Innovations in Saliva-Based Diagnostics and Xerostomia Management

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Educational Objectives

- List the types of biomarker which are found in saliva
- Describe how biomarkers for systemic disease are transported into saliva
- Describe the oral and systemic conditions associated with a dry mouth
- Discuss the value of saliva-based diagnostics in your practice
- Create evidence-based clinical care plans and self-care protocols for dry mouth patients.

Liquid Biopsy: Saliva-based Diagnostics for Oral and Systemic disease

Salivaomics Knowledge Database

The UCLA Human Salivary Proteome research project

How biomarkers for systemic disease are transported into saliva

- Cancer-derived exosome-like microvesicles are capable of interacting with salivary gland cells
- Tumor-derived RNA molecules transported through exosome vesicles from source of tumor, and re-processed into saliva as biomarkers

Saliva Diagnostics

Saliva Diagnostics

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http://www.hspp.ucla.edu/skb.swf

Novel saliva testing Technologies (PCR, OFNASET & EFIRM)


Types of biomarker which are found in saliva

- Metabolomes
- Microbiomes
- Genomes

Types of biomarker which are found in saliva: Transcriptomes

- Messenger RNA
- Micro RNA

Current Research on Saliva Testing for Systemic Diseases

- Salivary metabolomes aid in detecting oral SCC
- Salivary microbiome, metabolome & mRNA to detect pancreatic cancer
- Zika Test Uses Saliva to Detect Both Nucleic Acids and Antibodies of the Virus

Detecting tumor-causing mutations in saliva

- Saliva test Detects Epidermal Growth Factor receptor gene mutations to Dx lung cancer

SaliMark Future Pipeline Products

- SaliMark™ LC
- SaliMark™ SS
- SaliMark™ D2

Salivary glands may hold key to Parkinson’s diagnosis

- Testing submandibular salivary glands to diagnose Parkinson’s disease
- Investigating saliva for biomarkers of Parkinson’s disease
Salivary Biomarkers May Indicate Alzheimer’s Risk

- Diagnostic Biomarkers of Alzheimer’s Disease as Identified in Saliva Using 1H NMR-Based Metabolomics, *Journal of Alzheimer’s Disease*

Saliva Proteins May Aid Early Autism Diagnosis

- Consistent with current ideas about autism cause and comorbidities. [Image]

Salivary Biomarker linked to Stress, Resilience

Recent research suggests that increased levels of nerve growth factors in saliva are related to greater resilience and adaptation to stress.

Attitudes of Dentists, Physicians and Patients towards chairside screenings

- Most DDS sampled would be open to providing medical screenings
- Most primary care physicians would welcome screenings and referrals from DDS
- Many patients indicated they would regard DDS more highly, if they conducted medical screenings

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DNA and Dentistry

≈100 million Americans are infected with periodontal disease. It is recognized to increase risks for diabetes, heart disease, stroke, and other systemic diseases.


Saliva-Based Diagnostics in Your Practice

- MyPerioPath
- MyPerioID
- Alert 2™ MyPerioPath® + MyPerioID® IL-6

Image courtesy of OralDNA Labs
Saliva-Based Diagnostics in Your Practice

- OraRisk® HPV
- OraRisk HSV
- OraRisk® Candida
- OraRisk® CT/NG
- OraSure technologies take-home HIV screening test*

Celsius One™ salivary DNA tests

- Tests 8 gene markers related to inflammatory response

Online Ordering and Reporting

1. Sterile Saline Oral Rinse Sample
2. Online Ordering
3. Ship Overnight
4. Download Report

First DIY test for periodontitis

- Tests saliva for matrix aMMP-8, a ‘Destruction Marker’

SaliMark™ OSCC salivary test by PeriRx

- Analyzes Salivary Transcriptomes
- High sensitivity and specificity
- Performed chairside when a suspicious oral lesion is found

DNA Drugmap test

- Tests drug metabolism
- Most FDA-approved drugs are metabolised by Cytochrome P450 enzyme (CYP450)
- Drugmap predicts changes in CYP450 activity.
Saliva Drug Tests

- Saliva MultiDrug Screen test kit®
- QuickScreen®
- iScreen®

Saliva Glucose test

- iQuickIt Saliva Analyzer

Xerostomia—A Growing Problem

Xerostomia affects at least 1 in 10 adults in the general population.


A 50% reduction in salivary flow often occurs before xerostomia is noted.


Etiology of Salivary Gland Hypofunction

Getting involved in diagnosing xerostomia can provide a window to your patient’s overall health.
How Diseases & conditions cause Salivary Gland Hypofunction:

Local Factors
- Developmental defects
- Abnormalities of the salivary ducts
- Tumours
- Sialololiths (salivary stones)
- Irradiation of the head and neck
- Uvulopalatoplasty (removal of uvula)

Systemic Factors
- Dehydration
- Malnutrition
- Sympathetic response
- Damaged nerve supply
- Inflammatory response due to infection, or autoimmune disease


Xerogenic Diseases & Conditions
- Anxiety
- Depression
- Amyloidosis
- Asthma
- Lymphoma
- Menopause
- Bulimia nervosa
- Diabetes insipidus & diabetes mellitus - cause dehydration
- Fibromyalgia


How Drugs cause Salivary Gland Hypofunction
- Tissue damage
- Altering fluid and electrolyte balance
- Vasoconstriction
- Effect on neural pathways
- Sympathomimetic
- Anticholinergic

ADA Council on Scientific Affairs Conclusions and Practice Implications
- Health history
- Comprehensive evaluation
- Corrective actions
- Interdisciplinary patient care
- Patient education
- Palliative and preventive measures

10.14219/jada.2014.44 The Journal of the American Dental Association August 1, 2014 vol. 145 no. 8 867-873
Risk Assessment: A Xerostomia Screening Questionnaire

1. Does the amount of saliva in your mouth seem too little?
2. Do you have any difficulties swallowing?
3. Does your mouth feel dry when eating a meal?
4. Do you sip liquids to aid in swallowing dry food?


Chronic Salivary Gland Enlargement

- Sjögren’s Syndrome
- Sarcoidosis
- HIV infection
- Hepatitis C
- Bulimia Nervosa
- Mucoepidermoid Ca
- Lymphoma


Other Diagnostic Techniques

- Blood testing
- Immunologic testing
- Biopsy-incisional, or aspiration cytology
- Endoscopy
- Diagnostic imaging

Hands-On Saliva Testing

Images reproduced with permission from Eileen McQuade, RDH, BS
Saliva-Check BUFFER

Test for Saliva Quality, pH & Buffering Capacity

Image courtesy of http://www.gcamerica.com

Checking Hydration

Test 1: Unstimulated (resting) saliva

- Collect unstimulated saliva-refrain from swallowing for 30 seconds, then spit into the cup
- Assess colour and consistency of saliva
- Test resting salivary pH

Testing pH

- Ideal saliva pH 6.8 to 7.5

Image courtesy of http://www.gcamerica.com

Test 2: Collect Stimulated Saliva-Chew & Spit 5 min

- Chew unflavored paraffin wax
- Chew and spit saliva into cup every 15-20 seconds for 5 minutes

Images courtesy of http://www.gcamerica.com
The Salivary Flow Index: Salivary Flow Rates

- 0.3 to 0.4 mL/min
- 0.7 mL/min
- 1 to 2 mL/min
- <0.1 mL/min
- <0.7 mL/min

Assessment of Saliva

Saliva: The Movie

Hands-On Saliva Testing

Test 2 Continued: Testing Stimulated Saliva

- Measure volume of Stimulated Saliva collected
- Test Stimulated salivary pH
- Keep this saliva for Buffer testing
Test 3: Test Buffering capacity of stimulated saliva

- Use pipette to drop saliva onto the three parts of the buffer test pad
- Turn pad sideways on a tissue to remove excess saliva
- Check the score with the colour chart after two minutes

Buffer Test

Testing capacity to buffer an acid challenge

Testing for Cariogenic Bacteria

Multifaceted Management of Xerostomia and SGH

- Hydration
- Stimulate saliva
- Saliva Substitution
- Conserve functional salivary gland tissue
- Prevent Caries, remineralize
- Protect soft tissue
- Palliation

Sjögren’s Syndrome Foundation’s Clinical Practice Guidelines: Caries Prevention

- Fluoride
- Non-fluoride remineralizing agents
- Salivary stimulation
- Antimicrobials

Caries Prevention and Remineralization

- In-office fluoride varnish
- Self-applied fluoride

Calcium and Phosphate Products
- Recaldent
- Tri-Calcium phosphate
- Nanohydroxyapatite
- Bioactive glass (Novamin)

Silver Diamine Fluoride 38% (SDF)
- Arrests caries, even after cavitation

Xylitol
- Stimulates salivation
- Reduces oral population of Strep Mutans
- Reduces acidity & promotes remineralization
- Reduces plaque accumulation

Some Xerostomia Relief Products
- All Day spray
- Basic Bites
- Biotène
- BioXtra
- Colgate Hydris
- GC Dry mouth gel
- Lubricity
- M I Paste
- Neumisyn
- NeutraSal
- Optimoist
- OraMoist
- Oral 7
- SalivaMax
- Salivasure
- Saliva Orthana
- Spry Rain
- 3M Theramints™
- Xero Lube
- X-Pur

Supersaturated Calcium phosphate rinse


Images courtesy of GC America and 3M ESPE
Image courtesy of Oral Science
Images courtesy of Spry, Oral Science, and Carifree
MI Paste Plus with Recaldent (CPP/ACP™) for Xerostomia management

- Adds moisture
- Stimulates salivary flow
- Buffers plaque acid
- Remineralizes
- Reduces adherence of Strep. Mutans
- Relieves sensitivity

Images courtesy of GC America

Chlorhexidine

- GUM Alcohol-free 0.12% Chlorhexidine Gluconate Oral Rinse
- Perio Plus 0.12% Chlorhexidine rinse
- Prevora Chlorhexidine Varnish

Images courtesy of Oral Dent Pharma, Sunstar Americas, & Prevora.

Innovative and Evolving Therapies for Xerostomia

- An artificial salivary gland
- Calcium and salivary flow
- Sjögren’s patients have more pro-inflammatory (IL-17) molecules, and less anti-inflammatory molecules (Del-1)
Stem cell therapy

Adult Salivary Gland Stem Cells and a Potential Therapy for Xerostomia

Sarah Pringle, Ronald van Oo, Robert P Coppes. Regenerative Medicine
DOI: 10.1002/stem.1327

Acupuncture

Three points are treated in each ear:
- Shen Men
- Point Zero
- Salivary Gland 2
One in the radial aspect of each index finger (Large Intestine 1)

Hypnosis

Hypnosis for post-radiation xerostomia in head and neck cancer patients: a pilot study


Electronic Stimulation

Saliwell GenNarino

Images courtesy of Dr Andy Wolff

SaliPen

- Natural saliva production
- Lasting wetness effect
- Useful for all dry mouth patients

Images courtesy of Dr Andy Wolff

How to use the SaliPen

- No side effects
- One size fits all
- Low cost
- Electro-stimulation
- Online orders

Images courtesy of Dr Andy Wolff
Hyperbaric Oxygen therapy

The Effect of hyperbaric oxygen therapy on quality of life in oral and oropharyngeal cancer patients treated with radiotherapy


Vaccine for Sjögren's Syndrome

Primary Sjögren's syndrome and deficiency of ICA69


Gene therapy

Acquaporin 1 transgene facilitates formation of water channels in cells

Image created by Danielle L. Douglas

Local use of drugs: Pilocarpine Lollipops

Image courtesy of Eva Grayzel

Quick-Start Guide for Clinicians

- Three month recalls
- Extra-oral exam
- Intra-oral exam
- Xerostomia questionnaire
- Assess hydration inside lower lip
- Test salivary pH
- Clinical Oral Dryness Score
- In-office fluoride treatments
- Desensitization as required
- Dietary counseling

Quick-Start Self-Care Guide

- Drink water
- Stimulate saliva flow *
- Xylitol gum or candy
- Dry mouth spray or gel as required
- Avoid exacerbating factors
- High fluoride toothpaste
- Calcium & phosphate
- Petroleum-free lip balm
- Omega-3 supplements 1000 mg per day
- Moist foods low in acid, salt & sugar
Thank You!!
And now, for the
Door Prize!