Periodontitis and Systemic Disease: Reciprocal Relationship??

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Periodontal Disease: A Quick Overview

- Periodontal disease is a chronic inflammatory disease that destroys the bone and gum tissues that support the teeth.
- The American Academy of Periodontology (AAP) estimates that 3 out of 4 Americans are affected by periodontal disease, ranging from gingivitis to more severe periodontitis.
- If left untreated, cases of gingivitis can lead to periodontitis.
- Recent study shows periodontitis may be under diagnosed by as much as 50%

Concepts About Periodontitis

- Bacterial infection of periodontium
- Immune system mobilization
- Auto-immune disease
- All infected do NOT develop periodontitis
- Systemic and local factors play a role in susceptibility
### Periodontitis

- **Risk factors:**
  - Poor oral hygiene (Löe, Annerud et al. 1986)
  - Poorly controlled diabetes mellitus (Ternoven and Olssen 1993)
  - Osteoporosis (Ranburd et al. 1999)
  - IL-1 genotype (Kornman, Crane et al. 1997)
  - Smoking (Stenstrom, Eliason et al. 1991)
  - Stress (Genco, et al. 1996)

### The Host Response

- Gingivitis does not always lead to periodontitis (Löe 1978, Lindhe 1973)

- No difference in bacterial flora between active and inactive sites (Moore 1987)
  - Less than 20% of periodontal disease variability can be explained by levels of specific microbes (Hart 2000)

- Gingivitis does not always lead to periodontitis: 2/10 dogs didn’t develop periodontitis but all gingivitis (Lindhe et al. 1975)
The Host Response

- Sri Lankan Tea Workers (Löe 1986)
  - 11% Minimal Disease
  - 81% Mild Periodontitis
  - 8% Severe Periodontitis
  - Less caries and restorations
  - Poor plaque control

Multi-Factorial Nature

- Systemic conditions that increase susceptibility for periodontal diseases
- Periodontal infections that are risk factors for systemic conditions
Medical Evaluation

• History
• Examination
• Diagnostic studies
• Physician consultation

...to identify risk factors

Medical Evaluation

• Knowing a patient’s risk factors is necessary to establish an accurate:
  – Diagnosis
  – Treatment plan
  – Maintenance program
  – Prognosis

ASA Class 1  Normal, healthy patient
ASA Class 2  Mild systemic disease
ASA Class 3  Severe systemic disease that limits activity but is not incapacitating
ASA Class 4  Incapacitating systemic disease that is a constant threat to life
ASA Class 5  Moribund, not expected to live >24 hours

• Establish ASA physical status and appropriate therapy
Periodontal Diseases

- Chronic diseases
  - Multi-factorial
  - No cure
  - Control

...All risk factors are yet to be identified or understood

Medical Risk Factors That May Contribute To Periodontitis

- Tobacco use
- Diabetes mellitus
- Osteoporosis
- Hormonal alteration
- Stress
- Genetic influences
- Immunodeficiency
- Medications

Smoking and Periodontal Disease

- Bergstrom (1991)
  - Smoking hygienists had significantly more bone loss than non-smokers
- Linden (1994)
  - Young smokers more calculus, BOP, attachment loss
- Haber (1992)
  - Smokers more advanced periodontitis
  - 3.3 X more risk
Smoking And Periodontal Treatment

- Smokers had less PPD reduction than non-smokers
  - Preber & Bergstrom, JCP, 1990
- Smokers less PPD reduction and CAL gain than non-smokers for all modes of treatment
  - Ah et al. JCP, 1994
- 90% of refractory periodontitis cases were smokers
  - MacFarlane et al. JP, 1992

Smoking and Periodontal Treatment

- Worse results with bone grafts in smokers
  - Rosen
- Worse results with GTR in smokers
  - Tonetti
- Twice the incidence of implant failures in smokers
  - Gorman
- Smokers have less root coverage
  - Trombelli

Diabetes Mellitus

- Chronic disorder of glucose metabolism
- Hyperglycemia as result of insulin problem
- Insulin cofactor to get glucose into cells
- When glucose not available catabolism results
- Cause unknown
- 16-23 million American have diabetes
Diabetes

- Diabetes is a chronic, lifelong metabolic disorder in which the body does not produce and/or properly use insulin
- Insulin is a hormone needed to convert sugar, starches and other food into energy that the body uses to sustain life.

NHANES Data

- 21 million Americans diagnosed with diabetes mellitus
- An additional 8.1 million Americans are undiagnosed
- WHO predicts number of adult diabetics will rise to 366 million by 2030 and be the 7th leading cause of death

Types of Diabetes

- Type I – usually thought of as insulin dependent diabetes mellitus (IDDM)
- Type II – usually thought of as non-insulin dependent diabetes mellitus (NIDDM)
Type I Diabetes

• Autoimmune component causing destruction of β islet cells of pancreas
• Only 5-10% of diabetics have this form
• Signs/symptoms
  – Polydipsia
  – Polyphagia
  – Polyuria
• Patients dependent on insulin injections
• Uncontrolled diabetes promotes periodontitis

Type II Diabetes

• Increased insulin resistance with decreased production is characteristic
• Risk factors include:
  – Age over 40
  – Obesity
• 90-95% of diabetics exhibit this form
• Usually insulin not necessary but as patient ages is possible

Diabetes Mellitus

• Individuals with well-controlled diabetes have no more periodontal disease than persons without diabetes.
• Individuals with poorly controlled diabetes are 3x more likely to develop periodontitis
• Individuals with diabetes and who smoke are 20x more likely than nondiabetics to experience severe periodontitis
Complications of Diabetes

- Retinopathy
- Neuropathy
- Nephropathy
- Macrovacular disease
- Delayed wound healing
- Periodontal diseases

Clinical Manifestations of Diabetes

- Oral Cavity
  - Most severe when blood glucose uncontrolled – “brittle diabetics”
  - Increased Candida infection
  - Increased periodontal abscesses and periodontitis
  - Impaired wound healing
  - Controlled patients no limitations to treatment (HbA1C < 9%)

Periodontal Treatment - Diabetes

- Detailed Assessment of Glycemic Control
- Determine HbA1c values over past 2-3 months
- ADA recommends target HbA1c of <7%
  - HbA1c of >8% indicates action needed
- General guideline:
  - “good” = < 7 %
  - “moderate” = 8-10%
  - “poor” = >10%
**Periodontal Treatment - Diabetes**

- **HbA1c values:** good, moderate or poor

- **Poor**
  - Physician Consultation?
  - SCRP plus systemic doxycycline (100mg qhs x 2 weeks); home care
  - Consider LDD (20mg) for 3-6 months

- **Good**
  - SC/RP
  - Home care

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**Medical History (diagnosed DM)**

1. Type of diabetes
2. Initial assessment of control (ask patient about control)
3. Medications, diet

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**Treatment of Acute Periodontal Needs (e.g., abscess)**

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**Re-Evaluation (at 3 months post-SCP)**

1. Periodontal status?
2. Home care?
3. Diabetes control? (new HbA1c)

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**Poor**

- Periodontal maintenance
- Encourage improved glycemic control; Re-eval in 3 months (HbA1c)

**Good**

- Periodontal surgery as needed
- Periodontal maintenance
Management of Diabetic Patients

- Compliance / Control
  - Periodontitis & DM both chronic diseases
  - Compliance and "maintenance" important to both
  - Similar compliance problems seen with both

Osteoporosis

- Physiologic, gender-, age-related
- Cortical bone loss
  - 0.3-0.5% per year until menopause
  - After menopause, 2-3% per year
- Cancellous bone loss
  - After menopause, 4.8% per year
- More alveolar ridge resorption in women
  - (Ortman 1989)

Osteoporosis

- 25 million Americans have osteoporosis
- >1/3 of women have osteoporosis by age 75
- Leads to >1.5 million fractures/year, mostly in women
Risk Factors for Osteoporosis

• Age
  – increased risk with advancing age

• Gender
  – women have 2x fractures as men
  – osteoporosis DOES occur in men!

• Race
  – greatest risk for Caucasians, then Asians, Hispanics, Blacks

• Low calcium intake (RDA is 1200 mg/day)
  – average American woman 51-70 years old gets <600 mg/day

Risk Factors for Osteoporosis

• Smoking

• Heavy alcohol use (2+ drinks/day)

• Heavy caffeine intake

• Sedentary lifestyle; lack of exercise

• Depression

• Medications
  – corticosteroids (long-term), thyroid medications, diuretics

Osteoporosis

• Loss of bone mineral density due to:
  – uncoupling of bone formation and resorption

Decreased osteoblast activity or increased osteoclast activity = osteopenia/osteoporosis
Osteoporosis

- Estrogen decreases osteoclastic bone resorption

![Osteoporosis Diagram]

Postmenopausal estrogen decrease = bone resorption

Osteoporosis and Oral Health

- Decreased bone mineral density in systemic skeleton is associated with:
  - Decreased BMD in maxilla and mandible
  - Increased tooth loss and prevalence of edentulism
  - Increased loss of residual ridge height after extraction

Osteoporosis

- Greater alveolar crestal bone loss
- Greater attachment loss
- Estrogen users had more teeth (Daniell 1983 and Krall 1997)
- Alendronate (a bisphosphonate)
  - Inhibits osteoclast activity
  - Decreased progression of periodontitis (Brunsvold 1992)
Bisphosphonates

• Osteonecrosis Jaw (ONJ) also known currently as MRONJ (medication-related osteonecrosis of jaw)
  – May be asymptomatic for weeks or months until secondarily infected
  – 0.7/100,000 cases incidence
  – Most in pts receiving IV with corticosteroid therapy for cancer management
  – Some cases now surfacing with oral drugs
  – Less chance first 3 years of therapy
  – Mandible more affected than maxilla

Bisphosphonates

• Osteonecrosis (ONJ) Guidelines
  – Good maintenance
  – Decision matrix

<table>
<thead>
<tr>
<th>IV</th>
<th>Oral</th>
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<tbody>
<tr>
<td>Emergency Tx Only</td>
<td>Yes Other Risk Factors</td>
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<tr>
<td></td>
<td>-corticosteroids -chemo -radiotherapy -trauma -infection -cancer</td>
</tr>
<tr>
<td></td>
<td>No May be eligible for elective oral surgery Need to be made aware of risk</td>
</tr>
</tbody>
</table>

Susceptibility Blood Test of ONJ

• C-terminal cross-linking telopeptide (CTX)
• One lab in country
• Questionable value
• Provides susceptibility to possibility of ONJ for patients on bisphosphonates over 3 years.
• Drug holiday (4-6 months and retest)
Hormonal Influences on Periodontal Disease

• Puberty
• Pregnancy
• Stress

• Relationship of anaerobes
• All more affected with poor OH

Pregnancy Gingivitis

• 35-100% prevalence (Hasson 1966, Lundgren 1973)

• Follows the hormonal cycle
  – Estrogen and progesterone levels increase:
    • 14-30 weeks gestation (Löe and Silness 1963)

• Increased levels of anaerobes in subgingival microflora

Pregnancy

• If self-care good before pregnancy and the patient continues to practice good oral hygiene, there is usually no problem
• Usually occurs in patients who have gingivitis before becoming pregnant
• Inflammation of gingiva increases in pregnancy even in the presence of small amounts of plaque
Pregnancy

- Gingival inflammation increases in 2nd and 3rd trimesters when elevated estrogen levels in blood exaggerate host response to biofilm
- Second trimester associated with increased levels of Prevotella intermedia (P. intermedia)
- P. intermedia uses estrogen as a substitute for natural growth factor

Pregnancy

- Elevated progesterone levels enhance capillary permeability and dilation resulting in increased gingival exudate and edema
- High levels of progesterone and estrogen associated with pregnancy suppress immune response to dental plaque biofilm

Pyogenic Granuloma (Pregnancy Tumor)

- Papilla reacts strongly to the plaque
- A tumor forms on the interdental gingiva or gingival margin
- Noncancerous
- Not painful
Stress

- Acute stress can be immunoenhancing
- Chronic stress can impair physiologic regulatory mechanism that governs the immune system
- Hormone cortisol has anti-inflammatory and immunosuppressive properties
- Blood levels of cortisol become elevated in response to physical and psychological stress

Stress

- Increased cortisol levels
- Increased ulcerative diseases
  - Vincent’s disease, trench mouth, ANUG
  - Now NUG and NUP

Stress: Hygienist Importance

- Prolonged or intense periods of stress can cause suppression of the immune system
- This might tip the host-microbial interaction in favor of bacteria causing attachment loss
- Stress can alter how people look after themselves
- Make patients aware of potential effects of stress on general and oral health
Disease Variability

- There are different kinds of plaque
- Patients respond differently
- Genetics may be a factor:
  - Susceptibility to periodontal diseases
  - Responses to treatment

Periodontal Disease

- 50% of chronic adult periodontitis has a genetic component
- Predisposition may change over lifetime
- Susceptibility modified by environment, stress, nutrition or other disease onset
- Process called epigenetics

Genetics

- Studies on twins have determined more than 50% of destruction seen with periodontitis can be attributed to genetics when ruling out environmental differences (Michalowicz, et al. 1991)
- Genetic risk determinant for IL-1 genotype has found correlations with positive genotype and 7x’s more likely incidence of severe periodontitis (Kornman, et al. 1997)
What is IL-1?

- Interleukin-1
- Cytokine
  - One of the first chemical mediator activated in response to a bacterial challenge
  - Activates protective mechanisms (i.e.: PMN recruitment, blood clotting, wound healing, and connective tissue turn-over)

Pathogenic Mechanism

IL-1 Genotype

- Tooth Loss (McGuire 1999)
  - Heavy Smokers 3x more likely
  - IL-1 genotype positive 3x more likely
  - IL-1 genotype positive + Smoking 7.7x more likely
IL-1 Genotype

- Sri Lankan Tea Workers (Löe 1986)
  - 11% Minimal Disease
    - 84% Genotype Negative
  - 81% Mild Periodontitis
  - 8% Severe Periodontitis
    - 86% Genotype Positive
    - 67% with smokers ruled-out

Immunodeficiency and Periodontal Disease

- Blood dyscrasias
- HIV/AIDS

Disorders of White Blood Cells

- Agranulocytosis
- Cyclic neutropenia
- Leukemia
  - Acute
  - Chronic
Agranulocytosis

- Marked ↓ in circulating neutrophils
- Can result from a problem with development or accelerated destruction
- Clinically: high fever of sudden onset, chills, jaundice, weakness, and sore throat, excessive gingival bleeding, necrosis of tissues, regional lymphadenopathy
- WBCs < 1000/mm³
- All dental procedures contraindicated

Cyclic Neutropenia

- Type of agranulocytosis
- All dental procedures contraindicated only when neutropenic (WBC<1000)

Leukemia

- Malignant neoplasm of hematopoietic stem cells
- Primarily disorder of bone marrow
- Acute leukemias
  - Acute lymphoblastic leukemia
  - Acute nonlymphoblastic leukemia
- Chronic leukemias
  - Chronic myeloid leukemia
  - Chronic lymphocytic leukemia
Leukemia

- Proliferation of abnormal leukocytes
- Acute lymphocytic leukemia (ALL)
  - Most children <10 years
  - Most from B-cell lineage
- Acute Myeloid Leukemia (AML)
  - 80% of all acute leukemias in adults
  - Malignancy of myeloid bone marrow precursors
    - Absence of mature granulocytes (infection) and platelets (bleeding)
- Chronic Myeloid Leukemia (CML)
  - Increased numbers of granulocytes, splenomegaly
  - Overall survival averages 2-4 years from diagnosis

Leukocyte Adhesion Deficiency

- Primary
  - Genetic in origin
  - B cells, T cells, or both involved
  - Rare
- Secondary
  - From some other disorder
  - Drug induced
  - Acquired immunodeficiency disorder (AIDS)
HIV-Infection

- Acquired immunodeficiency syndrome (AIDS) is a communicable disease caused by the HIV virus
- Has a profound effect on cellular immunity
- Increased periodontal attachment loss in HIV-infected individuals

HIV Infection And AIDS

- Spectrum

![Diagram showing the progression from HIV infection to AIDS]

Diagnosing AIDS

- HIV infection with CD4+ < 200/μL blood
- Opportunistic diseases
  - Pneumocystis carinii pneumonia
  - Esophageal candidiasis
  - Kaposi’s sarcoma
  - HIV wasting syndrome
  - Pulmonary TB
  - Recurrent pneumonia
  - Invasive cervical Ca
HIV Testing

- Antibody tests
  - ELISA
  - Western Blot
  - Two positive ELISA and a positive Western Blot for HIV seropositive
- PCR
  - Establishes viral load

Oral Manifestations Possible (HIV or AIDS)

- Oral candidiasis
- Herpes simplex
- Cytomegalovirus ulcerations
- Herpes zoster
- Hairy leukoplakia
- Papillomavirus infections
- Kaposi’s sarcoma
- Lymphoma
- Periodontal disease
  - LGE
  - NUG
  - NUP
- Spontaneous bleeding
- Aphthous ulcers
- Salivary gland disease

Clinical Manifestations of AIDS-related Complexes (ARC)

- Oral candidiasis
- Fatigue
- Weight loss
- Lymphadenopathy
- Dementia
Linear Gingival Erythema (LGE)

NUP

Other HIV Presentations
Break Time

Oral Manifestations for Oral Cancer Treatment

- Radiation therapy
  - Mucositis
  - Xerostomia
  - Caries
  - Candidiasis
  - Osteoradionecrosis

Oral Manifestations of Oral Cancer Treatment

- Chemotherapy
  - Mucositis
  - Oral ulcerations
  - Anemia
  - Opportunistic infections
  - Bleeding
Effects of Medications on Oral Cavity

- Xerostomia
- Immune suppression
- Ulcerations
- Candidiasis
- DIGO
- Bleeding
- Tooth discoloration
  - Tetracycline
  - Minocycline
  - Others

Overgrowth of the Gingival Tissues

- The most dramatic medication-related change seen in the gingiva is an overgrowth of the gingival tissues.
- Drug-influenced gingival enlargement is an overgrowth of the gingiva that is a side effect associated with certain medications.

Drug Induced Gingival Overgrowth

- Incidence of gingival enlargement
  - Dilantin (Phenytoin)
    - 3-65%
  - Cyclosporin-A
    - 10-70%
  - Calcium channel blockers (hypertension meds) (Nifedipine, Verapamil, others)
    - 6.3-20%
JNC 8

- **Definition**
  - Normal: SBP <120 / DBP <80 diastolic (mm Hg)
  - Pre-hypertension: 120-139 systolic / 80-89 diastolic
  - Stage I: SBP 140-159 / DBP 90-99
  - Stage II: SBP > 160 / DBP > 100
  - Uncontrolled/Crisis: SBP > 180 / DBP > 110

- Increased BP for those over 80 allowable
- 50% of those >60 years (1/3 are aware)
- Usually asymptomatic
- Increases risk of stroke 7-10 times

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**JNC Dental Guidelines**

<table>
<thead>
<tr>
<th>Systolic Blood Pressure</th>
<th>Diastolic Blood Pressure</th>
<th>Medical Risk Factors</th>
<th>Dental Guidelines</th>
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<tbody>
<tr>
<td>120-139</td>
<td>80-89</td>
<td>Yes/No</td>
<td>Routine dental treatment OK; discuss high blood pressure guidelines</td>
</tr>
<tr>
<td>140-159</td>
<td>90-99</td>
<td>Yes/No</td>
<td>Routine dental treatment OK; consider sedation for complex dental or surgical procedures; refer for medical consult</td>
</tr>
<tr>
<td>160-179</td>
<td>100-109</td>
<td>No</td>
<td>Routine dental treatment OK; consider sedation for complex dental or surgical procedures; refer for medical consult</td>
</tr>
<tr>
<td>180-199</td>
<td>110-119</td>
<td>Yes</td>
<td>No dental treatment unless medical consultation; refer for emergency medical consult</td>
</tr>
<tr>
<td>&gt; 200</td>
<td>&gt; 120</td>
<td>No/Yes</td>
<td>No dental treatment; refer for emergency medical treatment</td>
</tr>
</tbody>
</table>

Medical risk factors include: prior myocardial infarction, angina, high coronary disease risk, recurrent stroke prevention, diabetes, kidney disease

Source: Herman, WW, Konzelman JL Jr, Prisant LM. New guidelines on hypertension.
CCB Hyperplasia

- 20%
- Calcium Channel Blockers
  - Coronary vasodilator
  - Treatment for
    - Hypertension
    - Angina
    - Cardiac arrhythmias
  - Mechanism:
    - Blocks influx of Ca ions through smooth muscle
    - Dilation of coronary and systemic arteries
  - Nifedipine, Diltiazem, Verapamil, etc…

Phenytoin (Dilantin)

- 50%
- Anticonvulsant for seizure disorders
- Common pattern
  - Begins at interdental papilla
  - May eventually fuse and cover the crown
  - Commonly seen on facial of anteriors
  - Pink and firm with hygiene
  - Red, spongy with poor hygiene

CCB+Phenytoin Hyperplasia
CCB+Phenytoin Hyperplasia

Blood Thinners

- Atrial fibrillation
- Past MI or CAD
- Past non-hemorrhagic stroke
- PAD (peripheral artery disease)

Importance?

Common Blood Thinners

- Coumadin (Warfarin)
  - PETC
  - Measure with PT/INR
- Heparin
  - PITTH
  - Measure with PTT
- Plavix
  - Measure with bleeding time
- Aspirin
  - Measure with bleeding time
Newer Blood Thinners

- Apixaban (Eliquis)
- Dabigatran (Pradaxa)
- Edoxaban (Savaysa)
- Rivaroxaban (Xarelto)

Bleeding After Oral Surgery

- Recent studies show no adverse bleeding with patients with INR from 3.5-4.2
- Showed extractions could be performed safely with local hemostatic methods

JADA, 2015, Vol 146: 6, pgs 375-381
Plavix and Bleeding

- Study showed no increased bleeding complications after full mouth extraction
- Plavix sometimes may not need to be discontinued prior to surgery

Omar et al, JADA, Vol 146: 5, pgs 303-309

Cyclosporine

- Immunosuppressive agent for organ transplants
- Severe cases of psoriasis
- Medically compromised
- May influence implant integration!

Periodontal Disease May Contribute To Systemic Disease

- Heart disease and stroke
- Peripheral artery disease
- Pregnancy problems
- Diabetes
- Pancreatic cancer
- Respiratory diseases
- Ulcer non-responding tx
- Anemia
- Kidney disease
- Alzheimer's disease
- Rheumatoid arthritis
Dental Biofilms as Sources of Infection

- Subgingival plaque biofilms provide a large and persistent source of periodontal pathogens to the host.
- Bacteria and their by-products are introduced into the bloodstream during toothbrushing, flossing, and subgingival irrigation.

Atherosclerotic Cardiovascular Disease (ACVD)

- ACVD is a group of heart or vascular diseases.
  - Angina, myocardial infarction, stroke, transient ischemic attack, peripheral disease
- Atherosclerosis (thickening of artery walls) is a major component of CVD.
- Atheroma is a fatty deposit in the inner lining of an artery.

Angina

- Stable
  - Chest pain from physical exercise or stress
  - Narrowing of the coronary vessels results in decrease O2 for cardiac muscle
- Unstable
  - Chest pain without physical exertion
  - Increases in frequency and intensity
  - Recurrent within several days of an MI
Impact of Periodontitis on ACVD

- Cardiovascular Disease
  - Inflammation is major risk factor for cardiovascular disease-as much or more than cholesterol.
  - The American Heart Association reports that cardiovascular disease is the leading killer of men and women in the United States.

- Periodontitis and Systemic Diseases
  - Cardiovascular disease generally refers to conditions that involve narrowed or blocked blood vessels that can lead to a heart attack, chest pain (angina), or stroke.

- Cardiovascular disease
  - 2.7x greater risk of CHD (Beck 1996)
  - 5x more likely of CVA in absence of yearly prophylaxis (Loesche 1998)
  - Significant dose-dependent associations between CAD prevalence and periodontitis (Dietrich, Circulation 2008; 117: 1669-1674)
  - Periodontitis prevalence correlated with angiographic evidence of CAD (Amabile et al., J Intern Med 2008; 263:644-652)
Host Immune Response

- Periodontal infection may contribute to atherosclerosis by inducing a local immune response
- Elevated systemic antibody responses to periodontal microorganisms
- Cross-reactivity occurs
- Periodontal pathogens induce the immune response to mistakenly target cells in blood vessels leading to inflammation and atherosclerosis

What is Inflammation?

- Inflammation is the body’s first response to an injury.
- The first phase (acute inflammation) includes redness, swelling, heat and altered function. It is self-perpetuating.
- Though inflammation can be helpful under certain conditions, uncontrolled inflammation, also called chronic inflammation, is harmful and causes tissue loss.
- Chronic inflammation can negatively affect all organs and tissues of the body.
- There are several biological markers of inflammation in your blood, including C-reactive protein.

Myocardial Infarction

- Aka Heart attack
- Obstruction of the coronary arteries
  - Necrosis of the heart muscles occurs in 2 minutes
  - No elective dental care within 3-6 months of a MI
  - Warning: patients usually on anticoagulants
• Other Studies Correlating Periodontitis and Coronary artery disease

- Patients with > 3mm probing depths on 50% of their teeth were 2.5 x’s more likely to have CAD (Beck et al. 1996)
- Patients <60 years, 2.7x increased risk of CAD patients have periodontal disease (Genco 1997)

Systemic Exposure to Periodontal Pathogens

• Loss of epithelial integrity in pockets
• Bacterial penetration
• Recurrent transient bacteraemia

Compromised Coronary Artery

Lumen
Thrombus
Atherosclerotic Plaque

Courtesy: L. Rose
Atherosclerosis

Coronary Artery Narrowing

Occluded Coronary Arteries

Periodontitis and Cardiovascular Disease

- Direct Mechanism
  - Endothelial injury results in activation of endothelial cells
  - Upregulation of surface adhesion molecules and Chemokines → monocyte recruitment
  - Macrophages in atheroma produce growth factors inducing smooth muscle proliferation via LDL
  - LDL particles trapped in artery and undergo oxidation and internalized by macrophages (chemotactic for other monocytes and inflammatory response)
- Benefit: Antioxidants can increase the resistance of LDL to oxidation
Periodontitis and Cardiovascular Disease

- Indirect Mechanism
  - Periodontitis increases levels of cytokines (ie: IL-6)
  - Inflammatory markers increased in periodontitis (C-reactive Proteins, Fibrinogen) and are produced by the liver
  - These acute phase proteins amplify systemic inflammation

Stroke

- Stroke was strongly associated with periodontitis (presence of CAL $\geq$ 6 mm after controlling for all possible confounders.
- Association between periodontitis and stroke was higher among adults younger than age 60 and normotensives.
- Data suggested that periodontitis is independently associated with non-fatal stroke
Stroke

- Results suggest that periodontal disease and fewer teeth may be associated with increased risk of ischemic stroke.

Joshipura et al.
Stroke. 2003
Jan;34(1):47-52

Peri-implantitis

Calcifications of carotid arteries
Peripheral Artery Disease

- Study suggests that periodontitis may be associated with an increased risk of PAD. This association could result from the increased concentration of serum inflammatory cytokines in those with periodontitis.


Periodontitis and Atherosclerosis

- Direct Mechanism
  - Atherosclerosis is an inflammatory disease
  - Early lesion: fatty streak (T-cells & macrophages)
  - Damage to the endothelium initiates the formation of an atheroma

With this information about inflammation’s role in the link between cardiovascular disease and periodontal disease, it is now more important than ever for dental health professionals to work together with medical professionals.
Infective Endocarditis

- Acute bacterial endocarditis
  - Rapid clinical course (weeks)
  - Death results without antibiotics
- Subacute bacterial endocarditis
  - Chronic course (months)
  - Low grade fever, anemia, malaise
  - Curable and preventable with antibiotics
  - Fatal if untreated

- Microbial infection of a cardiac valve or surrounding cardiac tissue
  - Classic symptoms: persistent bacteremia or fungemia and heart murmur with valve dysfunction
  - Fever, night sweats, myalgias, arthralgias, malaise, anorexia, easy fatigability (clubbing of the fingers, Osler’s nodes)

Infective Endocarditis

- The “Bugs”
  - Strep viridans
  - Staph aureus
  - HACEK gram-negatives
    - Haemophilus sp
    - Aggreibacter actinomycetemcomitans
    - Cardiobacterium hominis
    - Eikenella sp
    - Kingella sp
  - Also: Capnocytophaga, Lactobacillus sp
Infective Endocarditis

- Risk of Dental Manipulation
  - Induction of Bacteremia is Related to:
    - Degree of Soft Tissue Trauma
    - Pre-Existing Local Inflammatory Status
  - Any dental manipulation likely to result in gingival bleeding can lead to transient bacteremia

Current IE Prophylaxis Guidelines

- Artificial heart valves
- History of infective endocarditis
- Certain specific, serious congenital (present from birth) heart conditions, including
  - Unrepaired or incompletely repaired cyanotic congenital heart disease, including those with palliative shunts and conduits
  - Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first six months after the procedure
  - Any repaired congenital heart defect with residual defect at the site or adjacent to the site of a prostatic patch or a prosthetic device
- Cardiac transplant that develops a problem in a heart valve.
Prosthetic Device Infection (LJPI)

- Patients with artificial joints continue to increase
- Unlike SBE, prosthetic joint infections caused by non-oral bacteria like staphylococcus

LJPI Prophylaxis

- Ask patient what they want to do
- Consult Orthopedic surgeon about what they desire for their patient
- If pre-medicated before and want to continue, OK.

Inflammation and Infection Is A Risk Factor

- Genitourinary infection: pregnancy
  - Pre-term rupture of membranes
  - Pre-term labor
  - Pre-term low birth weight
    - (<37 wks, <2500 g)
Periodontal Inflammation

- >60% of infant deaths due to low birthweight (excluding birth defects)
- May account for 18.2% (45,500) of all PTLBW births a year

Offenbacher, 1996

Periodontal Inflammation and PTLBW

- Offenbacher, 1996:
  - Periodontal Infection Causes An Increased in PGE2 and TNF-α
    - They are the physiologic mediators of childbirth
    - Excessive secretion can result in pre-term delivery and low birth weight
- Patients with untreated periodontitis are 7 times more likely to deliver PTLBW babies (Other risk factors were adjusted)

Periodontal Disease and PTLBW

Periodontal Disease

- Effect of periodontitis on metabolic state
- Effect of periodontal therapy on glycemic control

Periodontitis Influences Diabetes

- Diabetics with severe periodontitis at baseline had a 6X increased risk of worsening of glycemic control over time compared to diabetic subjects without periodontitis
- Periodontitis associated with an increased risk of other diabetic complications
  - In severe periodontitis, the death rate from ischemic heart disease was 2.3 times higher than in subjects with no periodontitis or mild periodontitis
  - Mortality rate from diabetic nephropathy was 8.5 times higher in the severe periodontitis

Periodontal Therapy

- Type 1 and type 2 diabetic subjects with severe periodontitis have shown improvements in glycemic control following SC/RP + systemic doxycycline therapy
- Some studies showed significant improvement in glycemic control when periodontal therapy consisted of SC/RP alone.
Pancreatic Cancer

- Harvard researchers published in the Journal of the National Cancer Institute
- Untreated periodontal disease showed increased risk of 1.6 X for pancreatic cancer
- 51,529 over 16 years with severe untreated periodontal disease

Cancers

- Periodontal disease associated with a small, but significant, increase in overall cancer risk, which persisted in never-smokers. The increased risks noted for hematological, kidney, and pancreatic cancers need confirmation, but suggest that periodontal disease might be a marker of a susceptible immune system or might directly affect cancer risk. *Lancet Oncol.* 2008; 9(6):550-8

Oral Cancer

- Participants with chronic periodontitis were 5.2 times more likely to have tongue cancer with every millimeter of bone loss than were participants who did not have periodontitis. *Archives of Otolaryngology, May 2007*
Hospital-Acquired Pneumonia

- Hospital-acquired pneumonia results from organisms called potential respiratory pathogens (PRPs).
- PRPs can colonize the dental plaque biofilm.
- Plaque biofilm, then, serves as a reservoir for PRPs.
- A patient with PRPs colonizing the mouth and oropharynx is at an increased risk for developing hospital-acquired pneumonia.

Risk Factor for Pneumonia

- Research summary:
  - Periodontal disease and poor oral hygiene may be associated with hospital-acquired pneumonia.
  - Studies show that improved oral hygiene measures can reduce the incidence of hospital-acquired pneumonia.
Periodontitis and Covid-19

- COVID-19 Patients With Periodontitis Face Greater Risk of Dying
- Elevated levels of IL-6
- 22 X more likely to be placed on respirator
- Once on respirator odds of survival much lower.
Ulcer Treatment

- H. pylori in dental plaque is seldom eliminated by H. pylori-eradication therapy, and this may act as a source for future re-infection. Anand et al. J Periodontol 2006;77:692-698.

Anemia

- Results show that patients suffering from chronic periodontitis have a lower number of erythrocytes and hemoglobin compared to healthy controls. It can be concluded that, like any other chronic condition, chronic periodontitis can lead to anemia. Gokhale et al. J Periodontol 2010;81:1202-1206.
**Risk Factor for Chronic Kidney Disease**

- Progressive loss of kidney function leading to kidney failure
- Complex pathogenesis of chronic kidney disease makes studies of the role of periodontal disease challenging

**Kidney Disease**

- Periodontal disease is prevalent, severe and under recognized in renal failure patients. Prophylaxis and early dental treatment should be intensified in these subjects, and may be of interdisciplinary importance. Borwaski et al. Nephrol Dial Transplant. 2007 Feb;22(2):457-64.

**Risk Factor for Cognitive Impairment**

- Noticeable and measurable decline in cognitive abilities including memory and thinking skills.
- Evidence is weak for a connection between periodontal disease and cognitive impairment
Alzheimer’s Disease

• Alzheimer's disease (AD) affects approximately 4.5 million people in the U.S. and this number will increase as the population ages and the life-span increases.
• Inflammation within the brain is thought to play a role
• Periodontal infections may affect the onset and progression of AD

Rheumatoid Arthritis

• There is evidence to suggest that periodontitis could indeed be a causal factor in the initiation and maintenance of the autoimmune inflammatory response that occurs in RA. de Pablo et al. Nat Rev Rheumatol. 2009; 5(4):218-24
• Non-surgical periodontal therapy had a beneficial effect on the signs and symptoms of RA, regardless of the medications used to treat this condition. Ortiz et al. J Periodontol 2009;80:535-540.
• Many others

Behavioral and Psychosocial Status

• Pain and malaise from abscesses and chronic infections
• Decreased pleasure and socialization from food and drink
• Decrease in self-esteem and morale
• Decreased oral hygiene in depressed, ill, and disengaged patients
Rationale for Treatment of Periodontitis

- Treatment philosophy centered today on decreasing inflammation not eliminating bacteria
  - Probable cause for systemic links
- Impact on systemic health continues to show relationships and merits continued research
- Goal must be to inform patients of viable treatment options and possible systemic risks
- Prevent progression of disease while controlling inflammatory component
- Refer to specialist when indicated

*****Avoid medico-legal ramifications*****

Systemic Links

- OH > 85% PFS
- PPD > 5 mm w/ BOP
- SC/RP
- Remove hopeless teeth
- Endo
- Prophylaxis
- No treatment needed
- Perio plastic surgery
- Muco-gingival surgery
- Crown lengthening
- Implants

- OH > 85% PFS
- PPD < 5 mm w/o BOP
- Maintenance and annual re-evaluation
- Surgery
- Compromised maintenance q 3 months
- PPD < 6 mm
- PPD > 6 mm
- Osseous resection
- Anterior modified curtain
- Maintenance and annual re-evaluation

- OFD
- Regeneration
- Anterior modified curtain
- Posterior

PFS – plaque-free surfaces; OFD – open flap debridement; BOP – bleeding on probing
Questions??