgeons and dentists to default to using antibiotic prophylaxis (AP) on a regular basis. More than 90% of orthopedic surgeons currently recommend AP for patients with total joint arthroplasty undergoing dental procedures

Lockhart PB, Springer B, Baddour LM, Thornhill MH. Is it time to stop giving antibiotic prophylaxis to patients with prosthetic joints? J Am Dent Assoc. 2022;153(8):737-739

Prosthetic Joint Infection (PJI)

- Average cost is $23,000 - $50,822.00
- The incidence of PJI is 1–2.5% for primary hip or knee replacements and 2.1 – 5.8% for revision surgeries
- Treatment of gum disease lowers risk by 31%

Tai TW, Lin TC, Ho CJ, Kao Yang YH, Yang CY. Frequent Dental Scaling Is Associated with a Reduced Risk of Periprosthetic Infection following Total Knee Arthroplasty: A Nationwide Population-Based Nested Case-Control Study. PLoS One 2016;11(6):e0158096

Lentino JR. Prosthetic joint infections: bane of orthopedists, challenge for infectious disease specialists. Clin Infect Dis. 2003;36(9):1157–61.

Blom AW, Brown J, Taylor AH, et al. Infection after total knee arthroplasty. J Bone Joint Surg Br. 2004;86(5):688–91.

Blom AW, Taylor AH, Pattison G, et al. Infection after total hip arthroplasty. The Avon experience. J Bone Joint Surg Br. 2003;85(7):956–9. [PubMed]

Berbari EF, Hanssen AD, Duffy MC, et al. Risk factors for prosthetic joint infection: case-control study. Clin Infect Dis. 1998;27(5):1247–54.

https://www.ada.org/en/science-research/science-in-the-news/frequent-dental-scaling-was-associated-with-decreased-risk-of-periprosthetic-joint-infection

https://onlinelibrary.wiley.com/doi/full/10.1111/j.1469-0691.2011.03758.x

https://www.ada.org/en/science-research/science-in-the-news/frequent-dental-scaling-was-associated-with-decreased-risk-of-periprosthetic-joint-infection

Prosthetic Joint Infection (PJI)

- There is no uniformly accepted definition for PJI
- The microbial load needed to produce an infection in a prosthetic joint is much less than that for a native joint
- The strongest indicating factor of a PJI is a joint aspirate or surgically obtained periprosthetic material that yields a microorganism when cultured
- Other signs: sinus tract, wound dehiscence, purulence, prosthetic loosening, synovial fluid leukocytosis with neutrophilia, and elevated serum inflammatory markers

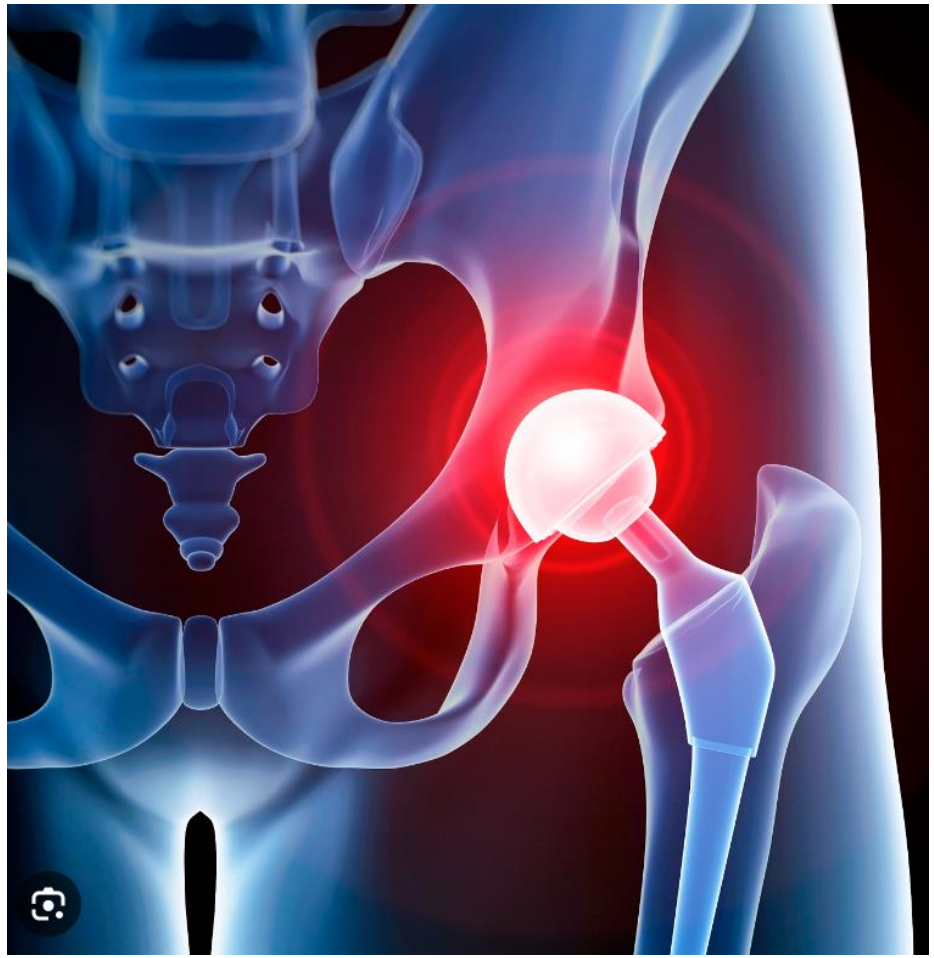
Classification: Early, Delayed, or Late Infections

- Early: Within 4 weeks (Risk of developing PJI is most pronounced in the early postoperative period)
  - *S aureus*, aerobic gram-negative bacilli, beta-hemolytic streptococci, and *Enterococcus* spp
- Delayed: Occur between 3 and 12 months
  - Coagulase-negative *staphylococci, C acnes, and enterococci*
- Late: Occur 1 to 2 years
  - *S aureus*, coagulase-negative *staphylococci, viridans streptococci*, *enterococci*, and occasionally gram-negative bacilli

Slullitel PA, Oñativia JI, Buttaro MA, Sánchez ML, Comba F, Zanotti G, Piccaluga F. State-of-the-art diagnosis and surgical treatment of acute peri-prosthetic joint infection following primary total hip arthroplasty. EFORT Open Rev. 2018 Jul;3(7):434-441

Risk Factors

- History of prior surgery at the arthroplasty site, current bacteremia or sepsis, and a previous or active infection at the current surgical site
- Tobacco use, excessive alcohol use, intravenous drug use, poor oral hygiene, malnutrition, poor preoperative glycemic control, and obesity. Patients with a BMI greater than 40
- First- or second-degree relative with a history of PJI
- Intra-articular injections of glucocorticoids, hyaluronic acid, or anesthetics in the 3 months preceding arthroplasty



Risk Factors

- Immunosuppression, poorly controlled diabetes mellitus, acute liver injury, chronic kidney disease, infection with the human immunodeficiency virus (HIV), inflammatory arthropathies, and the use of immunosuppressant or immune-modifying medications such as systemic corticosteroids or disease-modifying antirheumatic agents
- Surgical time of more than 90 minutes
- Hematoma, seroma, or wound dehiscence in the postoperative period
- Patients with Medicaid as their primary insurer

AAOS
American Academy of Orthopaedic Surgeons

ADA American Dental Association®

Prevention of Orthopaedic Implant Infection in Patients Undergoing Dental Procedures

Evidence-Based Clinical Practice Guideline

Adopted by:
The American Academy of Orthopaedic Surgeons Board of Directors
December 7, 2012

- 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 orthopedic 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 orthopedic implants maintain appropriate oral hygiene

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

Sollecito TP, Abt E, Lockhart PB, et al. The use of prophylactic antibiotics prior to dental procedures in patients with prosthetic joints: evidence-based clinical practice guideline for dental practitioners—a report of the American Dental Association Council on Scientific Affairs. J Am Dent Assoc. 2015;146(1):11-16.e8. doi:10.1016/j.adaj.2014.11.012

- Little evidence exists on the use of antibiotics as infection prophylaxis before dental procedures in patients with orthopedic implants
- Simple daily act of toothbrushing can result in transient bacteremia, prosthetic infection develops in few orthopedic patients even if they are not undergoing a course of antibiotics

Rees HW. AAOS appropriate use criteria: management of patients with orthopaedic implants undergoing dental procedures. J Am Acad Orthop Surg. 2017;25(7)

- The recommendations in this guideline are not intended to be a fixed protocol as some patients may require more or less treatment or different means of diagnosis
- Patient care and treatment should always be based on a clinician's independent medical judgment given the individual clinical circumstances

American Academy of Orthopaedic Surgeons, American Dental Association: Prevention of Orthopaedic Implant Infection in Patients Undergoing Dental Procedures: Evidence-Based Guideline and Evidence Report. Published December 7, 2012.

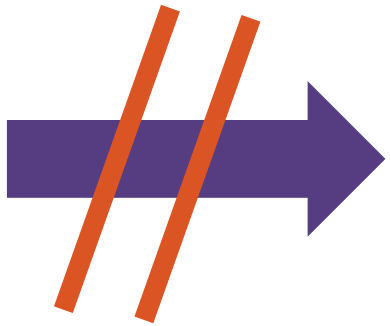
Kao FC, Hsu YC, Chen WH, Lin JN, Lo YY, Tu YK. Prosthetic joint infection following invasive dental procedures and antibiotic prophylaxis in patients with hip or knee arthroplasty. Infect Control Hosp Epidemiol. 2017;38(2):154-161.

- A 2017 case-control propensity-matched study
- 250,000 patients who had a knee or hip arthroplasty and identified 57,000 who had undergone a dental procedure matched against nondental procedure controls
- A subgroup analysis consisted of 6,500 dental patients who had AP matched against dental patients without AP.
  - PJI occurred in 328 patients in the dental group and 348 in the nondental group.
  - PJI occurred in 13 patients in the antibiotic group and in 12 in the nonantibiotic group.

The authors concluded that the risk of PJI is not increased following dental procedures in patients with hip or knee replacement and is unaffected by AP

Thornhill MH, Crum A, Rex S, et al. Analysis of prosthetic joint infections following invasive dental procedures in England. JAMA Netw Open. 2022;5(1):e2142987.

- 10,000 patients in the UK with late prosthetic joint infection (LPJI)
- Patients did not receive AP. There was no correlation between having an Invasive Dental Procedure (IDP) and the subsequent development of LPJI



Thornhill MH, Gibson TB, Pack C, et al. Quantifying the risk of prosthetic joint infections after invasive dental procedures and the effect of antibiotic prophylaxis. J Am Dent Assoc. 2023;154(1):43-52.

- 2,500 US patients with LPJI and the incidence of IDPs in the three months immediately prior to LPJI development versus the incidence of IDPs in the preceding 12 months, and whether AP had been used

No correlation between IDPs and development of LPJI, as well as no protective benefit of AP

Current evidence suggests that the risks associated with giving AP to patients with prosthetic joints outweigh any benefit in reducing the risk of developing LPJI

- Vast majority of PJIs are caused by Staphylococci
- Viridans group streptococci (VGS) are involved in less than 5% of PJI cases
- Poor oral hygiene may be an associated risk factor for distant site infections caused by oral bacteria.
- Orthopedic surgeons and dentists in many countries don’t recommend AP for prosthetic joint patients undergoing IDPs
- No evidence that the incidence of LPJI is any higher in these countries: Australia, Brazil, Canada, Denmark, France, Netherlands, Norway, Portugal, and the United Kingdom

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

Antibiotic Stewardship

- Allergy, anaphylaxis, gastrointestinal distress, antimicrobial resistance (AMR), and *Clostridioides difficile* (*C.diff*) infection (CDI)
- Estimated 35,000 deaths occur annually due to antibiotic-resistant infections
- 29,000 deaths occur annually due to CDI
- Significant increase in MRSA PJIs (AB overutilization?)
  - Hays MR, Kildow BJ, Hartman CW, et al. Increased incidence of methicillin-resistant Staphylococcus aureus in knee and hip prosthetic joint infection. ScienceDirect. Accessed March 21, 2023. https://www.sciencedirect.com/science/article/pii/S088354032300133X

Antibiotic resistance threats in the United States, 2019. US Department of Health and Human Services. Centers for Disease Control and Prevention. Updated December 2019. https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf

Medical-Legal Considerations

- Acts of commission versus acts of omission

Aspiration Pneumonia

- Periodontal (Gum) disease increases the risk of aspiration pneumonia four times
- Professional cleaning reduces risk between 50–67%
- Costs of treatment ($6,000–$40,000)
  [$14,000] median

In the elderly

- Gag reflex is reduced
- Decreased swallowing
- Coughing ability and ciliary transport are reduced
- Immune mechanisms are compromised

Pneumonia: The Leading Cause of Death by Infection in Elders

Oral Hygiene Reduces the Mortality from Aspiration Pneumonia in Frail Elders F. Müller J Dent Res. 2015 Mar; 94(3 Suppl): 14S–16S.

- Pneumonia accounts for 13 to 48% of all infections in nursing homes and is the leading cause of death from infection in patients aged 65 y and older
  - El-Solh AA. 2011. Association between pneumonia and oral care in nursing home residents. Lung. 189:173–180.
- Aspiration pneumonia is caused by foreign material descending into the bronchial tree and alveoli (materia alba, saliva, periodontal pathogens)
- Studies suggest a strong correlation between poor oral health and an increased risk of aspiration and pneumonia (Stein & Henry, 2009)
- Ventilated patients are also at risk
- A systematic review concluded 1 in 10 deaths from pneumonia in elderly nursing home residents may be prevented by improving oral hygiene (Sjogren et al. 2008)

Van der Maarel-Wierink, C.C., Vanobbergen, J.N.O., Bronkhorst, E.M., Schols, J.M.G.A., de Baat, C. Oral Health Care and Aspiration Pneumonia in Frail Older People: A Systematic Literature Review. Gerodontology. 2012; 30(1)

- Review of 5 papers
- Oral care was the primary intervention to reduce the development of aspiration pneumonia
- Increasing the individual's oral health reduced the risk of contracting and dying from aspiration pneumonia

Ventilators

Hutchins K, et al. Ventilator-associated pneumonia and oral care: A successful quality improvement project. Am J Infect Control 2009; (37):590-597

- 83% of patients who develop nosocomial pneumonias are mechanically ventilated
- Oral care protocol interventions led to an 89.7% reduction in ventilator associated pneumonia
- Oral hygiene strategies in hospitalized and nursing home populations also can reduce the incidence of pneumonia

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Association Between Oral Health and Incidence of Pneumonia: A Population-based Cohort Study from Korea

- Aspiration of droplet nuclei containing pathogenic microorganisms is the hallmark of aspiration pneumonia
- The association between pneumonia and oral health has been examined in nursing homes, and the incidence of pneumonia has been reported to be lower in elderly populations receiving oral care
- Caries and missing teeth were associated with a higher incidence of pneumonia. Better oral hygiene care, such as frequent tooth brushing and regular professional dental cleaning, was associated with a lower incidence of pneumonia
- This study showed no association between periodontal disease and pneumonia

Minkook Son, Sangyong Jo, Ji Sung Lee & Dong Hyun Lee
Scientific Reports volume 10, Article number: 9576 (2020)


but wait there's more!
imgflip.com

Association Between Periodontal Disease and Aspiration Pneumonia

- de Melo Neto, J. P. et al. Periodontal infections and community-acquired pneumonia: a case-control study. Eur. J. Clin. Microbiol. Infect. Dis. 32, 27–32, https://doi.org/10.1007/s10096-012-1710-y (2013).
- Gomes-Filho, I. S. et al. Influence of periodontitis in the development of nosocomial pneumonia: a case control study. Journal of periodontology 85, e82–90, https://doi.org/10.1902/jop.2013.130369 (2014).
- Iwasaki, M. et al. Periodontal disease and pneumonia mortality in haemodialysis patients: A 7-year cohort study. J. Clin. Periodontol. 45, 38–45, https://doi.org/10.1111/jcpe.12828 (2018).
- Yang, L.-C. et al. The Association of Periodontal Treatment and Decreased Pneumonia: A Nationwide Population-Based Cohort Study. Int. J. Environ. Res. Public Health 17, 356, https://doi.org/10.3390/ijerph17010356 (2020).

Toothbrushing Related to the Incidence of Pneumonia

- Nasiriani, K., Torki, F., Jarahzadeh, M. H. & Rashidi Maybodi, F. The Effect of Brushing with a Soft Toothbrush and Distilled Water on the Incidence of Ventilator-Associated Pneumonia in the Intensive Care Unit. Tanaffos 15, 101–107 (2016).
- Ames, N. J. Evidence to support tooth brushing in critically ill patients. Am. J. Crit. Care 20, 242–250, https://doi.org/10.4037/ajcc2011120 (2011).

Association Between Daily Toothbrushing and Hospital-Acquired Pneumonia A Systematic Review and Meta-Analysis

- Systematic review and meta-analysis of 15 randomized clinical trials with a population of 2,786 patients was conducted. Subgroups included patients who received invasive mechanical ventilation versus those who did not, toothbrushing twice daily versus more frequently, toothbrushing provided by dental professionals versus general nursing staff, electric versus manual toothbrushing
- Effective way to decrease the rates of hospital-acquired pneumonia (HAP) among patients
- Linked with reduced rates of intensive care unit (ICU) mortality, shorter duration of mechanical ventilation, and shorter stays in the ICU
- Only studied ICU patients

Selina Ehrenzeller, Michael Klompas JAMA Intern Med. Published online December 18, 2023

Brigham and Women's Hospital Press Release

- "It's rare in the world of hospital preventative medicine to find something like this that is both effective and cheap. Instead of a new device or drug, our study indicates that something as simple as brushing teeth can make a big difference,”

Klompas 2023

Summary and Conclusions

- The oral cavity is connected to the body
- Previous evidence supporting SBE prophylaxis is weak, not evidence based
- Efficacy of AB on reducing bacteremias and IE is not known
- Bacteremias are more likely the result of daily activities rather than invasive dental procedures
- Risk of adverse reactions to antibiotics and resistant strains generally outweigh the benefits of prophylaxis for many patients
- Antibiotic prophylaxis is recommended only for specific cardiac conditions

Summary and Conclusions

- Conflicting guidelines from the American Academy of Orthopedic Surgeons and the American Dental Association has led many orthopedic surgeons and dentists to default to using antibiotic prophylaxis
- Risks associated with giving AP to patients with prosthetic joints outweigh any benefit in reducing the risk of developing LPJI
- In general, for patients with prosthetic joint implants, prophylactic antibiotics are not recommended prior to dental procedures to prevent prosthetic joint infection
- Sufficient evidence to support the notion that good oral health is an important factor in IE and PJI

Summary and Conclusions

- There is strong evidence to support the practice of toothbrushing to prevent Hospital-Acquired Pneumonia
- The recommendations are only guidelines, not the standard of care
- The physician should weigh the risks of each patient and make the clinical decision to premedicate or not to premedicate
- Physician recommendations supersedes AHA, AAOMS and AAOS recommendations

Questions?