The Integrated Dental Model for Chronic Disease Management

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Diabetes Oral Health Connection

- Oral Health Complications of Diabetes
  - Tooth loss
  - Oral pain
  - Extensive Periodontal Disease
  - Coronal and root caries
  - Soft tissue pathologies
  - Decrease in salivary function
Systemic Treatment with Dental Medicine

- Diabetes
- Cardiovascular Disease
- Stroke Intervention
Diabetes Oral Health Connection

• Medical and oral health inter-relationships
  ▫ Glycemic control
  ▫ Neuropathy
  ▫ Nephropathy
  ▫ Retinopathy
  ▫ Cardiovascular disease
Diabetes impact on oral health
Salivary Flow Rate (Xerostomia)

• Saliva not only begins the digestive process; it protects teeth by preventing decay, regulating your mouth's acidity level and keeping bacteria in your mouth from running rampant.
• But when saliva's lacking, plaque builds, enamel erodes, cavities quickly form and fungal growth runs rampant
Salivary Flow Rate (Xerostomia)

• Diabetes and Dry Mouth
  ▫ Prevalence of dry-mouth symptoms (xerostomia),
  ▫ Prevalence of hyposalivation
  ▫ Possible interrelationships between salivary dysfunction and diabetic complications.
Self Report - Xerostomia

• Does your mouth usually feel dry?
• Do you regularly do things to keep your mouth moist?
• FOX QUESTIONNAIRE
  ▫ Do you have to sip liquids to aid in swallowing foods?
  ▫ Does your mouth feel dry when eating a meal?
  ▫ Do you have difficulties swallowing dry foods?
  ▫ Does the amount of saliva in your mouth seem too little?

## Self Report - Xerostomia

<table>
<thead>
<tr>
<th></th>
<th>Diabetes Subjects</th>
<th>Control Subjects</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does your mouth usually feel dry? (MOUTH DRY?)</td>
<td>15.8%</td>
<td>10.3%</td>
<td>0.047</td>
</tr>
<tr>
<td>Do you regularly do things to keep your mouth moist?</td>
<td>20.2%</td>
<td>14.1%</td>
<td>0.058</td>
</tr>
<tr>
<td>Fox Questionnaire:</td>
<td>24.1%</td>
<td>17.6%</td>
<td>0.045</td>
</tr>
</tbody>
</table>
Salivary Flow Rate Measures

<table>
<thead>
<tr>
<th></th>
<th>Diabetes Subjects</th>
<th>Control Subjects</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resting Salivary Flow Rate (ml/min)</strong></td>
<td>0.22 ± 0.014</td>
<td>0.28 ± 0.016</td>
<td>0.045</td>
</tr>
<tr>
<td><strong>Resting Salivary Flow Rate &lt; 0.01ml/min</strong></td>
<td>11.8%</td>
<td>2.7%</td>
<td>0.0005</td>
</tr>
<tr>
<td><strong>Stimulated Salivary Flow Rate (ml/min)</strong></td>
<td>0.89 ± 0.047</td>
<td>1.02 ± 0.054</td>
<td>0.071</td>
</tr>
<tr>
<td><strong>Stimulated Salivary Flow Rate &lt; 0.10 ml/min</strong></td>
<td>12.4%</td>
<td>5.5%</td>
<td>0.019</td>
</tr>
</tbody>
</table>

CONCLUSIONS

• Hyposalivation and xerostomia were significant oral complications in this cohort of type 1 diabetic patients.

• Xerostomia was frequently associated with more frequent snacking behaviors and with the current use of cigarettes.

• Use of xerogenic medications significantly decreased resting salivary flow rates in both diabetic and control subjects.

• Higher rates of dental decay were found among diabetic subjects having low resting salivary flow rates.

• Elevated fasting blood glucose concentrations were associated with significant reductions in resting salivary flow rates.
Periodontal Disease
Diabetes and Periodontal Disease

- Strong and growing evidence points to an association between diabetes and periodontal disease
  - One third of patients with diabetes have oral complications, mainly periodontitis and tooth loss
  - Large body of evidence shows that periodontal disease is a complication of diabetes mellitus
  - Periodontal disease is more severe in individuals with diabetes, especially those with poor control

Periodontal Disease

Extensive Periodontal Disease and Patient Age

b) Age of Onset of Type 1 Diabetes

"late onset" defined as later than 8.4 years of age
"early onset" defined as equal to or before 8.4 years

% Patients with Ext. Periodontal Ds.

Patient Age

<25 yr.  25-29 yr.  30-34 yr.  35-39 yr.  >40 yr.

(15.4 yr.)  (22.5 yr.)  (27.0 yr.)  (33.6 yr.)  (37.4 yr.)
Tooth Loss and Diabetes

• Usually associated with:
  ▫ Periodontal disease
  ▫ Smoking habits
  ▫ Poor Control
Prevalence of Tooth Loss vs. Age Category

Type 1 Diabetes (n = 390)

NHANES III

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Mean Number of Missing Teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 24 yr.</td>
<td>0.6</td>
</tr>
<tr>
<td>25-29 yr.</td>
<td>0.9</td>
</tr>
<tr>
<td>30-34 yr.</td>
<td>1.1</td>
</tr>
<tr>
<td>35-39 yr.</td>
<td>2.1</td>
</tr>
<tr>
<td>40-44 yr.</td>
<td>3.3</td>
</tr>
<tr>
<td>45-50 yr.</td>
<td>5.2</td>
</tr>
<tr>
<td>Overall</td>
<td>2.51</td>
</tr>
</tbody>
</table>

Type 1 Diabetes (n = 390) NHANES III
Missing teeth according to type of diabetes

Oral Soft Tissue Pathologies with Diabetes
## Oral Soft Tissue Pathologies

<table>
<thead>
<tr>
<th>Soft Tissue Lesions</th>
<th>Control</th>
<th>IDDM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Angular Cheilitis</strong></td>
<td>3 (1.1%)</td>
<td>13 (3.2%)</td>
</tr>
<tr>
<td><strong>Atrophy of Tongue</strong> ****</td>
<td>6 (2.2%)</td>
<td>36 (8.9%)</td>
</tr>
<tr>
<td><strong>Denture Stomatitis</strong> *</td>
<td>4 (1.5%)</td>
<td>19 (4.7%)</td>
</tr>
<tr>
<td><strong>Fibroma, Irritation</strong> *</td>
<td>1 (0.4%)</td>
<td>10 (2.5%)</td>
</tr>
<tr>
<td><strong>Fissured Tongue</strong> ****</td>
<td>1 (0.4%)</td>
<td>22 (5.4%)</td>
</tr>
<tr>
<td><strong>Med. Rhom. Glossitis</strong> ****</td>
<td>1 (0.4%)</td>
<td>29 (7.2%)</td>
</tr>
<tr>
<td><strong>Traumatic Ulcer</strong> *</td>
<td>3 (1.1%)</td>
<td>14 (3.4%)</td>
</tr>
<tr>
<td><strong>Total lesions/Subjects</strong></td>
<td>77 / 268</td>
<td>246 / 405</td>
</tr>
</tbody>
</table>

Chi square: * = p < .05,  ** = p < .001


Oral health impact on diabetes
Oral Health - Diabetes

- A national focus in recent years
- Surgeon General’s report, *Oral Health in America*, emphasized the need to better understand the correlation between systemic and oral disease
  - Reported oral health complications associated with diabetes
Poor Glycemic Control

- Expanding body of literature implicating severe periodontitis as a risk for poor glycemic control
- Periodontal treatment in individuals with diabetes can improve glycemic control
  - Leading to a reduction of the effects of diabetes

Poor Glycemic Control

- Edentulous Periodontal disease and subsequent tooth loss significantly impact overall health by compromising a patient’s ability to maintain a healthy diet and proper glycemic control.
  - Edentulous participants consumed fewer vegetables, less fiber and carotene, and more cholesterol, saturated fat and calories than participants with 25 or more teeth.

Poor Glycemic Control

- [Edentulous] University of Pittsburgh study found that diabetic participants who had partial tooth loss or who were edentulous were generally older, had lower incomes and education and had higher rates of nephropathy, neuropathy, retinopathy, and peripheral vascular disease.

Poor Glycemic Control

- Stewart et al. – statistical review of study suggests that periodontal therapy was associated with improved glycemic control in persons with type 2 DM.
  - During the nine-month observation period, there was a 6.7% improvement in glycemic control in the control group when compared to a 17.1% improvement in the treatment group, a statistically significant difference.

Poor Glycemic Control

- Landmark Study – Pima Indian Tribe (Az)
  - Effective treatment of periodontal infection and reduction of periodontal inflammation is associated with a reduction in level of glycated hemoglobin.
  - In addition, at 3 months, significant reductions ($P \leq 0.04$) in mean HbA$_{lc}$ reaching nearly 10% from the pretreatment value.
  - Control of periodontal infections should thus be an important part of the overall management of diabetes mellitus patients.

Integrated Dental Medicine
Medical Role

- Oral examination
- Oral health education
- Appropriate referral for care
Oral Examination

• Caries identification
  ▫ Surface caries easily identifiable
  ▫ Incipient decay harder to identify but more important with preventive strategies

• Gum disease
  ▫ Gingivitis vs. periodontal disease
Caries/Cavities
Caries/Cavities
Periodontal Disease

- Rather than a single disease entity, periodontal disease is a combination of multiple disease processes that share a common clinical manifestation.
- The etiology includes both local and systemic factors.
- The disease consists of a chronic inflammation associated with loss of alveolar bone.
- Advanced disease features include pus and exudates [infection – more difficult to anesthetize].

Periodontal Disease
Referral

- Different aspects
  - See immediately
  - See this week
  - Normal appointment
<table>
<thead>
<tr>
<th><strong>ASK THE PATIENT:</strong></th>
<th><strong>MUST BE SEEN TODAY?</strong></th>
<th><strong>See tomorrow or this week</strong></th>
<th><strong>See when available</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>“On a scale of 1 to 10 how badly are you hurting?”</td>
<td>Pain level 6 to 10</td>
<td>Pain level 4 to 5</td>
<td>Pain level 3 or below</td>
</tr>
<tr>
<td>“How long have you been hurting?”</td>
<td>This level for a week or less</td>
<td>This level of pain for a month or less</td>
<td>Had these symptoms for over a month</td>
</tr>
<tr>
<td>“Describe the type of pain or discomfort you feel.”</td>
<td>Throbbing</td>
<td>Broken tooth, lost a filling</td>
<td>Chip tooth, broken filling</td>
</tr>
<tr>
<td>“How are you sleeping at night?”</td>
<td>Keeps me awake at night</td>
<td>Able to sleep with medication</td>
<td>Able to sleep</td>
</tr>
<tr>
<td>“What occurred to make the tooth begin to hurt?”</td>
<td>Unknown or bit down on something hard</td>
<td>Bit down on something or other cause</td>
<td>Sweets; candy causes it to hurt</td>
</tr>
<tr>
<td>“Have you noticed any other symptoms?”</td>
<td>Fever and/or swelling</td>
<td>------</td>
<td>------</td>
</tr>
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**Three or more checkmarks results in patient needing appointment this week**

**Three or more checkmarks results in the patient being given the next available standard appointment time**
Dental Role
Periodontal disease as a predictor

- Conflicting data; HOWEVER,
- Studies have demonstrated that it is an early complication of diabetes
- Pre-existing periodontitis predicts poor cardiovascular and renal outcomes


Dental-Medical Screening

• 70% of US adults see a dentist at least once a year (CDC)
• Individuals tend to seek routine and preventive oral care more frequently than routine and preventive medical care

Dental-Medical Screening

• Analysis of the NHANES revealed that an algorithm using simple periodontal measures, available only in dental settings, and risk factors known by patients may offer an unrealized opportunity to identify undiagnosed individuals.

• Finding supported by two other retrospective studies.


• At least one of the following self-reported risk factors
  - Family history of diabetes
  - Hypertension
  - High cholesterol
  - Overweight/Obesity

• Continue to receive a periodontal examination
  - Simple algorithm composed of two dental parameters
    - Number of missing teeth
    - Percentage of deep periodontal pockets
  - Optimal cut-offs of ≥26% deep pockets and ≥4 missing teeth

• A point of care HbA1C test
  - Fasting – at second appointment
  - The addition of a fingerstick HbA1C with 2 dental parameters are of significant merit (73% to 92% increase in sensitivity)

Periodontal Pockets
Dental-Medical Screening

- Screening/Identification protocol reflects a clinical approach that can be easily used in all dental care settings
- Dentists are willing to incorporate screening for medical conditions into their practices
  - A national, random sample of U.S. general dentists was surveyed by mail by means of an anonymous questionnaire
  - Respondents were willing to refer patients for consultation with physicians (96.4 percent), collect oral fluids for salivary diagnostics (87.7 percent), conduct medical screenings that yield immediate results (83.4 percent) and collect blood via finger stick (55.9 percent).

Integrated Model

• Cost Effective
  ▫ Jeffcoat et al. found that $10,672 was spent for medical care for patients with diabetes who did not have periodontal treatment.
  ▫ Revealed an average reduction of approx. $2,500 (23%) in cost per year of those with periodontal treatment.
    • Dental care estimated cost of standard fees (CSC)
    • $463.00
Barriers to Health Promotion

• Diabetic Patients
  ▫ Income, employment, and cost
  ▫ Time priorities

• Dental-Medical Students
  ▫ Focus on requirements and clinical skills
  ▫ Patient treatment versus Patient management
  ▫ Surgeons mentality / Drill and Fill

• Dentist Practitioners
  ▫ Current knowledge and access to information
  ▫ Economics of dental practice

• Physicians
  ▫ Coordination of medical and dental care
  ▫ Relevance to medical management and complications

• Oral Health Researcher
  ▫ Strength of findings and validity of conclusion
  ▫ Oral infections impact on glycemic control
Cardiovascular Disease
ASVD and Periodontal Disease

- A link between oral health and cardiovascular disease has been proposed for the greater part of the last century.
- Recently, concern about possible links between periodontal disease (PD) and atherosclerotic vascular disease (ASVD) has intensified
  - This is driving an active field of investigation into possible association and causality.
ASVD and Periodontal Disease

• Both processes share several common risk factors, including cigarette smoking, age, and diabetes mellitus.

• Patients and providers are increasingly presented with claims that PD treatment strategies offer ASVD protection; these claims are often endorsed by professional and industrial stakeholders.
Available data indicate a general trend toward a periodontal treatment–induced suppression of systemic inflammation and improvement of noninvasive markers of ASVD and endothelial function.

HOWEVER, The effects of PD therapy on specific inflammatory markers are not consistent across studies, and their sustainability over time has not been established convincingly.

http://circ.ahajournals.org/content/early/2012/04/18/CIR.0b013e31825719f3.long
Lockhart et al. (AHA)

• **HOWEVER**, This review highlights significant gaps in our scientific understanding of the interaction of oral health and ASVD.

• **HOWEVER**, Identification of clinically relevant aspects of their association or therapeutic strategies that might improve the recognition or therapy of ASVD in patients with PD would require further study in well-designed controlled interventional studies.
Oral Health and Stroke
Periodontal Disease and Stroke

- Post hoc analysis of prospective longitudinal studies and smaller case control studies have reported the association between periodontal disease and stroke.
- Early studies demonstrated that periodontal disease appears to bear a stronger association with stroke than with coronary artery disease.


Periodontal Disease and Stroke

- In a combined analysis of two prospective studies, periodontal disease was found to increase the risk of incident stroke nearly three fold.
- Proposed mechanisms include inflammation mediated pro-coagulant state, atherosclerosis mediated by direct microbial invasion of blood vessel wall, and interaction with recognized vascular risk factors.

Periodontal Disease and Stroke

• Several studies have also reported a major positive association between periodontal disease and ischemic stroke, in stroke free patient populations.

• A new study completed at the Univ. of South Carolina also found periodontal disease is independently associated with recurrent vascular events in stroke/TIA patients and aortic arch thickness

Oral Health and Stroke

- Regular dental examinations allow for early detection and treatment of oral conditions associated with the risk of further vascular events.
- Loss of teeth or masticatory function is associated with poor compliance of home health care in stroke patients.
- Less than half of stroke survivors in the United States received dental care, leaving substantial room for improvement.
- Stroke survivors need education about the importance of regular dental care, particularly minority groups.

The Dental Intervention Model for Stroke Prevention

- A true controlled dental intervention study for stroke prevention is not available
- Currently in the early stages of research and development.
- A hand full of studies reveal:
  - Women may have better benefit than men.\(^1\)
  - Quality of life can be maintained if poor oral health is reduced through better daily oral hygiene practices, education, and professional maintenance.\(^2\)
  - The effects of healthy teeth in the prevention of stroke and cardiovascular disease appear to be quite compelling.\(^3\)

Questions???