



How Dental Health and Systemic Health Affect Each Other

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COMMON RISK APPROACH : LINK BETWEEN CHRONIC SYSTEMIC DISEASE AND ORAL DISEASE

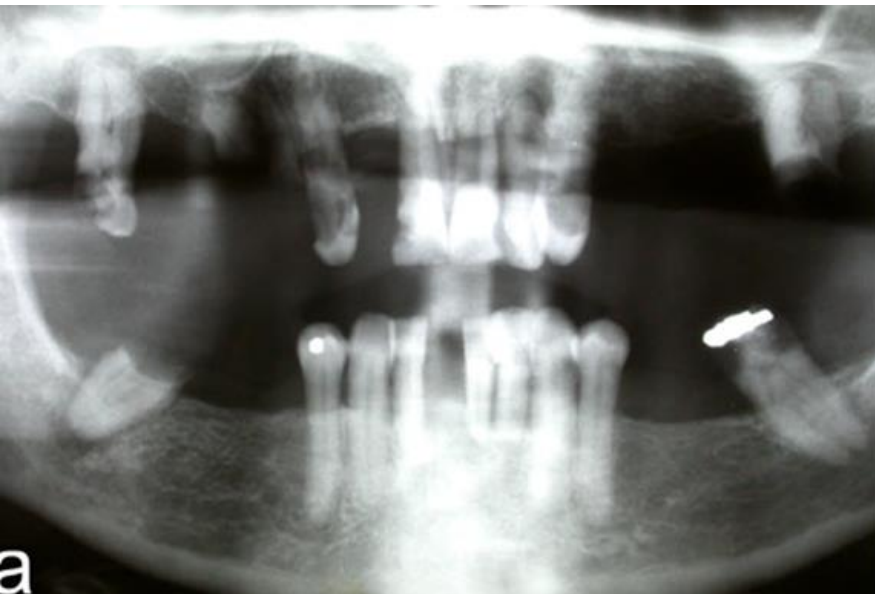
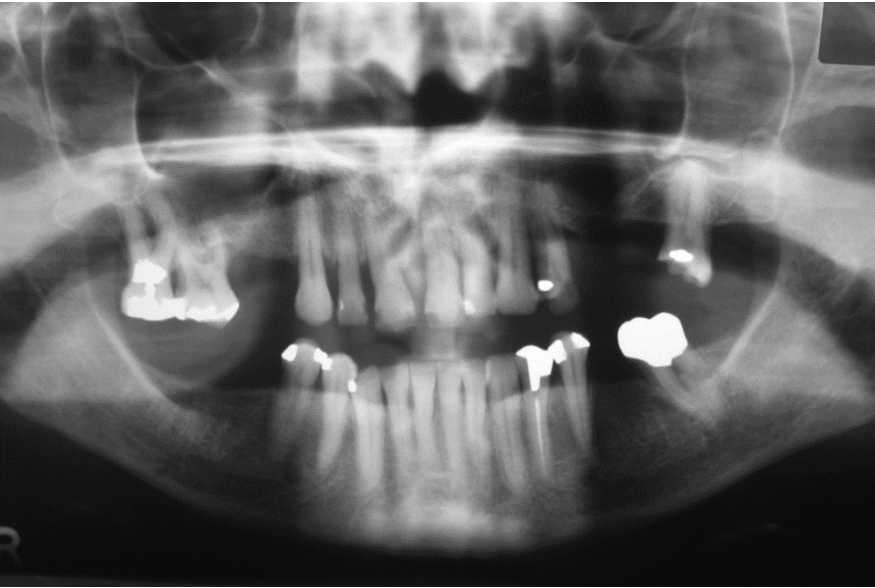
Chronic diseases and lifestyle-related risks

	Poor Diet/ Obesity	Physical Inactivity	Smoking
Coronary Heart Disease	●	●	●
Stroke	●	●	●
Cancer	●	●	●
Diabetes	●	●	●
Chronic Respiratory Diseases	●		●
Oral Diseases	●		●

Key messages and concepts

- Dental function – nutrition - systemic health interaction
- Medicines – dry mouth – oral diseases
- Inhaled oral bacteria – respiratory disease
- Bacteraemia from inflamed gingival sites
- Cytokine production from “quiet” inflammation
- Systemic burden of infection

Tooth loss, chewing function, food selection, nutrition



More patients with
more complex
medical backgrounds



Diabetes Mellitus

Periodontitis is often considered the sixth complication of diabetes

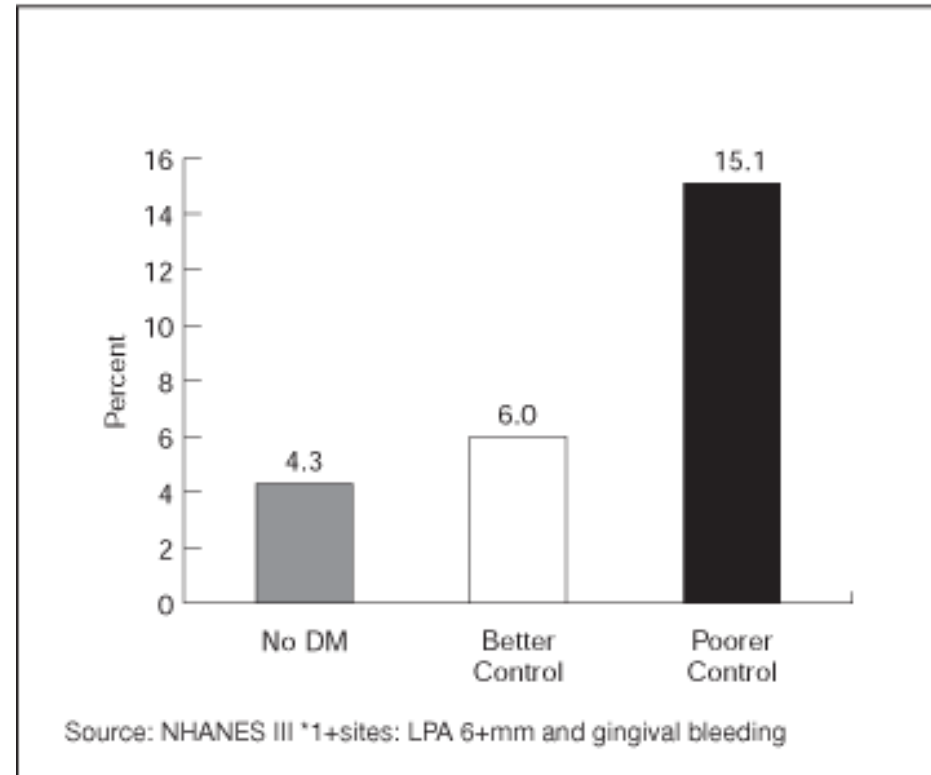
- Patients with diabetes require more rigorous follow-up and greater attention to prevention
- Patients with a history of *poor glycaemic control and oral infections*, require more frequent recall visits, AND urgent attention to acute oral infections.



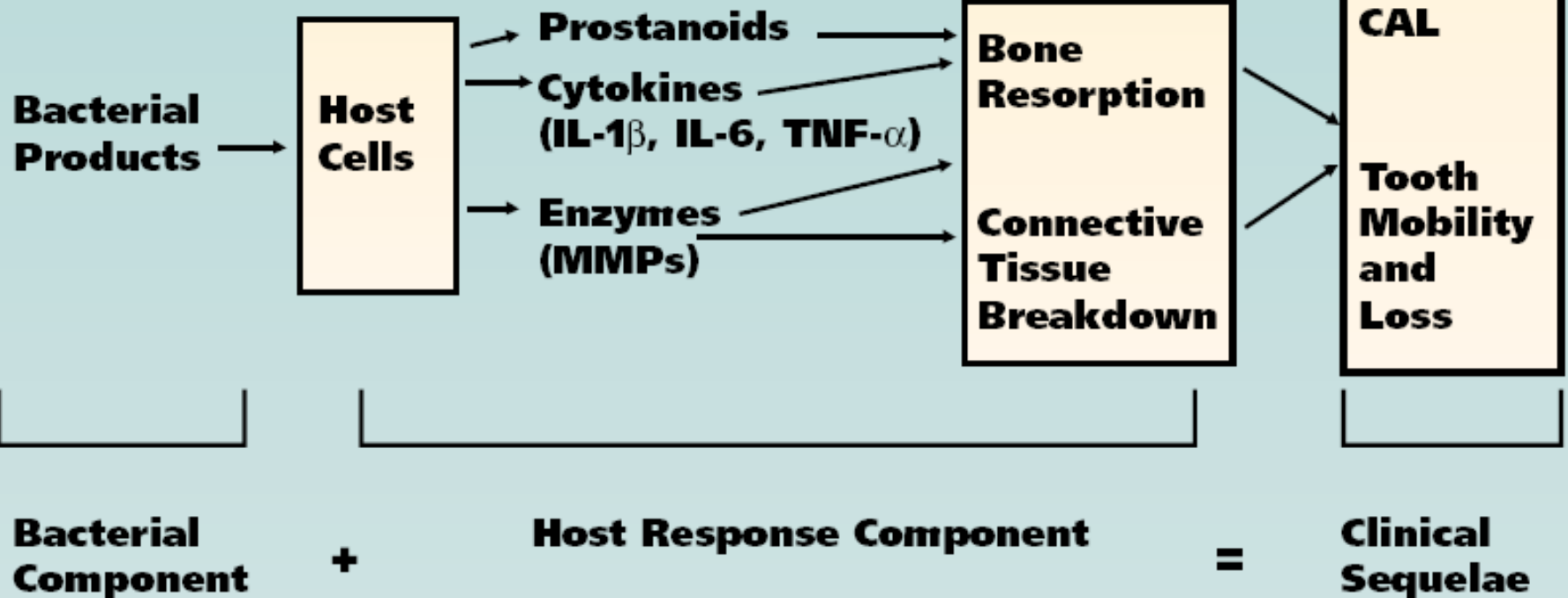
Diabetes Mellitus

- Poor glycaemic control is associated with more severe periodontal diseases.
- **Untreated periodontitis impairs glycaemic control.**
- **Untreated diabetes accelerates periodontitis.**

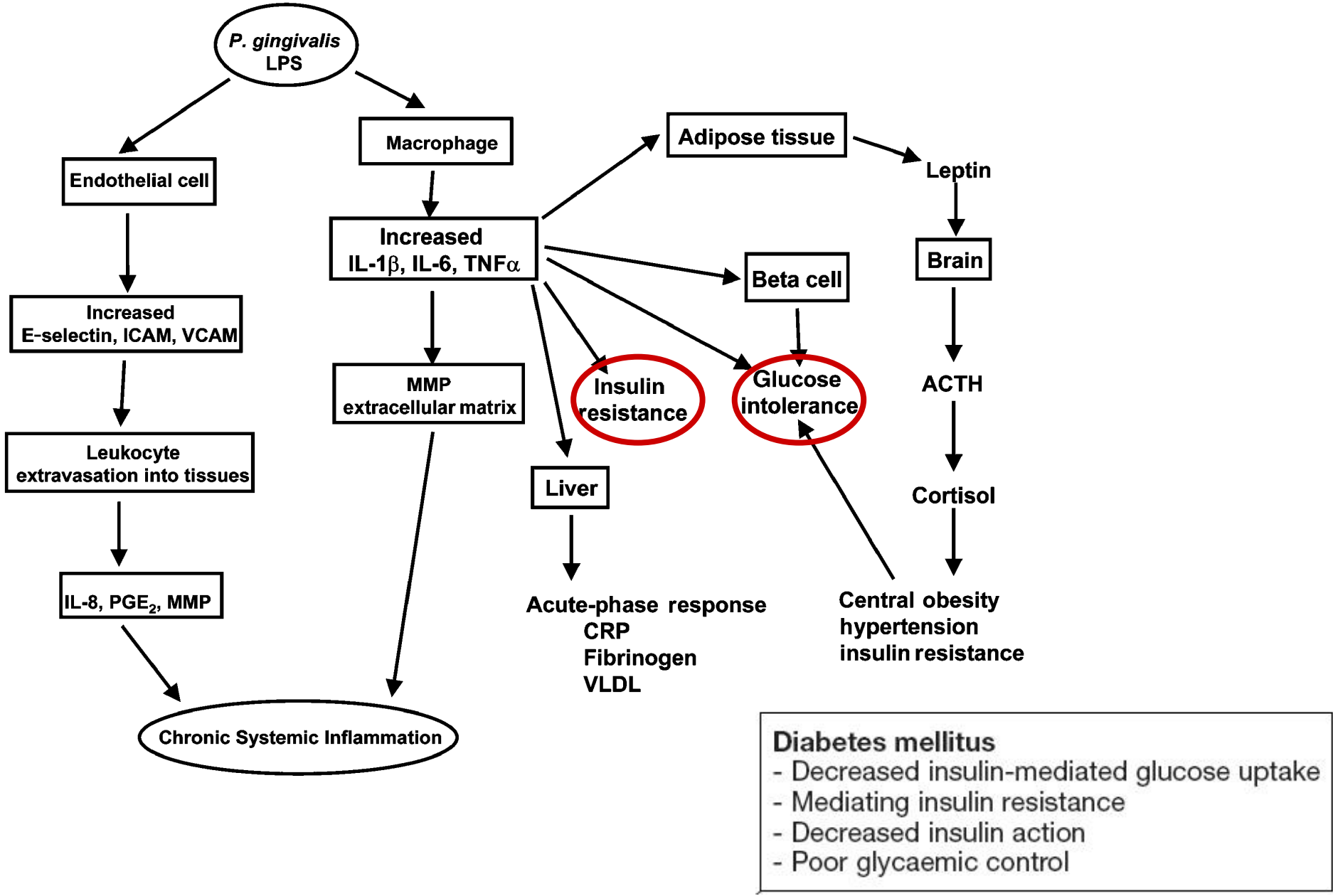
Figure 6. U.S. Adults, Ages 45+, with Severe, "Active" Periodontitis* by Glycemic Control Status



Risk and Rate of Progression Are Altered by Diabetes

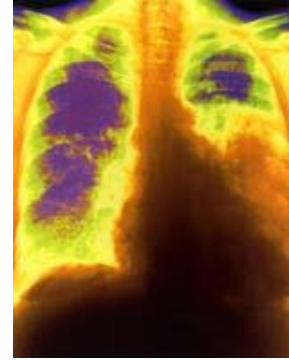


Periodontal – systemic health interactions in Diabetes





Inhalation



- Aspiration of dental plaque and saliva, especially in infirm and elderly.
- Bacteria of oral/periodontal origin can be found in lungs of patients with COPD, pneumonia and VAP
- Once in the lung, periodontal bacteria:
 - Bind to lung epithelium
 - Allow colonization by pulmonary pathogens
 - Activate epithelial cells to produce inflammation, leading to fluid accumulation
 - Activate production of enzymes which break down lung connective tissues



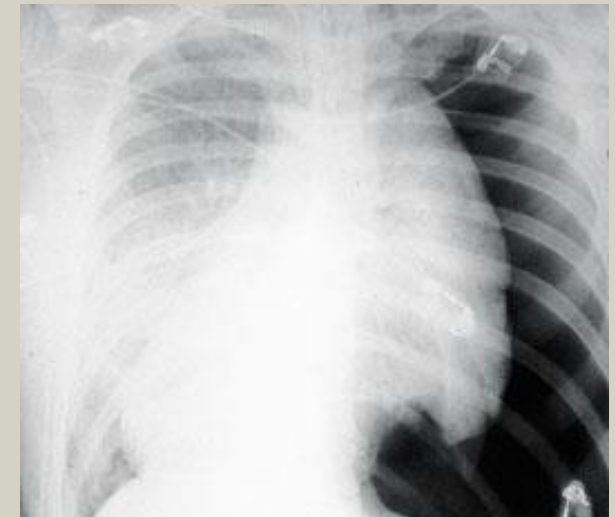
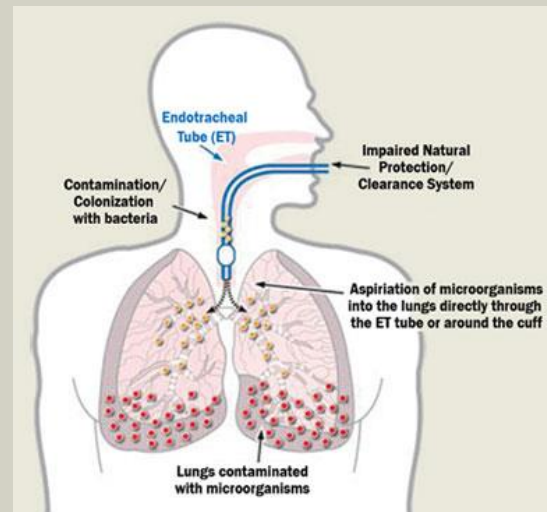
Table 1. Risk groups for respiratory infection from oral bacteria

Medical risk factors

Intellectual disability
Intubated patients
Mechanically ventilated
Intensive care
After major surgery
Oesophagectomy
Stroke
Coma
Bedridden patients
Frail elderly patients
Pre-existing lung disease
Immune suppression

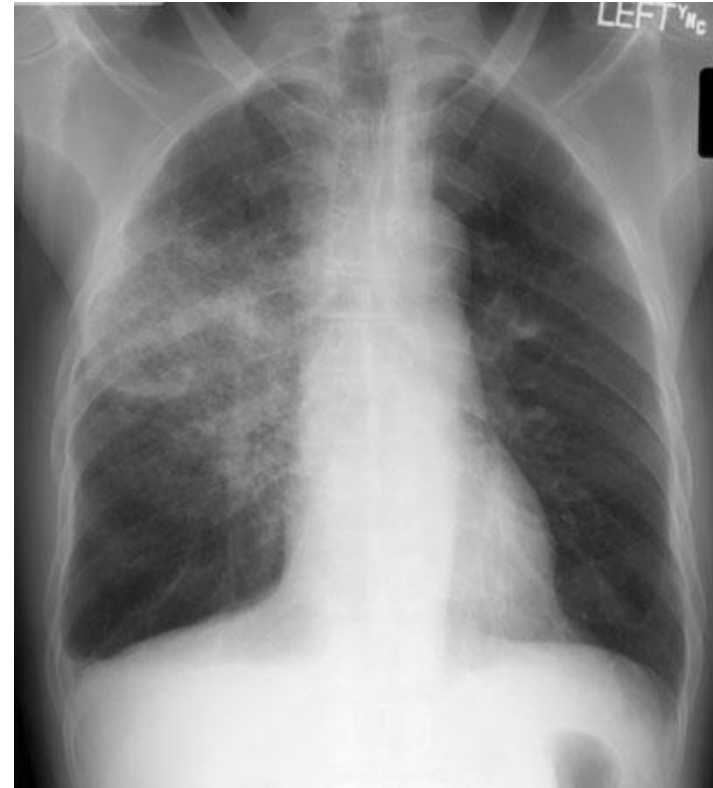
Dental risk factors

High plaque levels
Irregular oral hygiene
Untreated periodontitis
Dry mouth
Mouth breathing



Oesophageal cancer patients after oesophagectomy

- Aspiration of oral bacteria into the upper respiratory tract
- Analysis of preoperative samples of dental plaque and sputum from patients who developed post-operative pneumonia after oesophagectomy indicate that in the **majority of cases (over 70%)**, the causative organisms were from dental plaque.
- Akutsu Y, Matsubara H, Okazumi S, Shimada H, Shuto K, Shiratori T, Ochiai T. Impact of preoperative dental plaque culture for predicting postoperative pneumonia in esophageal cancer patients. Dig Surg. 2008;25:93-7.



Ventilator-associated pneumonia in ICU patients

- Respiratory pathogens isolated from the lung of patients who receive mechanical ventilation and who develop VAP **genetically identical** to strains of the same species isolated from the oral cavity in up to **90% of cases**.
 - 3X daily toothbrushing reduces the risk of VAP in stroke, neurological and medical ICU patients within one week
 - 2 X daily use of **an effective anti-plaque rinse** (CHX, EO) reduces the risk of nosocomial pneumonia in intubated patients, by a factor of more than 6 times, compared with the same daily standard oral care protocol **without** a mouthrinse.
- For CHX, need high conc [2%] because it does not suppress gram-negative organisms causing VAP,
 - e.g. *Pseudomonas*, *Acinetobacter*, and *Enterobacter* species



Patients with intellectual and developmental disabilities (IDD).

- Oral organisms in dental plaque and saliva cause over **60%** of respiratory infections (pneumonia and sinusitis) in IDD patients.
 - *Streptococcus pneumoniae*,
 - Methicillin resistant *Staphylococcus aureus* (MRSA),
 - *Prevotella melaninogenica*, and
 - *Candida albicans*,
- IDD patients require meticulous comprehensive oral hygiene of the oral cavity to reduce their oropharyngeal microbial load and the attendant risks of **respiratory infections**.
- Binkley et al. Oral microbial and respiratory status of persons with mental retardation/intellectual and developmental disability: an observational cohort study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009;108:722-31.

Oral Microbes in the Circulation

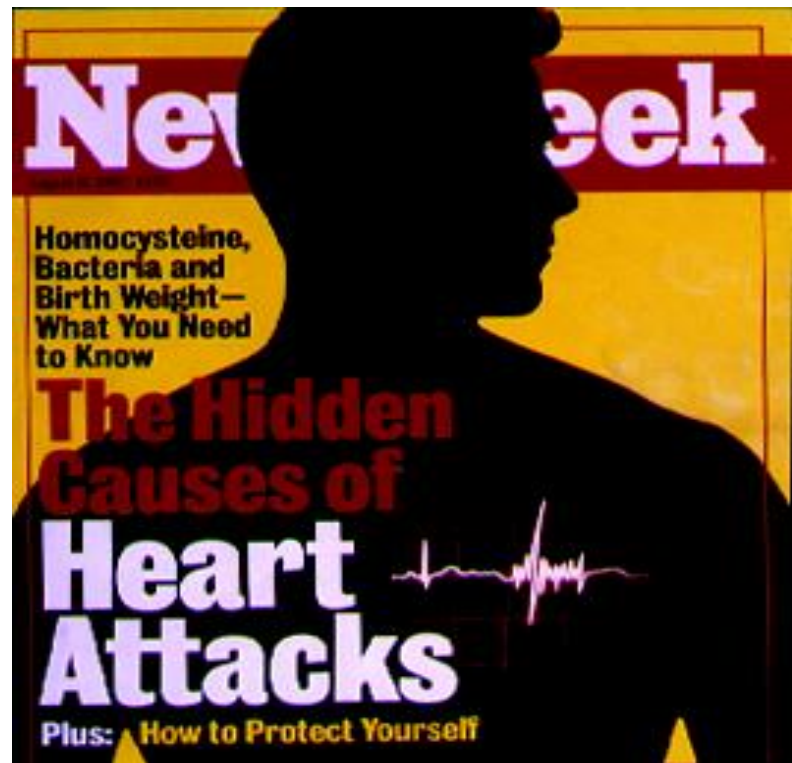
Bugs in Your Pipes

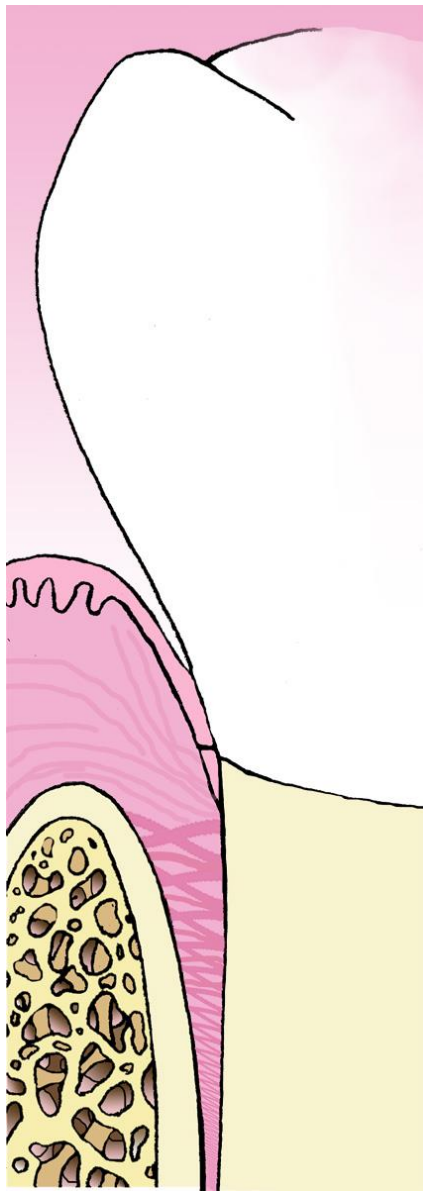
Does heart disease spread like the flu? Growing evidence suggests that infectious agents play a role. Some suspects:

Chlamydia pneumoniae Causes respiratory illness; may also damage the arteries

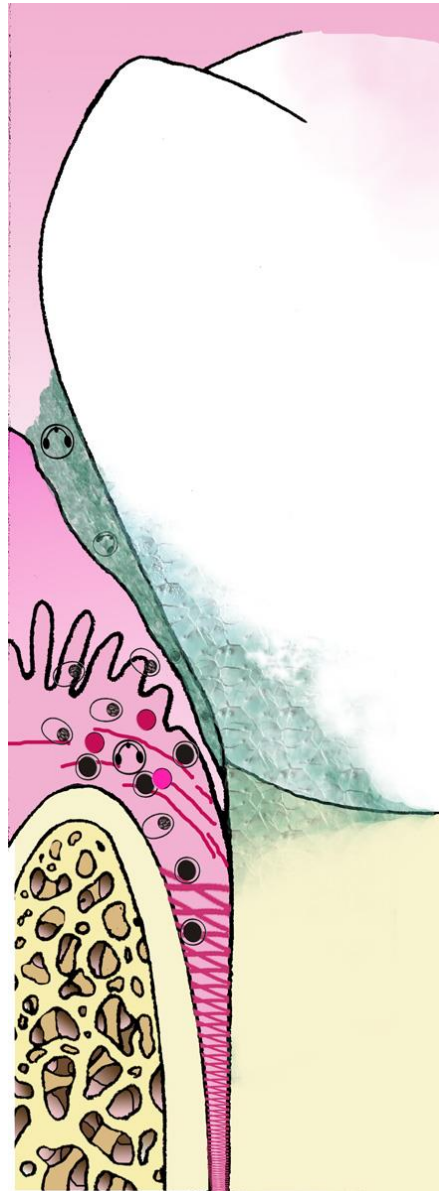
Porphyromonas gingivalis People plagued by gum-disease bug have more coronaries

Cytomegalovirus Common herpes virus seems to exacerbate vascular conditions





Health



Gingivitis

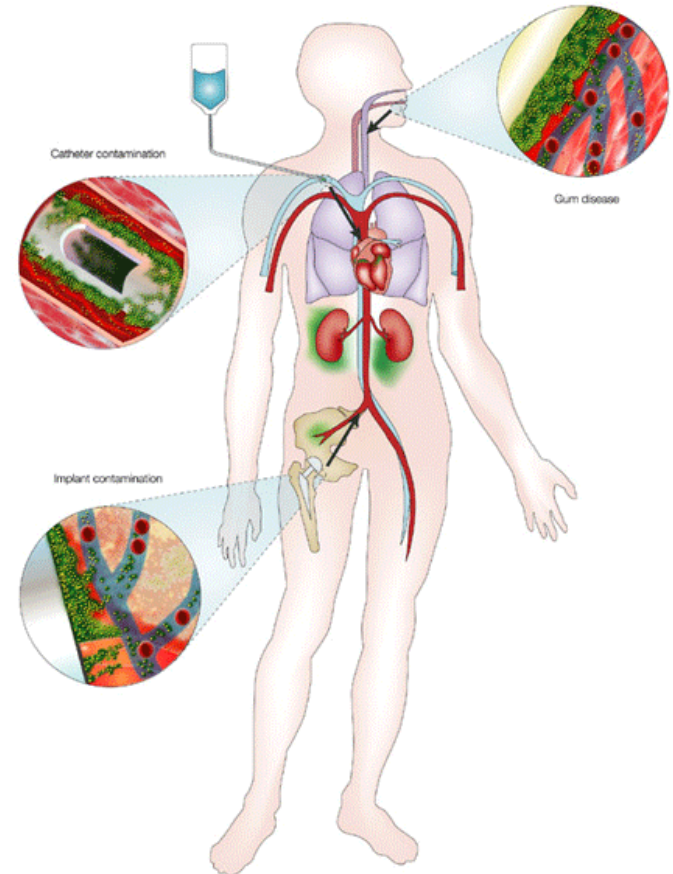
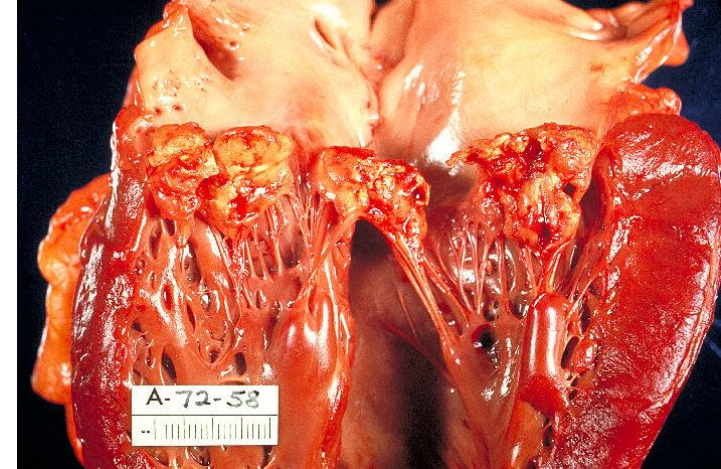


Periodontitis

S. Offenbacher

Infective endocarditis:

More daily bacteraemia with gingivitis or periodontitis

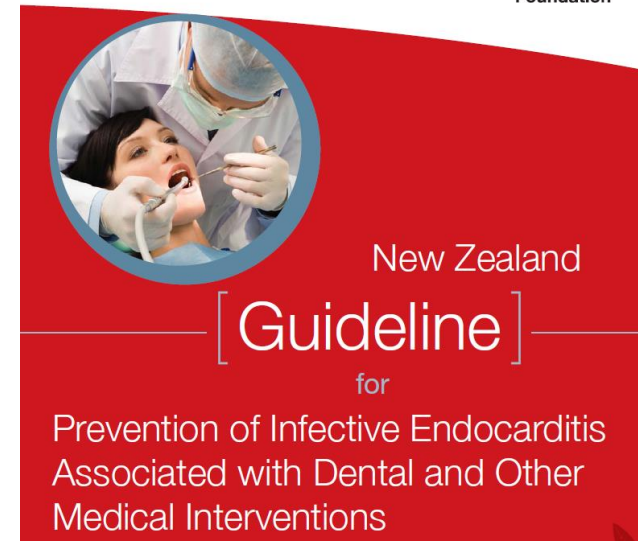


Infective endocarditis

- Significant numbers of disadvantaged New Zealanders, especially young Maori and Pacific people, have **rheumatic valvular heart disease** and important **dental and periodontal disease**.

- Prevention:

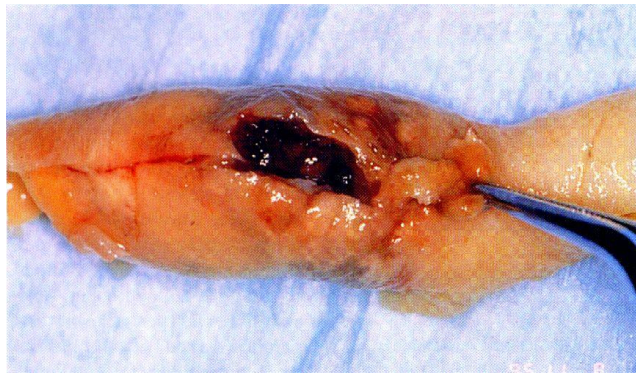
1. Regular professional dental care
2. Use of appropriate products
3. Manual and powered toothbrushes
4. Floss/interdental cleaning
5. **Other plaque-control devices such as antibacterial mouthwashes.**



- Emphasis on improved oral health, **rather than a sole focus on dental procedures and ABT prophylaxis.**

Systemic Exposure to Periodontal Pathogens

- Bacteria penetrate into periodontal and vascular tissues and invade intracellularly.
- **Organisms are found alive intra-cellularly within atheroma lesions: *P. gingivalis* 38-40% in carotid and coronary atheromas**
- **Exposure of bacterial biofilms to the systemic circulation**
- **Direct spread of bacteria**
- **Release of inflammatory mediators**
- **Immunological injury caused by oral bacteria**



Chiu et al (1998)

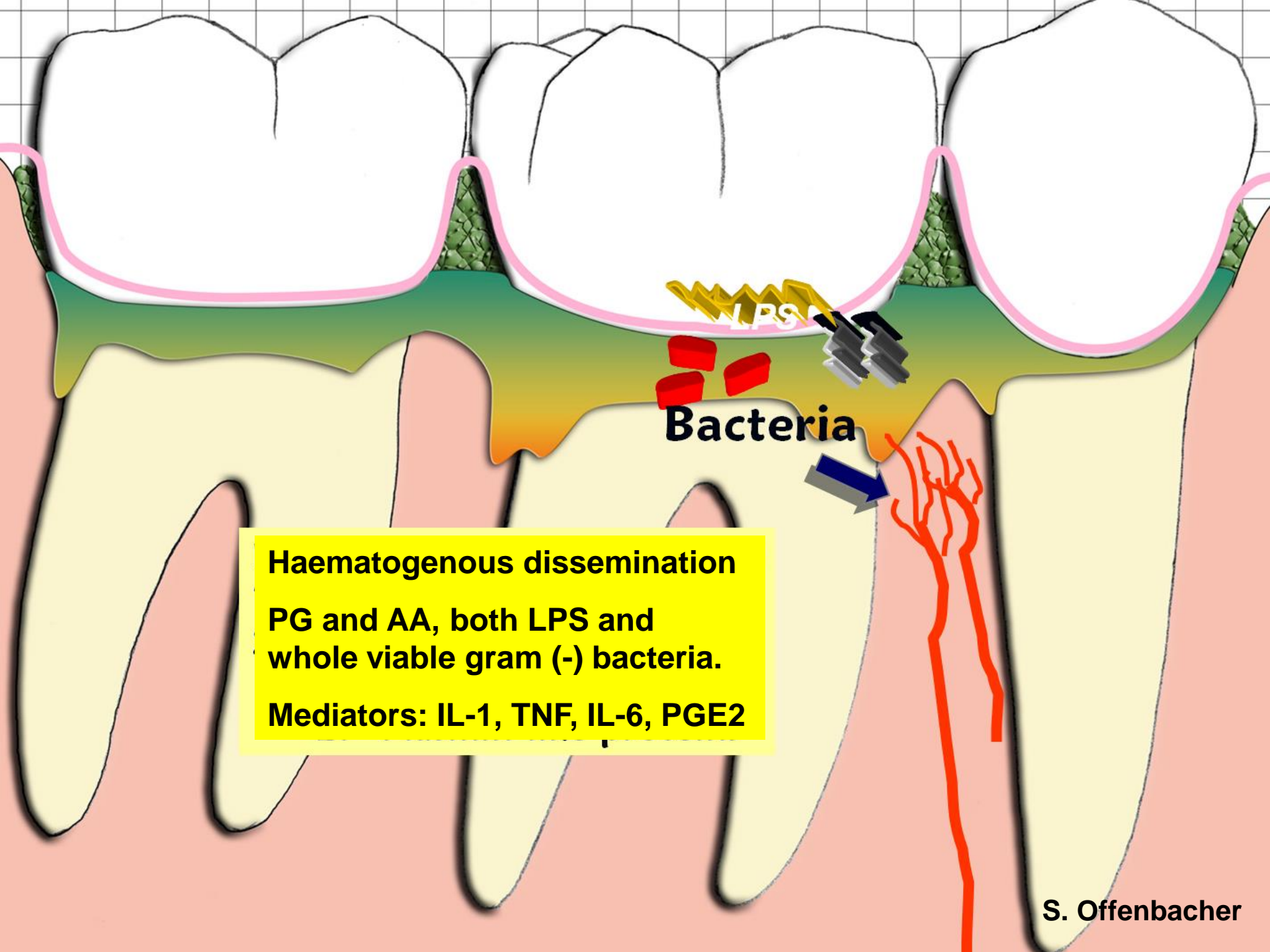
Periodontal Pathogens in Carotid Endarterectomy Specimens

(PCR, Southern hybridization with oligo-probes)

<i>P. gingivalis</i>	13/50	26%
<i>B. forsythus</i>	15/50	30%
<i>P. intermedia</i>	7/50	14%
<i>A. a.</i>	9/50	18%

44% positive for at least one periodontal pathogen

Haraszthy et al. *J Dent Res*, 1998



Haematogenous dissemination

**PG and AA, both LPS and
whole viable gram (-) bacteria.**

Mediators: IL-1, TNF, IL-6, PGE2

Advanced periodontal destruction



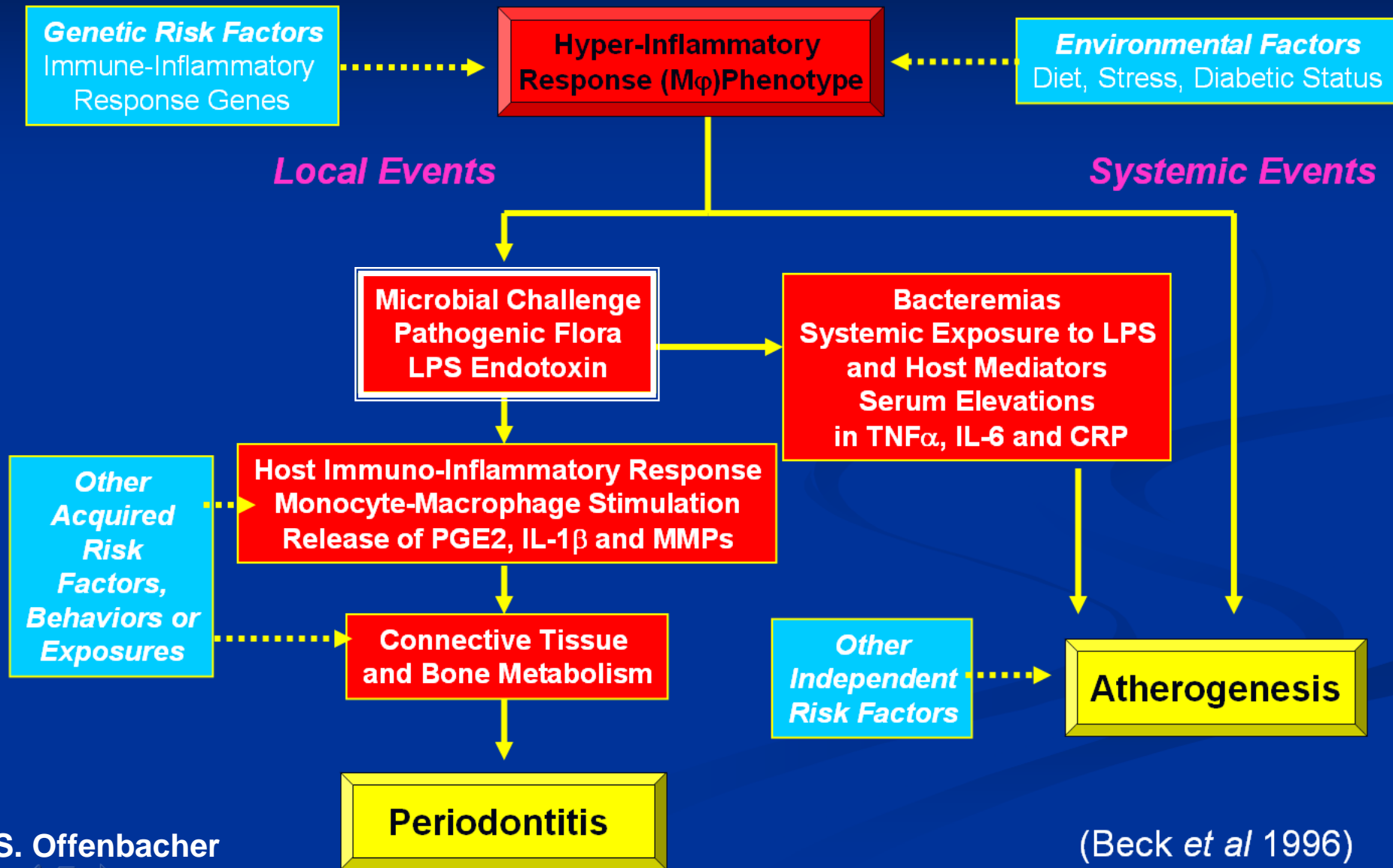


Loss of epithelial integrity within the pocket can represent an ulcerated surface area of up to 50-72 cm² in contact with the biofilm.

Periodontal treatment reduces the body's burden of infection



Proposed Model of Periodontitis-Cardiovascular Disease Association



(Beck et al 1996)

Current Model of Periodontitis Associated Pregnancy Complications

Maternal Periodontal Disease

Hematogenous dissemination

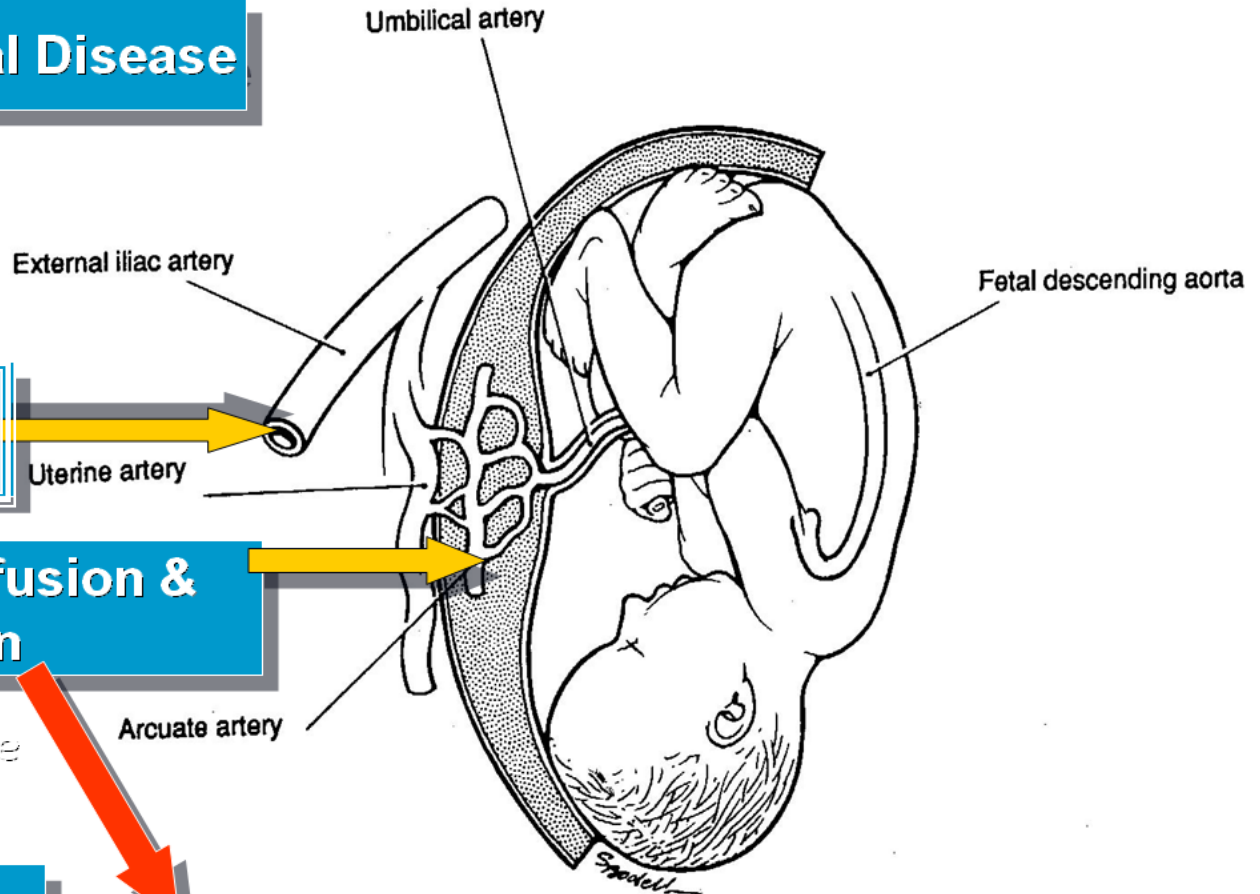
Placental & Fetal Exposure to Microbes

Poor Placental Perfusion & Inflammation

Preterm Membrane Rupture & Labor

Preterm Delivery

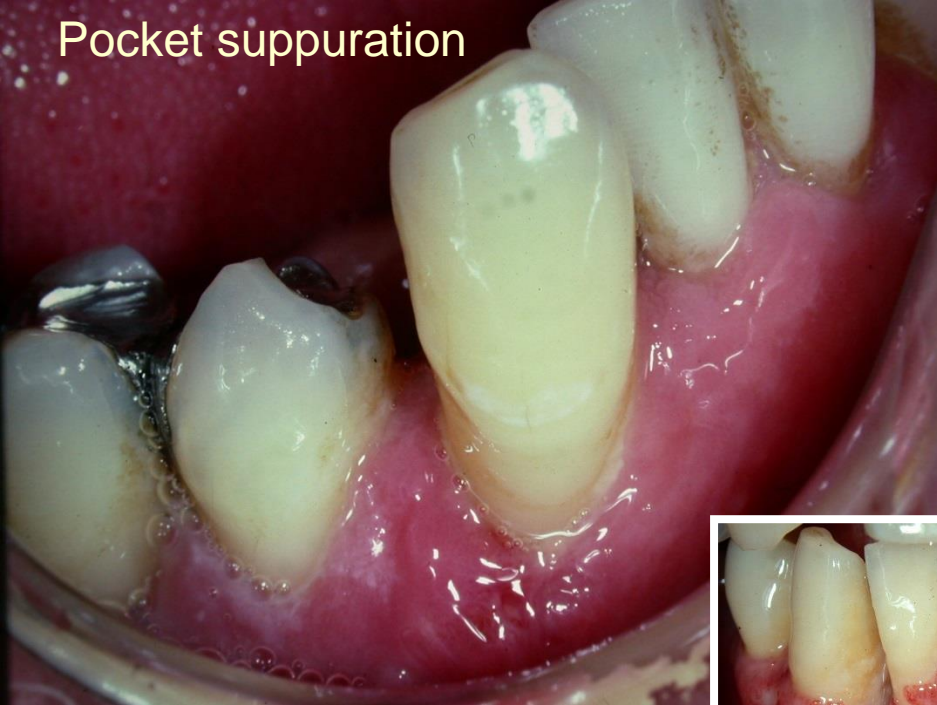
Fetal Growth Restriction (FGR) & Neonatal morbidity



How certain?

- Strength of association between periodontitis and systemic disease
 - **Diabetes – strongly (2 way)**
 - **Pulmonary disease – yes: subgroups VAP, IDD**
 - **Cardiovascular disease – possibly**
 - **Adverse pregnancy outcomes – probably in certain ethnic groups**

Pocket suppuration

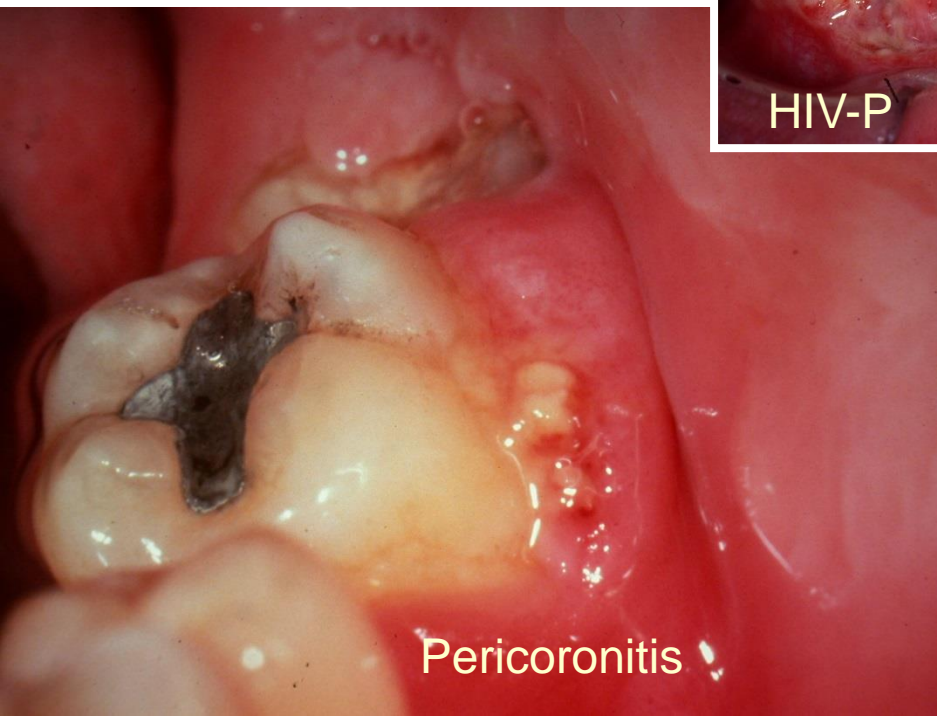


Periodontal abscess



HIV-P

Pericoronitis



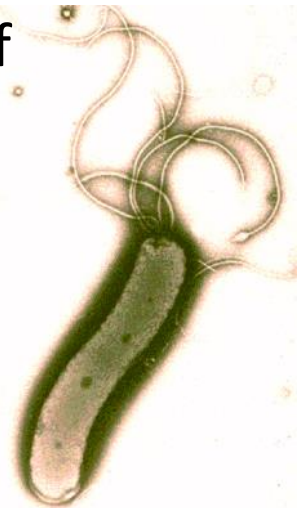
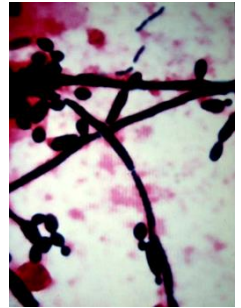
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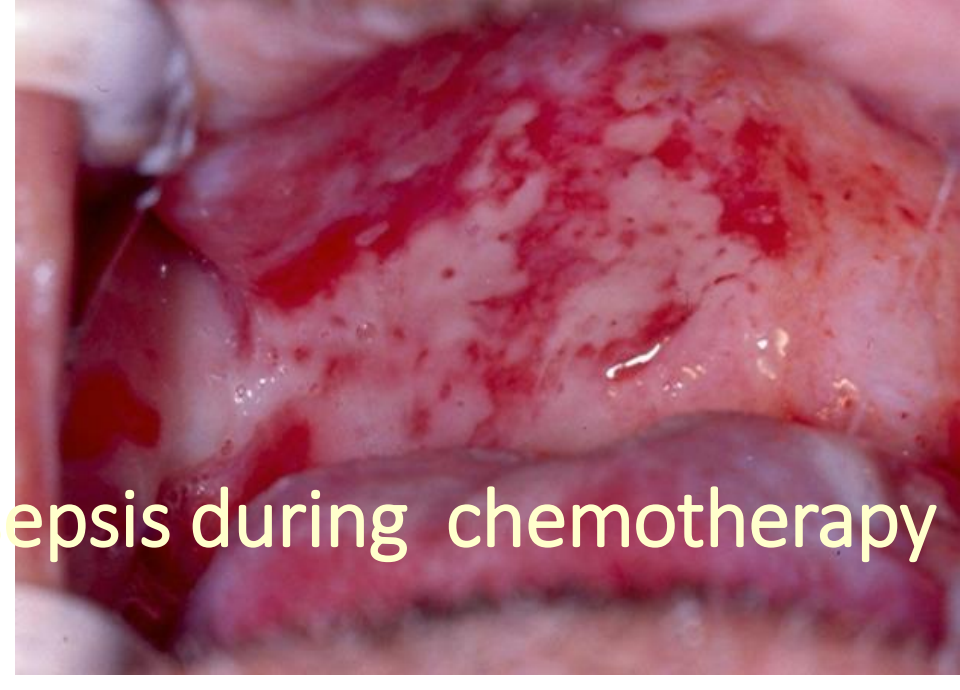
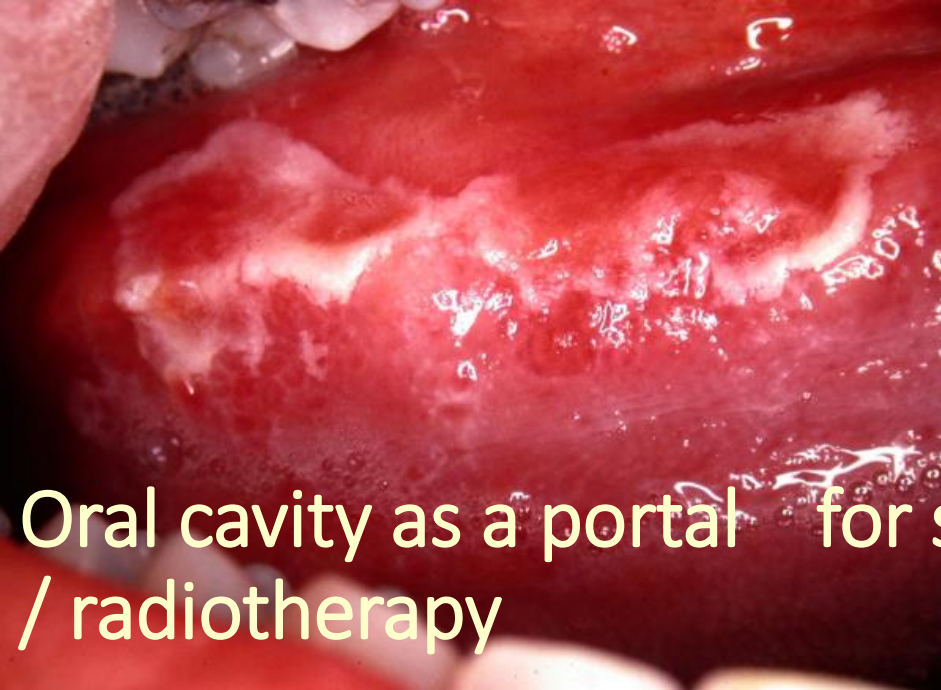


Dental plaque and distant infection:
Oral bacteria make bad tourists

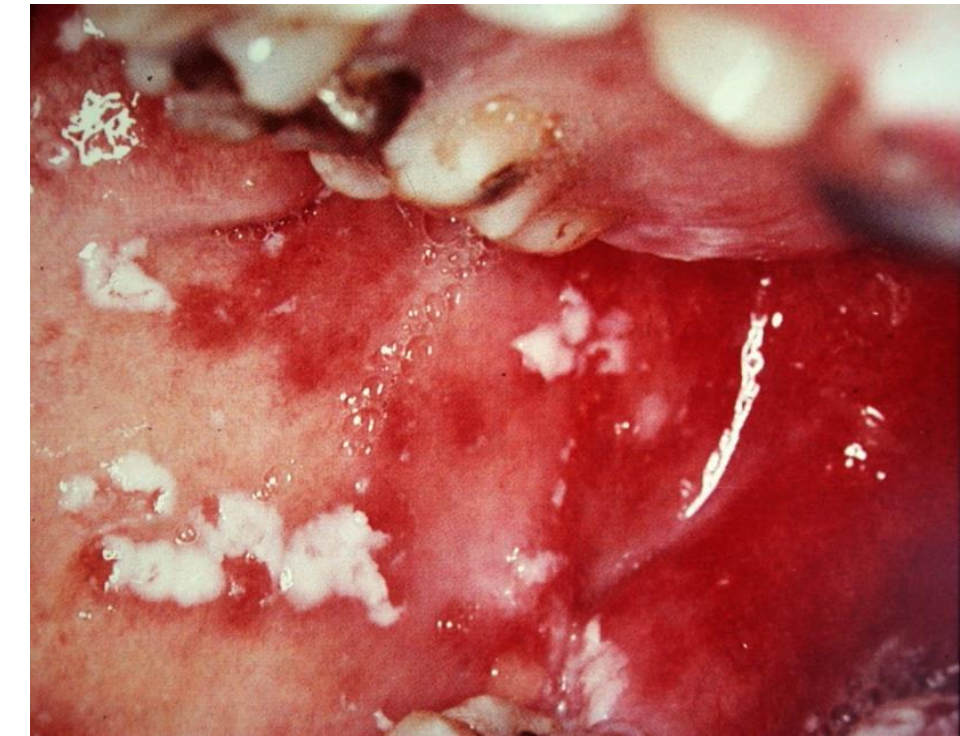
Reservoir of Organisms

- Complex flora of > 700 bacteria and 20 fungi
- *Candida albicans*: 50% carriage in adults
 - Mucocutaneous infections
- *Helicobacter pylori* in normal adults
 - **saliva 54%, plaque in gingival crevice 48%**
 - Ascends from this reservoir to the middle ear and to the para-nasal sinuses directly or by reflux, resulting in otitis, sinusitis, pharyngitis, and laryngitis.
 - HP in dental plaque may be a risk factor for relapse of gastro-intestinal infection and relapse of gastric ulceration after antibiotic therapy.



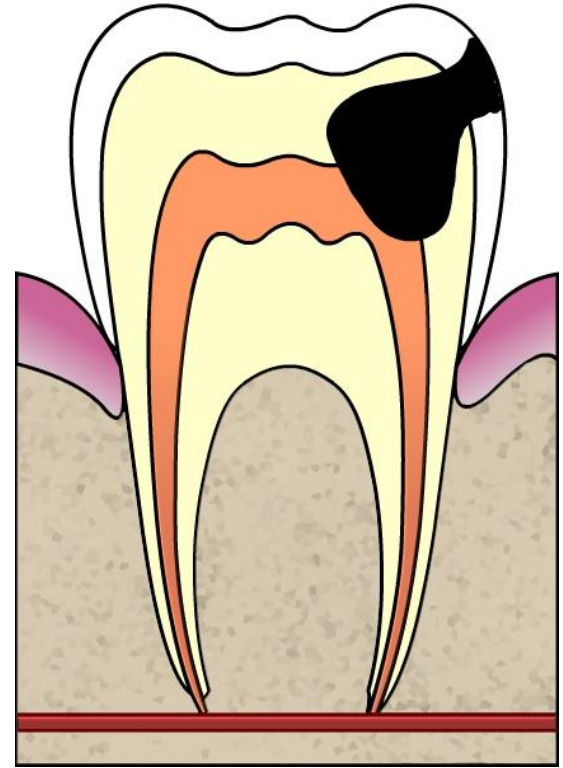


Oral cavity as a portal for sepsis during chemotherapy / radiotherapy



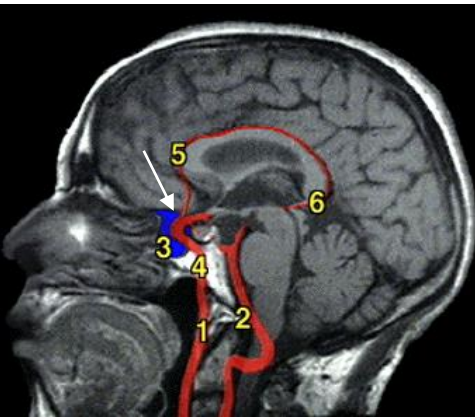
Oral cavity sources of distant infection

- Periapical infection
 - After dental caries, tooth fracture, and pulp exposure
- Gingival and periodontal infection
- Mucosal breaches
 - Ulcerations and lesions
 - Mucositis from chemotherapy or radiotherapy
 - Penetrating injuries and foreign bodies

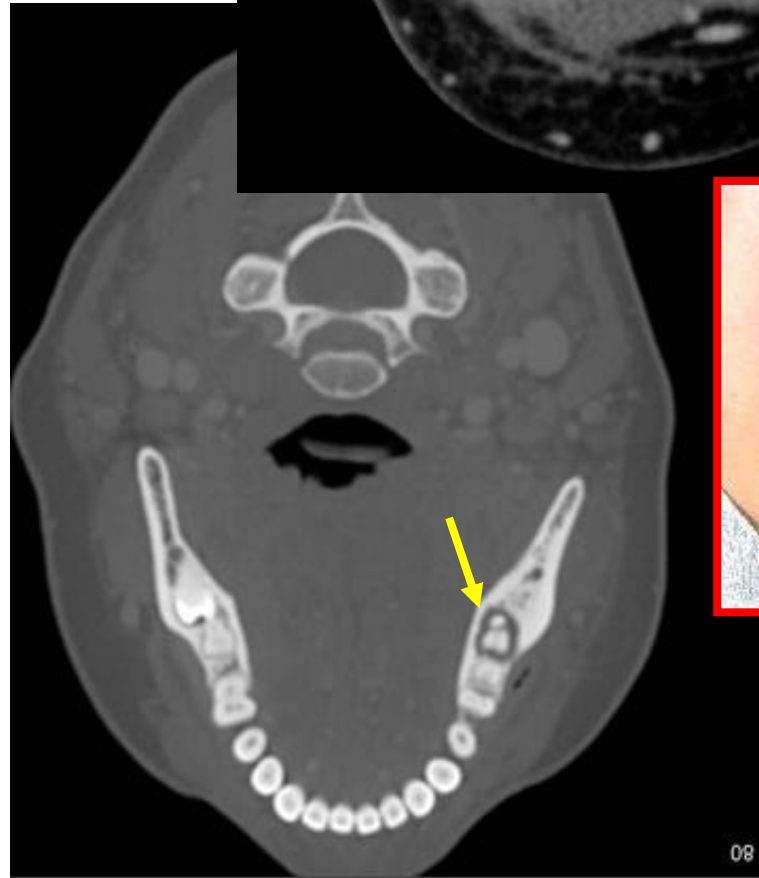
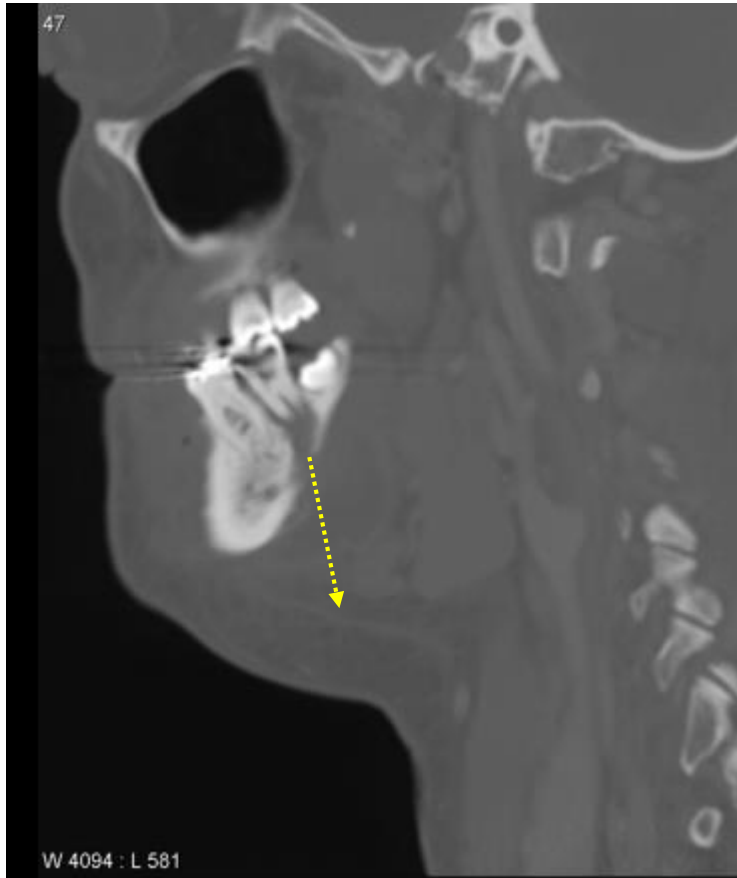


Maxillary tooth infections

- Danger triangle: anterior teeth
 - Cavernous sinus thrombosis
- Canine teeth
 - Canine fossa and orbital involvement
- Molars
 - MX sinus involvement



Mandibular molars:
Dental abscess extending
into the submandibular
space

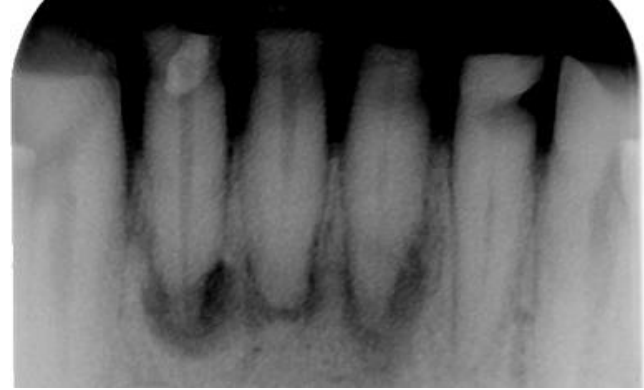


Ludwig's angina

- Serious, potentially life-threatening cellulitis of the floor of mouth
- Spreads to the sublingual space **via the fascial planes, not by the lymphatics**
- The tongue is forced upward and backward, causing airway obstruction.
 - Tracheostomy needed for airway support
 - High dose iv ABTs and surgical decompression
- **Mortality:** No ABT: 50%; ABT and surgical therapies: less than 5%

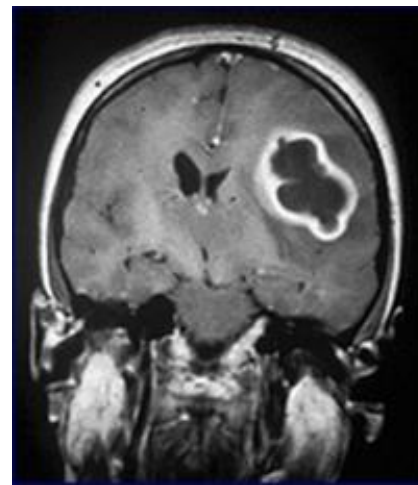
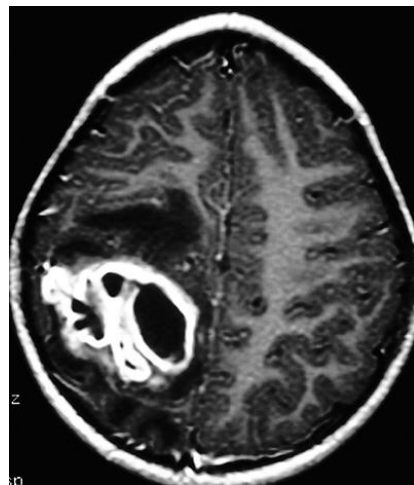


PUO in compromised patients:
Chronic periapical lesions which
reactivate when host resistance falls



Haematogenous spread of infection from the mouth to distant sites

- Immune compromised patients
- Pyrexias of unknown origin in oncology patients 30% dental origin
- Systemic sepsis and intravascular coagulation
- Orbit
- Brain
- Liver
- Lung
- Spleen





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