Geriatric Oral Health

Navigating chronic disease and oral dryness

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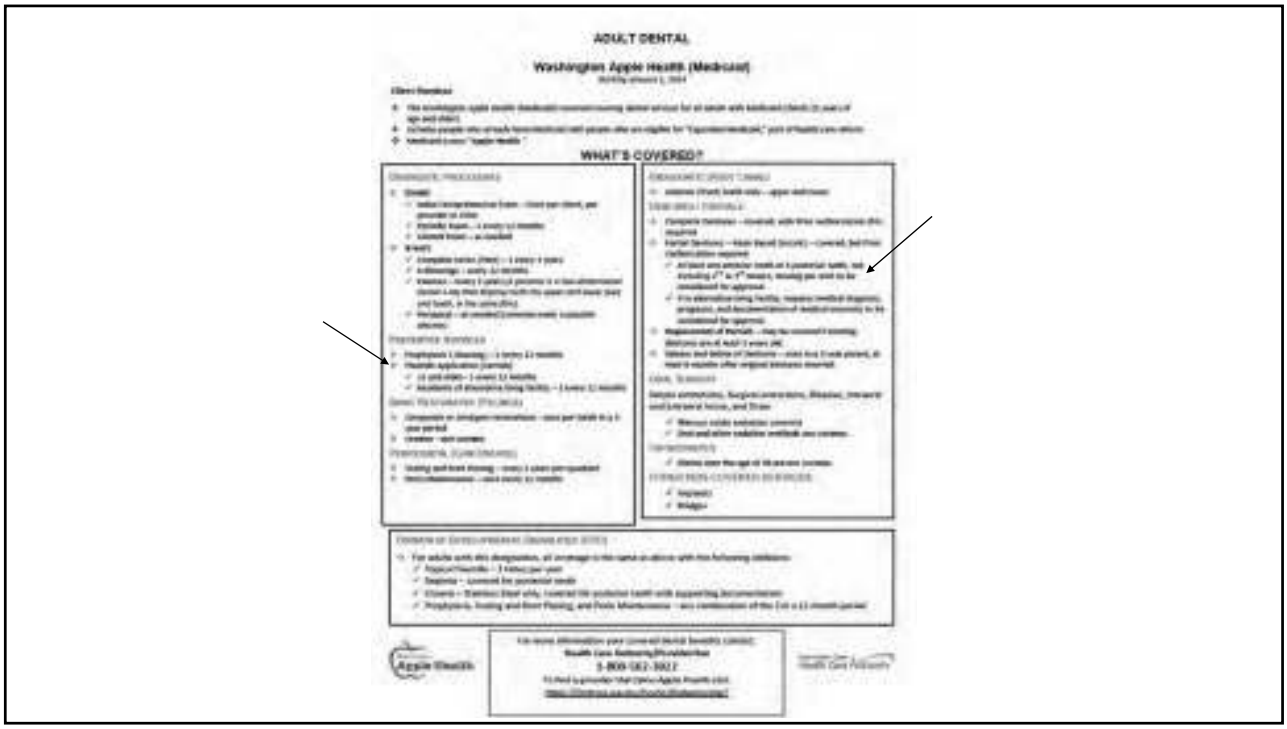
Facts: Older Adult Oral Health

- By 2060, according to the US Census, the number of US adults aged 65 years or older is expected to reach 98 million, 24% of the overall population.
- Older Americans with the poorest oral health tend to be those who are economically disadvantaged, lack insurance, and are members of racial and ethnic minorities.
- Being disabled, homebound, or institutionalized (e.g., seniors who live in nursing homes) also increases the risk of poor oral health.
- *Many older Americans do not have dental insurance because they lost their benefits upon retirement and the federal Medicare program does not cover routine dental care*



ADULT DENTAL

Washington Apple Health (Medicaid)

WHAT'S COVERED?

1-800-562-3022

ADULT DENTAL

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1-800-562-3022

Edentulism

- There are about 35 million edentulous people in the US, and 178 million people are missing at least one tooth
  - Roughly 90% of the US edentulous population wears dentures
- 51% of Americans, ages 55 to 64, wear full or partial dentures
- 29% of Americans, ages 45 to 55, wear full or partial dentures
- 16% of Americans, ages 35 to 44, wear full or partial dentures
- *The number of partially edentulous people will continue to increase in the next 15 years to more than 200 million individuals. Partial edentulism affects the majority of adult Americans.*

Tooth loss

- As a result of *Caries* and *Periodontitis*
- Result of *Injury*, *Cancer*, or simply *Wear*
- *Edentoulism affects our most vulnerable populations – the aging and the economically disadvantaged*
  - *and at the Center for Healthy Living I work with both of these populations*
- *Consequences of missing teeth include significant nutritional changes, obesity, diabetes, coronary artery disease, and some forms of cancer.*

Which groups of elderly are the most vulnerable?

- Homeless elderly (mental health issues)
- Dependent elderly with dementia.
- Community dwelling elderly in independent living without a strong support group, ie. a senior center, active social workers or family.

How do medical/dental insurance and financial constraints affect potential interventions?

- Apple health does not reimburse root canal therapy on molars and premolars (only on 1-rooted teeth), which means that extraction would be the best financial option if (root) caries reaches the dental pulp. At the SoD, an extraction is around $100, while a root canal on a molar is in the range of $1000.
- After multiple extractions in the premolar and molar regions, elderly without dental insurance lose the ***vertical dimension*** of their bite, and the bite "collapses". As a result, the chewing capacity decreases. Antagonist teeth also supra-erupt, when there is no occlusal contact. This makes it very difficult to restore a patient's dentition back to function. You might need both Orthodontic treatment and Surgery, which is not an option for most elderly.
- Apple health only reimburses all resin partial dentures, which is not the best quality dentures.

Oral disparities in older adult populations

- Across NIH, it has been recognized that there is an increasing need to support research that can address issues around aging, including the basic biology of aging to clinical studies focused on delivering best care to all older adults.
- The NIDCR Strategic Plan for 2014-2019 (http://www.nidcr.nih.gov/research/ResearchPriorities/StrategicPlan/StrategicPlan14/goal3.htm) describes four primary goals. Research to improve the oral health of older adults addresses three of these goals
- GOAL 1: Support the best science to improve dental, oral, and craniofacial health.
- GOAL 2: Enable precise and personalized oral health care through research.
- GOAL 3: Apply rigorous, multidisciplinary research approaches to overcome disparities and inequalities in dental, oral, and craniofacial health).
  - One objective of Goal 3 is to support multi-disciplinary, multi-level research and research training to overcome health disparities, including the oral health of the elderly.

Global oral health goals (65+)

- A 25% reduction in the present level of edentulous status
  - Presently (2006) 27% of Americans 65 years and older are edentulous
- WHO has an oral health goal of 20 teeth
  - Prevention of Caries is KEY!

Treatment goal

- Preserve and maintain dentitions throughout life.
  - "Teeth for life"

- Low indices of socio-economic status are associated with elevation in caries
  - Reduced access to care
  - Reduced oral health aspirations
  - Low self-efficacy
  - Health behaviors that may enhance caries risk

NIH: NIH consensus statement. Diagnosis and management of dental caries throughout life, 2000

Length of tooth survival in older adults with complex medical, functional and dental backgrounds

- Retrospective longitudinal study based on dental records.
  - University-affiliated, community-based geriatric dental clinic in Minnesota
  - Mean age 76 years; Range: 43 – 102; 491 patients
  - LTC and Community dwelling adults
  - 70% were enrolled in Minnesota's Medical Assistance program
  - Average of seven (7) medical conditions
    - Considerable Anti-Cholinergic side effects

- 1. Poor oral health at first exam
  - Multiple active carious teeth or retained roots (5 or more)
  - ~ 20% of participants with 5 or more carious teeth/retained roots loose an additional tooth within 12 months after their existing conditions were treated

- 2. Dental caries and the use of removable dentures synergistically impaired tooth survival in older adults
  - Pat who wore dentures were at a higher risk of losing teeth sooner at any given time during the follow-up period than were participants who did not wear removable dentures

Chen et al. (2012)

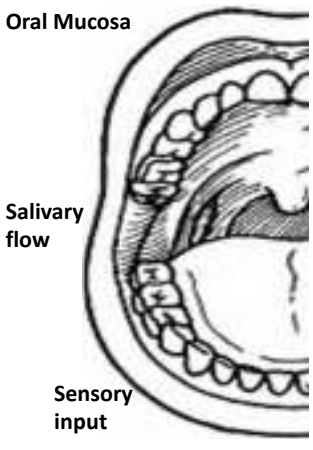
Learning objectives

1. Compare and contrast normal and accelerated aging changes in the oral cavity

2. Describe how to compensate for effect of medications causing a dry mouth

3. Provide preventive oral care for community dwelling elderly and elderly in assisted living facilities

ORAL Function in the Elderly



Loss of "volume"

Loss of bone height
Retention of lower jaw dentures difficult

Thinning of collagen and elastic fibers
Fat atrophy

Source: Beer and Beer, 2009

Age influence on periodontal tissues

- Periodontal conditions of seniors
  - *Oral mucosa*
    - Atrophic, satin-like and friable
    - Thin, smooth and dry
  - *Gingiva*
    - Looses its stippling due to flattening of rete pegs
      - Epithelium:
        - Diminished keratinization, thinner
        - Parakeratosis is frequent
        - Inflammatory cells
          - Often signs of chronic inflammation

        ] Decreased barrier function

      - Connective tissue
        - Fewer connective tissue cells (fibroblasts)
        - Less elastic fibers – tissue loss of elasticity
        - Thicker collagen bundles = Fibrosis
    - Capillaries decrease in numbers
      - Blood supply is reduced
    - Clinically, gingiva is reduced, migrates to tooth apex, presents a reduced resilience
    - Becomes more sensitive to external factors

YOUNG ADULT

Epithelium
- Thick (250 μm)
- Stippled surface

Lamina Propria
- Long, narrow papillae
- Dense connective tissue – gingival ligament fibers

Source: Andreescu et al., 2013

Aging of the Immune response

- Gingival immune defense is diminished
  - Inflammation develops easier
  - Healing process is slower
  - Immuno-senesence – gradual deterioration of the immune system
- Ineffective protection against microbes at the muco-cutaneous junction

  (Ongradi J and Kovesdi V, 2010)
- More rapid and severe development of gingivitis

  (Fransson C et al., 1999)
- Number of dendritic cells (=antigen presenting) are significantly lower in older age groups

  (Zavala WC and Cavicchia JC, 2006)

Aging of Mechanoreceptors

- Aging of sensory nerve endings (mechanoreceptors)
  - Ruffini's
    - Decrease in number
    - *Consequences?*
  - Free nerve endings
    - Decreased sensitivity
    - *Consequences*?

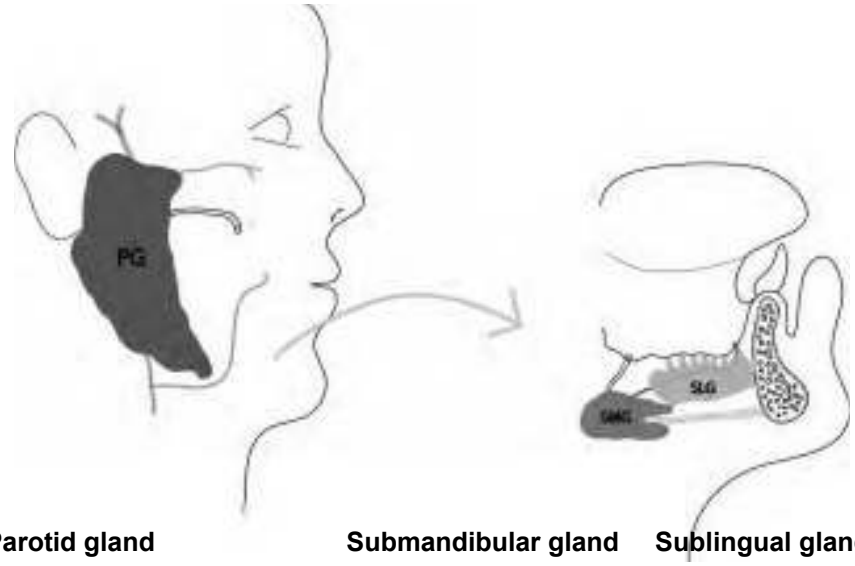
Aging of sensory innervation

- Elevation in sensory thresholds for multimodal somato-sensory nerve endings
  - Warming, cooling, pain, touch, 2-point discrimination
- Elevation in sensory thresholds for taste
  - 178 individuals: 45 y and younger, 65 y and older
  - Older adults (both genders) have a higher threshold for salt
  - Older adults have a higher threshold for sour, with older males having the highest threshold

Source: Heft and Robinson, 2010 (Clinical study)

"… a world without saliva is a world without pleasure… like living with a drought…"
Leo Sreebny (2000)

Major Salivary Glands



Parotid gland	Submandibular gland	Sublingual gland
PG	SMG	SLG

Minor Salivary Glands

Mucous

- Palatine glands
- Posterior lingual glands

Serous

- Glands of von Ebner

Mixed

- Anterior lingual glands
- Buccal glands
- Labial glands

"Whole saliva"

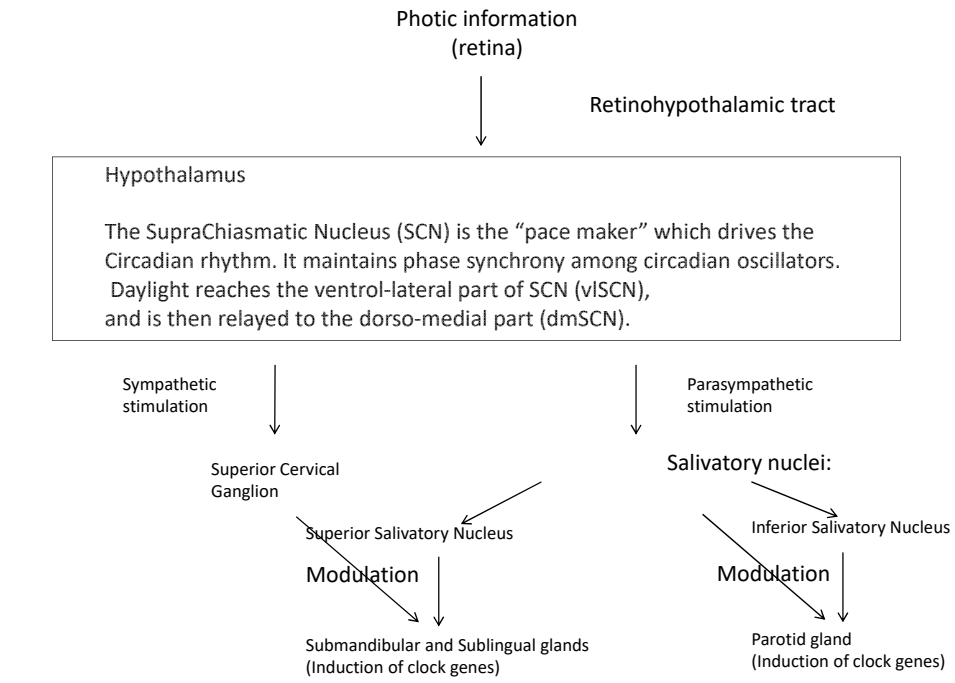
Glands	Resting saliva *DECREASES WITH AGING*	Stimulated saliva
Parotid glands	20% of saliva	50% of saliva
Submandibular	65%	30%
Sublingual glands Minor glands	15% — 80%	20% — 50%
	0.3 ml/min 18 ml per hour	1.7 ml/min 102 ml per hour
	14 h/day + 8 h/night Important for protection of the oral mucosa and teeth	2 h/day Important for chewing, swallowing and digestion

Saliva production is stimulated by:

Unconditioned reflexes:

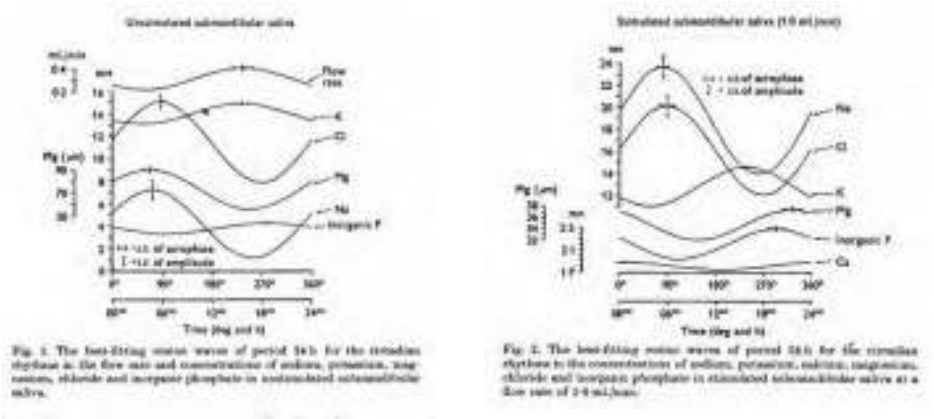
- Taste buds (neuroepithelial cells) and sensory receptor endings
  - Gustatory salivary reflex
  - Mechanoreceptor fibers sensitive when pinching the tongue.
- Masticatory stimulus
  - Sensory receptors within the periodontal ligament
- Olfactory stimulus
  - Area cribrosa
- Day light
  - Retina (Hypothalamus-Pituitary Axis, HPA)

Conditioned reflexes, such as hearing, thinking about and looking at food



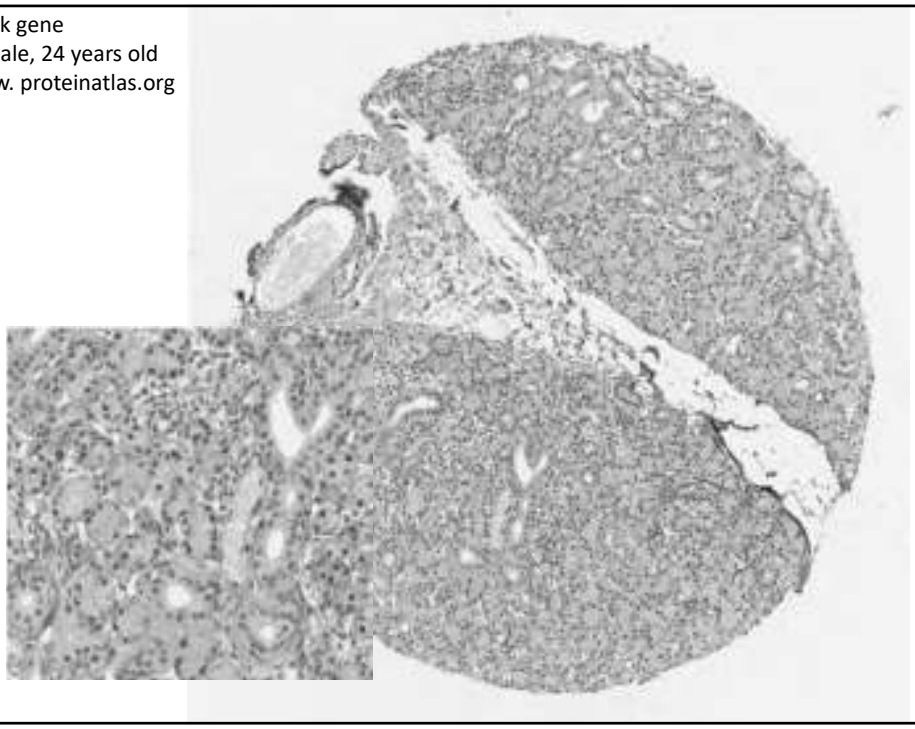
Vujovic´, N et al. (2008)

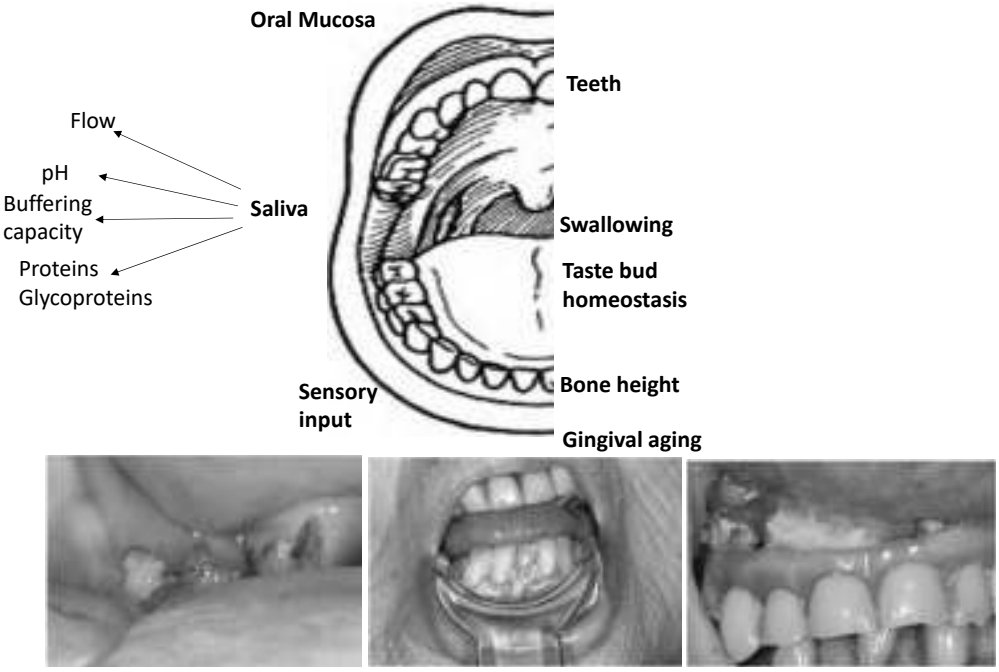
Salivary content of ions oscillates according to a circadian rhythm



Dawes (1974)

Clock gene
Female, 24 years old
www. proteinatlas.org





Flow
pH
Buffering capacity
Proteins
Glycoproteins

Saliva

Flow	Cholinergic stimulation Aquaporin water channels are Testosteron -dependent
pH	H ions in Striated ducts
Buffering capacity	Three different buffer systems Striated ducts
Proteins	Serous acinar cells Adrenergic stimulation
Glycoproteins	Mucous acinar cells Cholinergic stimulation

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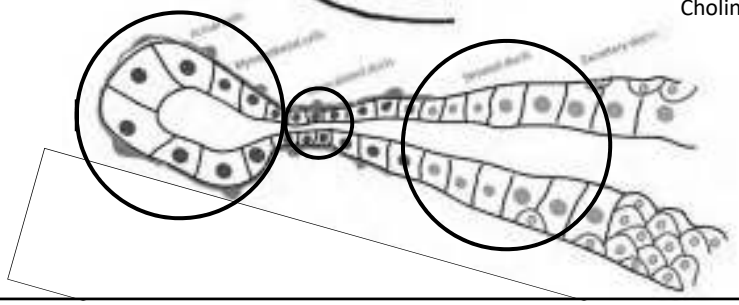
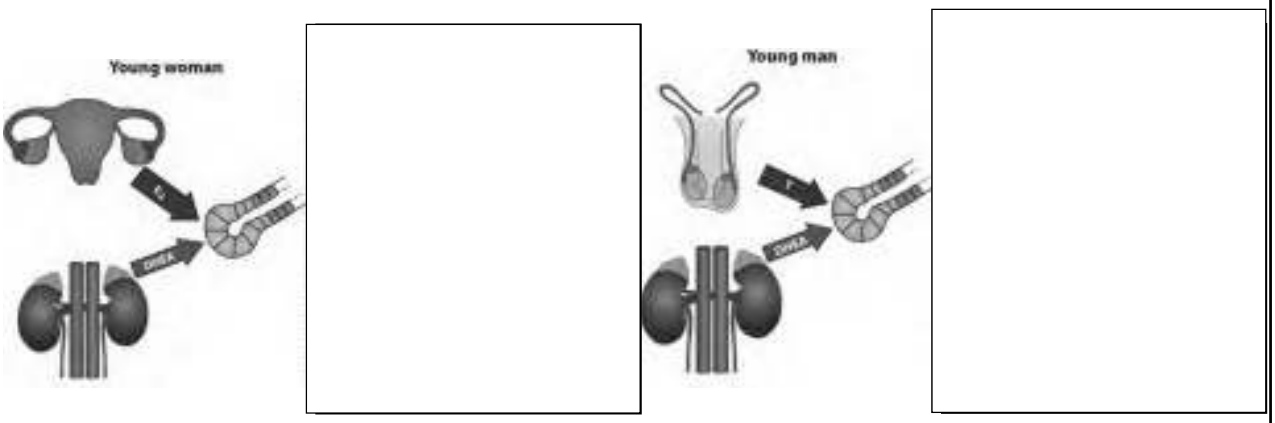


Endocrinology vs. Intracrinology
Effect of sex steroids on exocrine glands



F. Labrie (2015)

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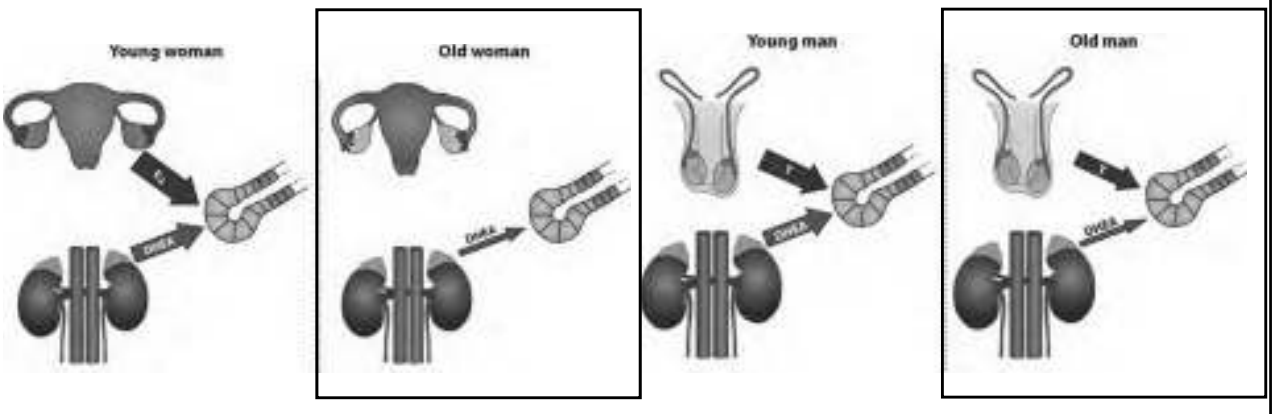
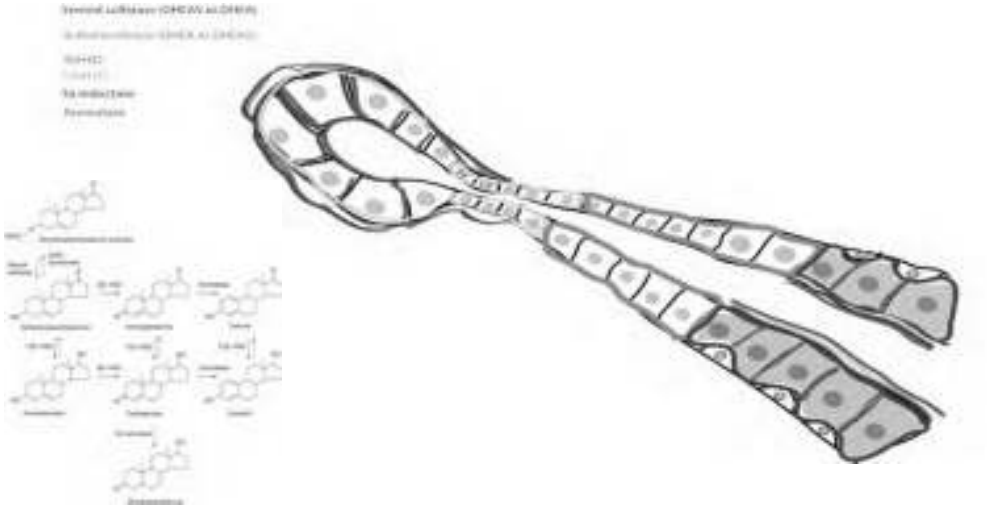


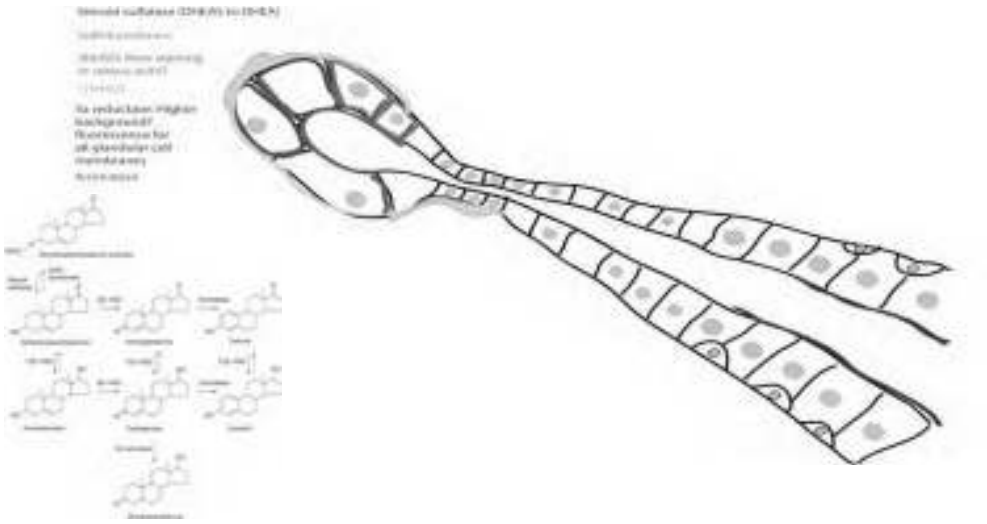
F. Labrie (2015)

Normal localization of sex steroid converting enzymes



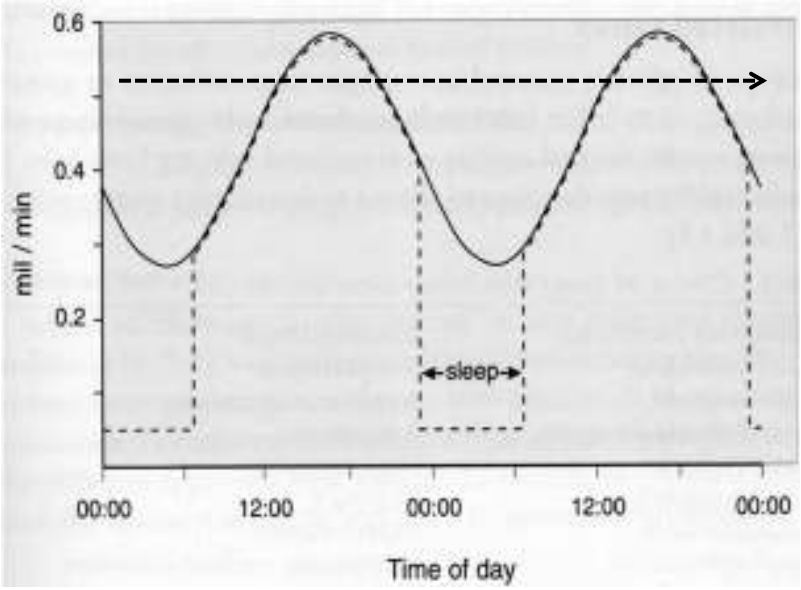
SKJ Interpretation of Spaan et al., 2009

Sjögren's syndrome



SKJ Interpretation of Spaan et al., 2009

Flattening of the circadian rhythm with aging



Salivary changes during normal aging?

1. Reduced flow rate?

2. Composition of saliva?

3. Increased oral dryness?
   - Decreased secretion of antimicrobial peptides

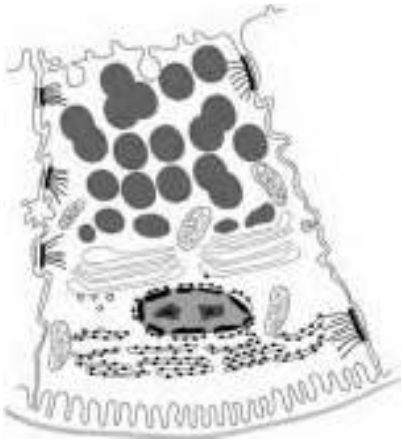
1. Reduced flow rate with Aging: Yes!

- The flow rate of resting whole saliva decreases with age (Sreebny, 2000)
  - A reduction in the flow rate from Submandibular/Sublingual glands with age. Resting parotid flow is very difficult to measure due to its small volume.
- Reduced stimulated flow rate from parotid glands as well (Yeh, 1998)
  - 1133 subjects
  - Other studies have shown contradictory results, this is due to the fact that most organs can compensate for a loss of parenchyma

2. Changes in composition of saliva with aging: YES!

- Synthesis of mucins decrease
  - Important glycoproteins in unstimulated salivary flow
  - Submandibular/sublingual glands and minor salivary glands
    - Aggregates bacteria
    - Forms pellicle
    - Protects against dehydration

Mucous acinar cell



Contents of secretory granules:

MUC5B, 130 kDa

Binds Ca2+ and Hydroxyapatite. Aids in lubrication.

MUC7, 100 kDa

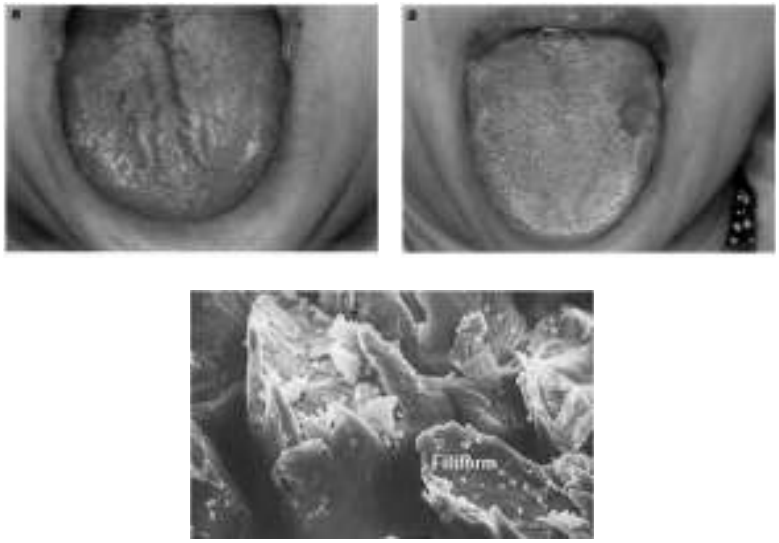
Interacts w/ bacteria, facilitates their removal. Aids in mastication, speech and swallowing.

- Hydrophilic
  - Resist mucosal dehydration
- Pellicle formation
- Bind to bacterial surfaces
  - Limit their colonization
  - Crosslink and aggregate bacteria

2. Changes in composition of saliva with aging: YES!

- Synthesis of mucins decrease
  - Important glycoproteins in unstimulated salivary flow
  - Submandibular/sublingual glands and minor salivary glands
    - Aggregates bacteria
    - Forms pellicle
    - Protects against dehydration
- Synthesis of Histatin 5 decreases
  - Higher frequency of Candida infections in the elderly (Sugimoto et al., 2006)
    - 124 healthy elderly, 65 years and older; 84% positive!
    - Correlated to
      - A. Type of denture
      - B. Histatin 5 concentrations in saliva
        - anti-fungal, bactericidal

A common consequence of reduced saliva secretion is an overgrowth of Candida, which will cause an Atrophic Tongue



Terai et al. (2005): Atrophic tongue associated with *Candida*

A common consequence of reduced saliva secretion is an overgrowth of Candida, which will cause an Atrophic Tongue

Following treatment with fungal medication

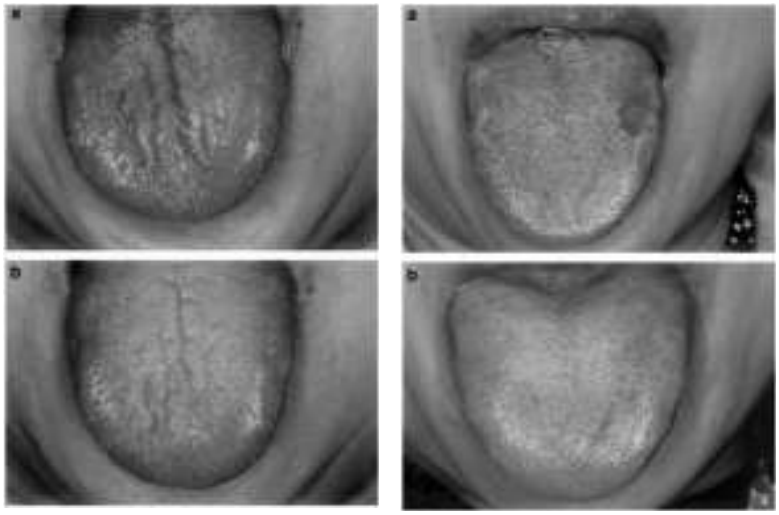


Figure 2 Glossal findings in the total atrophic case

(a) Total atrophic change was seen at pre-treatment.
(b) Regeneration of filiform papilla was seen in two weeks after treatment.

Figure 3 Glossal findings in the partial atrophic case (migratory glossitis)

(a) Partial atrophic change was seen in the left dorsum of the tongue.
(b) Regeneration was seen in a week after treatment.

Terai et al. (2005): Atrophic tongue associated with *Candida*

3. Increased oral dryness? Yes!

- First study conducted in 1984 in Sweden
  - 16% of 70 year old men, and 25% of 70 year old women suffered from oral dryness
- Sreebny and Valdini (1988)
  - "Does your mouth usually feel dry?"
  - 20.8% of men, and 33.3% of women
- All studies taken together
  - 14 – 46% of individuals suffer from oral dryness
  - Women more so than men

Osterberg et al. (1984); Sreebny (2000)

Lower salivary flow rate due to:

1. Reduction in acinar volume
2. "Flattening" of the Circadian rhythm

Changes in protein composition:

1. Lower levels of Mucins
2. Lower levels of Histatin 5

If subjective oral dryness:

1. Less fluid secretion, USF mL/min
2. Lower levels of Antimicrobial peptides from PG, SM, SL and minor glands

Masticatory Performance

- The ability to break foods down into discrete portions by chewing.
- Number of **chewing cycles** needed to chew a standardized piece of food **increase with age**
- Maintaining or restoring masticatory function - the ultimate goal of dental/oral care.

- *Factors that affect masticatory performance are*

1. Loss and restoration of posterior teeth
2. Tooth wear
3. Occlusal force
4. Salivary flow
5. Oral motor function (accelerates masticatory dysfunction with ageing)

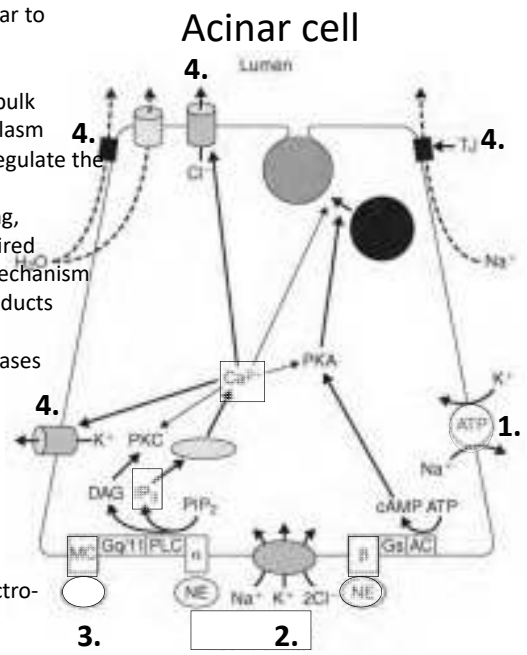
Medications with high dental impact

1. Na^+/K^+ ATPase creates an extracellular to intracellular gradient of Na^+

2. $Na^+K^+2Cl^-$ co-transporter drives the bulk of acinar Cl^- ions into the cytoplasm
   - β-adrenergic stimulation upregulate the co-transporter
   - When co-transporter is lacking, fluid secretion is severely impaired
   - A second Cl^- concentrating mechanism is HCO_3^- dependent, in salivary ducts

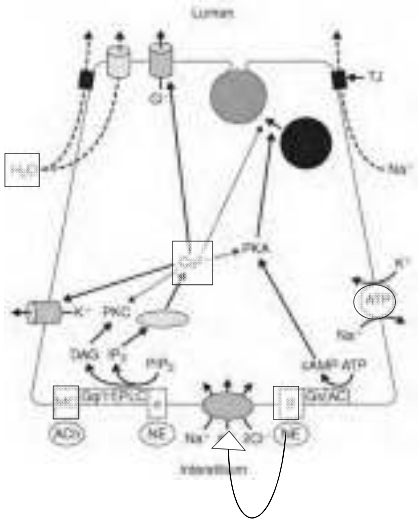
3. Stimulation of M_3R by ACh releases intracellular Ca^{2+} from ER
   - The IP_3 wave and the Ca^{2+} wave is shared betw/ the acinar cells within a unit.

4. Ca^{2+} opens Ca-dependent Cl^- and K^+ channels
   - Na+ follows Cl^- to uphold electro-neutrality
   - H_2O follows osmotically
   - Presence of Androgens for function of AQ5



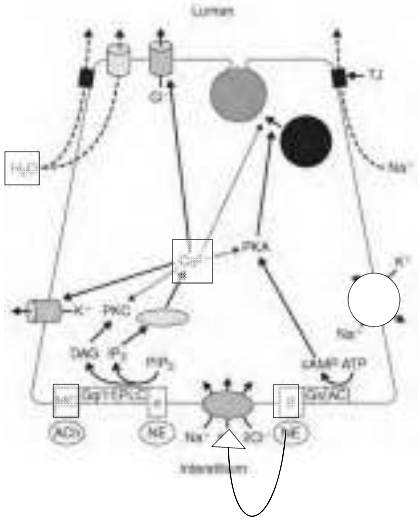
Important steps for saliva secretion

- Fluid secretion is dependent on gradient set up by Na^+/K^+ ATPase
- $Na^+/K^+/Cl^-$ – co transporter
- Muscarinic stimulation
  - IP_3 receptors on ER release Ca^{2+}
  - Ca^{2+} dependent ion channels drives fluid through the cell
- Aquaporin 5 channels
  - Androgen dependent

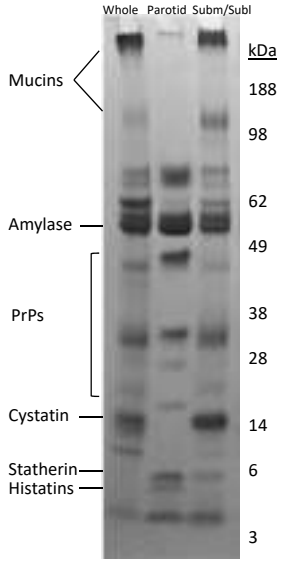


Reduced salivary flow

- Medications which affect salivary flow the most:
  - Anti-cholinergic medication
  - Beta-blockers
  - Ca^{2+} antagonists
  - Diuretics



Contents of saliva



Carpenter (2013)

- **99.5% water and 0.5% dissolved substances:**

Salivary proteins and glycoproteins

- Amylase, Cystatins, Mucins, Proline-rich proteins (PrPs), Lysozyme, sIg's, Lactoferrin, Peroxidase, Histatins, Statherin, Defensins etc.
  - Mucins:
  - PrPs:
  - Statherin:
  - Histatins:
  - *Growth factors:* NGF, EGF, and other regulatory peptides
  - *Antimicrobial*: Lysozyme, Lactoferrin, Lactoperoxidase, Histatins, Defensins
  - *Digestion of starch and lipids:* Amylase and Lipase

Inorganic ions

- Bicarbonate, potassium, calcium and phosphate ions

Gases

- Oxygen, carbon dioxide and nitrogen

Saliva Testing

TEST 1: Saliva-Check Buffer

HYDRATION (minor salivary glands, 15% of resting saliva)

1. Visual inspection of hydration

UNSTIMULATED SALIVA (minor and major salivary glands)

1. Flow (mL/min)
2. Consistency
3. pH (may also measure buffer capacity)

STIMULATED SALIVA (minor and major salivary glands)

1. Flow (mL/min)
2. pH
3. Buffer capacity

TEST 2: Saliva-Check Mutans

STIMULATED SALIVA

- 4. Str. Mutans test

  (more or less than 500,000 CFU of Str. Mutans in 1 mL of stimulated saliva)

Saliva Testing

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  (more or less than 500,000 CFU of Str. Mutans in 1 mL of stimulated saliva)

Saliva-Check BUFFER
Test for Saliva Quality, pH & Buffering Capacity

Saliva-Check BUFFER

Saliva-Check BUFFER is a saliva testing examination tool that is used to educate patients, assist in preventive treatment planning and properly select dental materials in order to initiate changes in the patient's oral hygiene. This product plays a significant role in maintaining oral health. It identifies, measures and assesses the patient's saliva condition, which helps determine the body's possible risk of caries. It is also helpful for testing hydration, salivary consistency, resting saliva pH, stimulated saliva flow, stimulated saliva pH and saliva buffering capacity. The Saliva-Check BUFFER is ideal for use during routine oral examinations.

TEST 1 – Visual inspection of level of hydration
Visually assess the lower lip labial gland secretion. Evert the lower lip, gently blot the labial mucosa with a small piece of gauze and observe the mucosa under good light. Droplets of saliva will form at the orifices of the minor glands.

Assess the time for visible production of saliva as follows :

Greater than 60 seconds : resting flow Low

Less than 60 seconds : resting flow Normal

TEST 2 – Saliva consistency
Visually assess the resting salivary consistency in the oral cavity :

Sticky frothy saliva residues: Increased viscosity

Frothy bubbly saliva: Increased viscosity

Watery clear saliva: Normal viscosity

Salivary flow (mL/min)
Collect saliva during 5 minutes (drooling)

TEST 3 – pH measurement
Instruct the patient to expectorate any pooled saliva into the collection cup. Take a pH test strip, place this into the sample of resting saliva for 10 seconds, and then check the colour of the strip. This should be compared with the testing chart available in the package.

Resting saliva

- 3.51 mL
- 5 minutes

Flow = 0.7 mL/min

Stimulated saliva

- 8.46 mL
- 5 minutes

Flow = 1.7 mL/min

Str Mutans

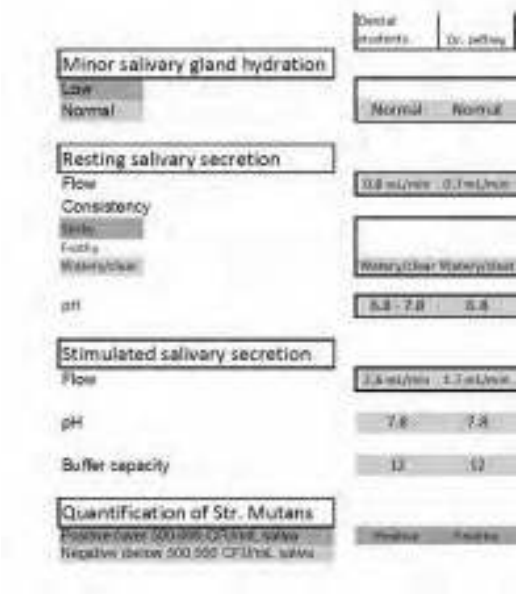
Your Test results

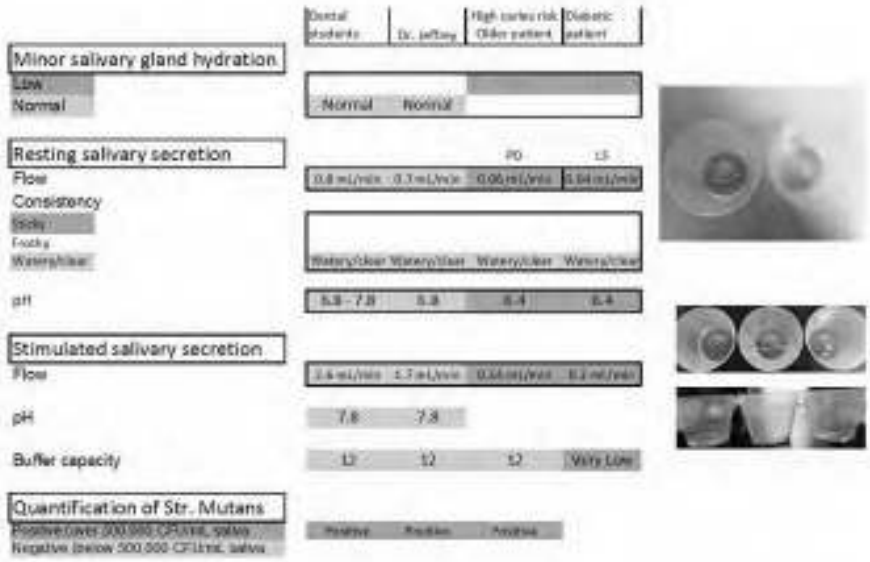
- HYDRATION
  - Low: Over 60 s for visible production of saliva
  - Normal: Less than 60 s for visible production of saliva

- UNSTIMULATED SALIVA
  - Flow: Less than 0.1 mL/min | 0.1 – 0.25 mL/min | Above 0.25 mL/min
  - Consistency:
    - Sticky,
    - frothy,
    - watery/clear
  - pH: pH: 5.0 – 5.8 Highly acidic | pH: 6.0 – 6.6 Moderately acidic | pH: 6.8 – 7.8 Healthy

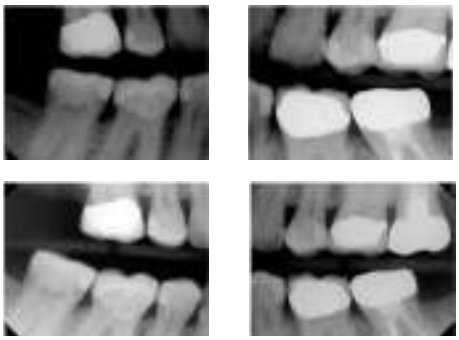
- STIMULATED SALIVA
  - Flow: Less than 0.7 mL/min | 0.7 mL/min – 1.0 mL/min | Over 1.0 mL/min
  - pH: pH: 5.0 – 5.8 Highly acidic | pH: 6.0 – 6.6 Moderately acidic | pH: 6.8 – 7.8 Healthy
  - Buffer capacity: Very low | Low | Normal/High

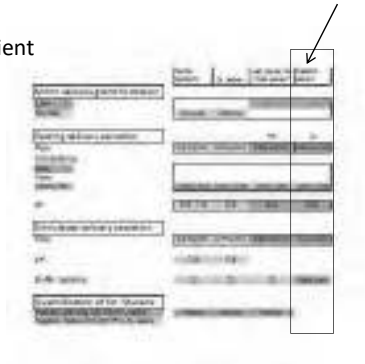
- STIMULATED SALIVA - MUTANS
  - Positive (over 500,000 CFU/mL saliva)
  - Negative (below 500,000 CFU/mL saliva)

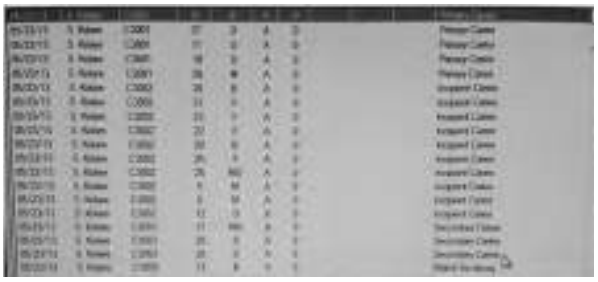



Minor salivary gland hydration
Low
Normal
Resting salivary secretion
Flow
Consistency
Sticky
Frothy
Watery/clear
pH
Stimulated salivary secretion
Flow
pH
Buffer capacity
Quantification of Str. Mutans
Positive (over 500.000 CFU/ml, saliva
Negative (below 500.000 CFU/ml, saliva
Normal
Normal
Watery/clear
Watery/clear
Watery/clear
Watery/clear
5.8 - 7.0
5.8
6.4
6.4
7.8
7.8
12
12
12
Very Low

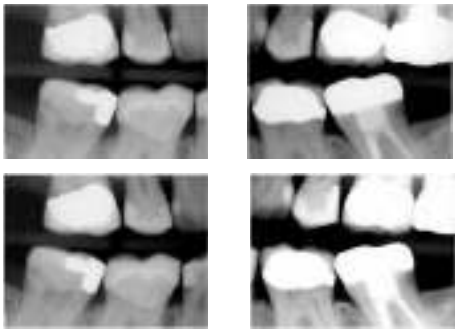
2013 - Younger diabetic patient







2015–Younger diabetic patient



Xerostomia inventory

- The xerostomia inventory (adapted from Thomson et al., 1999b).
-
  - I sip liquids to aid in swallowing food
  - My mouth feels dry when eating a meal
  - I get up at night to drink.
  - My mouth feels dry I have difficulty in eating dry foods
  - I suck sweets or lollies to relieve dry mouth
  - I have difficulties swallowing certain foods
  - The skin of my face feels dry
  - My eyes feel dry
  - My lips feel dry
  - The inside of my nose feels dry

- MacEntee, Michael I. (2011-06-09). Oral Healthcare and the Frail Elder: A Clinical Perspective (Kindle Locations 2147-2158). Wiley. Kindle Edition.

Reduced salivary flow as a result of disease:

- Sjögren's syndrome
- Systemic Lupus Erythematosus
- GvHD
- Irradiation

+ *as a result of medications*


Measurements made simple

Visually inspect minor gland secretion:
a. Hydration (Low/Normal)

Measure unstimulated whole saliva (UWS)
a. Flow (ml/min)
b. pH

Measure stimulated whole saliva (SWS)
a. Flow (ml/min)
b. pH

Medicine cups
+

Hydrion pH test paper

Digital scale with TARE function

How to help with oral dryness?

Cochrane Review (2011)
Thirty-six randomized controlled trials involving 1597 participants met the inclusion criteria

Oxygenated glycerol tri-ester (OGT) (oxygenated oil) saliva substitute spray shows *evidence of effectiveness* compared to an electrolyte spray, which corresponds to approx. a mean difference of 2 points on a 10-point visual analogue scale (VAS) for mouth dryness.

http://www.aquoral.com/

Summary
Aging changes in the Oral Cavity

- *Enamel* is stable, but prone to demineralization at the gingival margin and proximal
- Biological changes for women at menopause are drastic. Loss of 25% of *bone mass* (750g/3000g), men loose less (450g/4000g). This loss of bone mass is esp. evident in the mandible.
- *Gingiva and PDL*: Decreased barrier function, more prone to gingivitis, slower collagen turn-over, chronic inflammation.
- Loss of *sensory input* from nerve endings and mechanoreceptors
- Flattening of the *circadian rhythm* reduces protein synthesis in oral mucosa and salivary glands
- *Menopause* affects oral mucosa and salivary glands to a yet not fully known extent.
  - Women no longer have active estrogen circulating in plasma. Instead dependent on local conversion of DHEA into bioactive estrogens and androgens for tissue metabolism.
- Lower secretion of *Aldosterone* affects salivary gland striated ducts and result in a lesser uptake of NaCl from saliva.
- Loss of *stem cell* activity: In salivary glands a 20-40% decrease in number of acinar cells (serous and mucous) with aging.
- *Salivary glands*:
  - Reduced flow rate with aging, decreased levels of mucins, histatins; increased oral dryness which is accompanied by decreased levels of antimicrobials
- Accelerated oral aging as a result of *medications*: Anti-cholinergic, beta-blockers, Ca^{2+} antagonists, diuretics
- Cochrane review: Only an oxygenated oil was effective in reducing oral dryness; 2 points on a 10-points visual analogue scale
  - AQUORAL

How can we prevent the effects of decreased flow/impaired salivary gland function?

♡

Carpenter (2013)

Caries and Preventive Care in the Elderly

Tooth lesions in the elderly

- 1. Root caries
  - Fast progression; easy to overlook during caries registration
    - Crown margins or Subgingival
  - RMGI (will take up and release NaF from fluoride varnish/rinse); very sensitive to moisture
  - Amalgam (Ag is toxic for bacteria)

- 2. Dental erosion and NCCL
  - GERD
  - Diet
    - High erosive potential: Citrus fruits, Apples, Cranberries and Grapes
    - Medium erosive potential: Colas, Vinegar, White and red wine
    - Low erosive potential: Beer, carbonated water (Bartlett, 2007)
  - Tooth brushing habits

- 3. Deep enamel/dentin caries lesions
  - Step-wise excavation
    - Condense CaOH paste ; LC'd CaOH liner; Temporary filling; Wait 3 months
  - Indirect overcapping/Direct overcapping
    - Condense CaOH paste; LC'd CaOH liner; Permanent filling
  - Debridement is covered in Apple Health (and RCT for anterior teeth)

1. Root caries in Elderly

- Elderly are more at risk for root caries due to
  - Dentures
    - Plaque retention
  - Lack of dexterity
    - Electric toothbrushes when necessary
  - Diet: Shift from complex to simple sugars
  - Poor oral hygiene (loss of sensitivity)
  - Decreased SubM/SubL salivary flow (un-stimulated; 0.16 mL/min)

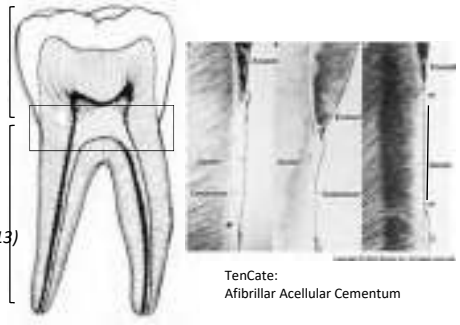
Root caries is the major source of tooth loss in older adults!

Tooth loss is the most significant oral health-related negative variable of quality of life for elderly!

Gati and Vieira, 2011; Bardow et al., 2005; de Guillory et al., 2013

1. Root caries in Elderly

- 50% of older adult over 65 y/75 y have root caries
  - Patients who have lived in fluoridated areas throughout most of their lives have a lower prevalence of root caries (Center for Disease Control and Prevention, 1992)
- Demineralization
  - Enamel: pH 5.2
  - *Cementum: pH 6.7*
    - *(T. Donovan, CDE course: Worn dentition, 2013)*



TenCate:
Afibrillar Acellular Cementum

Poor Oral Hygiene

- Gingival recession exposes root surfaces
- Presence of *Str Mutans*, *Lactobacilli* and *Actinomyces* are increased in root caries patients (Preza et al., 2008)

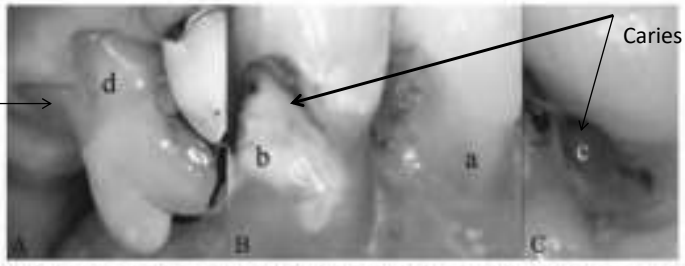


FIG. 1. (A) Control subject. d, plaque, healthy root. (B and C) HC subject. (B) a, plaque, healthy root; b, plaque, carious root. (C) c, dentin,

2. Non-Caries Cervical Lesions due to Dental erosion
DENTIN FORMATION (Sclerotic dentin)

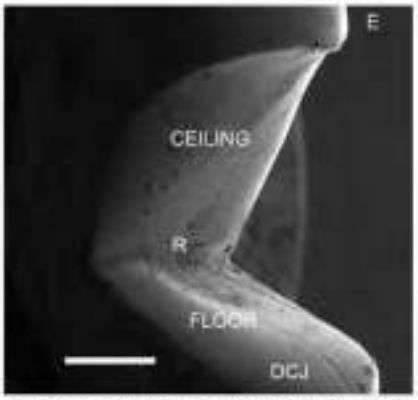


Fig 2. A mandibular central incisor with a fluted wedge-shaped cervical lesion. The enamel edge (E) overhangs the ceiling dentine which makes a right angle junction (R) with the floor. The floor is featureless dentine down to the rolled edge of the dentine-cementum junction (DCJ) (bar = 1 mm).

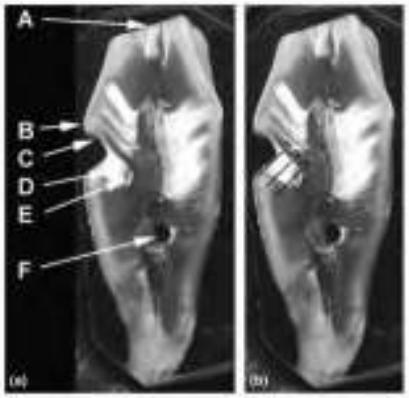
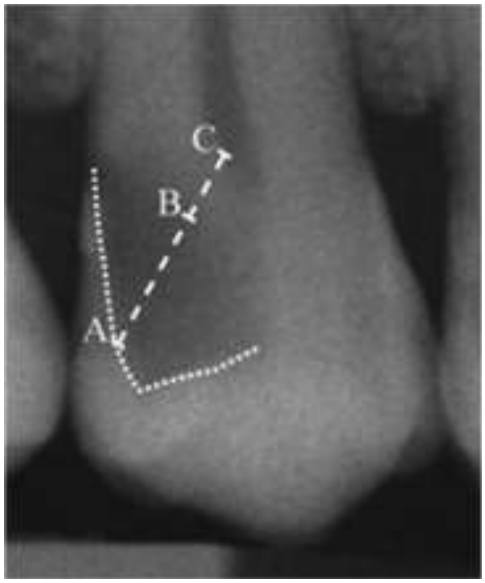


Fig 3. (a) A longitudinal ground section of the incisor shown in Fig 2. Red dye has penetrated patent tubules from within the tooth. (A) Attrition wear facet with underlying tract of white tubules. (B) Thinned facial enamel edge overhanging the lesion. (C) Ceiling of the lesion, a tract of white tubules follows the path of primary curvature of dentinal tubules. (D) Tract of sclerotic tubules extending from the lesion floor to the pulp. (E) Reparative dentine. (F) Hole drilled for dye penetration. (b) Oblique transverse sections. Level 1: the horizontal floor of the wedge-shaped lesion. Level 2: between the floor of the lesion and the pulp. Level 3: through reparative dentine.

Daley et al., 2009

3. Deep caries lesions leading to step-wise excavations



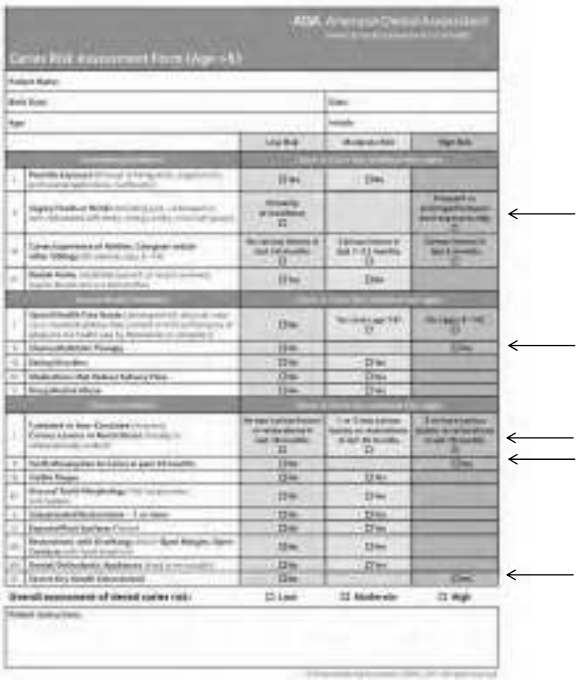
I. Stepwise excavations result in fewer pulp exposures (17.5%) compared with direct complete excavations (28.9%).

II. At 1 yr follow-up, stepwise excavations had a higher success rate (74.1%) compared to direct complete excavation (62.4%)

Consider using a self-etching bonding system, ie. no need to etch w/ 37% Phosphoric acid, and no need to rinse following etching.

Bjorndal et al. (2010): Treatment of deep caries lesions in adults: Randomized clinical trials comparing stepwise vs. direct complete excavation; and direct pulp capping vs. partial pulpotomy

ADA:
Caries
Assessment
Form



Chronic disease

Accelerated aging changes

Americans die from Chronic disease

• About half of all adults—117 million people—have one or more chronic health conditions.

• One of four adults has two or more chronic health conditions

• 1.7 million Americans die from a chronic disease each year, this accounts for 7 out of 10 deaths in the United States.

• Five chronic diseases: Heart disease, Cancer, Stroke, Chronic Obstructive Pulmonary Disease (COPD), and Diabetes account for *more than 2/3 of all deaths in the US*.

• The average 75-year-old suffers from 3 chronic conditions and takes 5 prescription medications.

*Health conditions and Drugs marked with * affects Dental Treatment and Oral Health*

Chronic Health Conditions	*Top generic drugs 2014:*	*The five most Common drugs for elderly:*
1. Arthritis*	1. Hydrocodon	1. Lipitor*
2. Hypertension*	2. Lisinopril*	2. Novasc*
3. Heart disease*	3. Levothyroxine*	3. Fosamax*
4. Any cancer*	4. Atorvastatin*	4. Prilosec*
5. Diabetes*	5. Amlopidine*	5. Celebrex*

Source: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

Hypertension ~ 70%

Source: http://www.bodymad.com

Senior Center clinic patient

- 1st visit (March, 2014)
  - M73
  - Extremely scared (anxiety/panic) for dental treatments; "crossed nerves"
  - Needs full mouth extraction for CD/CD
  - HBP - BP: 165/92, pulse 102
  - **3 Problems**
    - **1. Patient is extremely scared**
    - **2. Needs full mouth extraction**
    - **3. Blood pressure is much to high too accommodate 1 and 2**

Hypertension

Usual recommendation is no elective procedure if BP is over 160/100 (= Stage 2 Hypertension)

If BP is between 160/100 and 180/110 dental procedures could still be carried out, if BP is not accompanied with symptoms of severe hypertension: Headache, shortness of breath, nosebleeds, severe anxiety.

However, there are no recognized or published criteria, based on absolute BP levels, to indicate when the urgent dental care should proceed (Muzyka & Glick, 1997; Glick, 1998; Aubertin, 2004; Herman, Konzelman, & Prisant, 2004).

Ira B. Lamster;Mary E. Northridge. Improving Oral Health for the Elderly: An Interdisciplinary Approach (p. 162). Kindle Edition.

Local Anesthesia

- **2% Lidocaine 1:100,000 EPI**
  - Lidocaine is a natural vasodilator
- **4% Prilocaine (Citanest Forte) 1:200,000 EPI**
- **4% Articaine (Septocaine) 1:200,000 EPI**
- **3% Mepivacaine (Carbocaine) plain**

Senior Center clinic patient

- 1st visit (March, 2014)
  - M73
    - Accompanied by daughter
  - Extremely scared (anxiety/panic) for dental extractions; "crossed nerves"
  - Needs full mouth extraction for CD/CD
  - HBP - BP: 165/92, pulse 102

Premedication with Xanax (Alprazolam; Benzodiazepine)
0.5 mg the night before
0.5 mg in the morning of the procedure
2 x 0.5 mg 1 hr before procedure

- 2nd visit (April, 2014)
  - BP 117/90, pulse 102
  - 7 teeth extracted (Maxilla)
  - 4.0 mL 4% Citanest Forte 1:200,000

Diabetes ~ 30%

Source: http://theubpost.mn

Dental treatment of Diabetic patients

- The well-controlled diabetic can usually be managed conventionally to include most surgical procedures. Maintenance of a normal postsurgical diet is important.
  - *Patients may require reduction of insulin dose immediately prior to oral surgical procedures that will result in reduced calorie oral intake so as to prevent unintended hypoglycemia.*
- Marginally or poorly controlled diabetics should be treated with caution.
  - Elective dental treatment should be avoided until the patient is stabilized.
- Patients should be encouraged to maintain *excellent oral hygiene and comply with recall appointments*.
  - Usually low salivary flow, with decreased levels of calcium, phosphate and fluoride. If dental caries is a potential problem, use 1.1% NaF toothpaste and/or gels and ACP-containing products. Xerostomia should be managed on a case-by-case basis.

S: 70cm presents for Caries Susceptibility Test (Saliva Testing) and EXT Root Tip #30

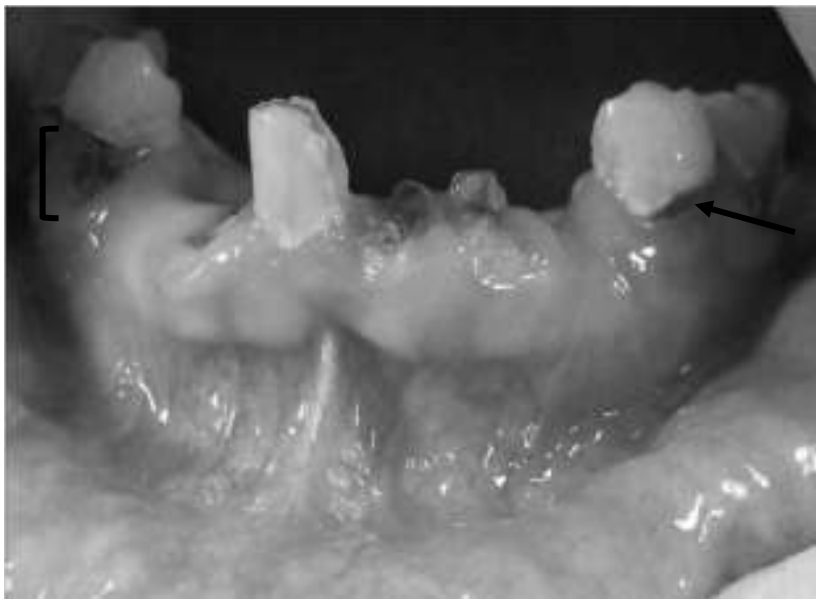
PMH: Diabetes, High Cholesterol, Overactive Bladder
Meds: Lipitor, Metformin, Toviaz

O: BP: 137/67. Pulse 65.

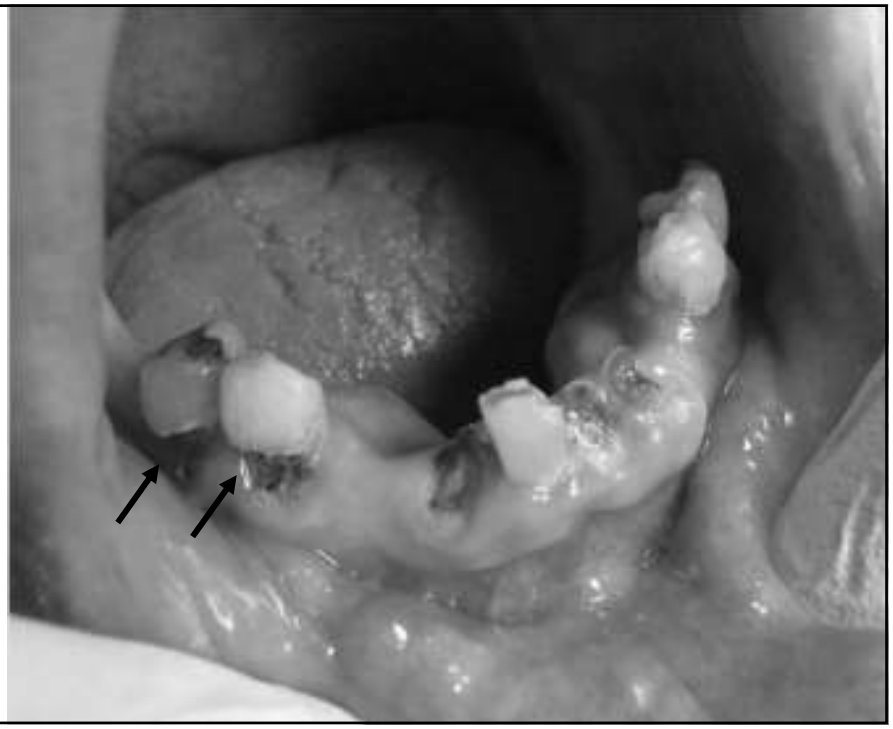
A: Low end Unstimulated and Stimulated Flow Rate. Positive S. Mutans.
#17MO - Defective Restoration - Place MO Amalgam
#29 - Class III Mobility - Evaluate - Likely EXT
#30 - Root Tip - EXT

P: Saliva Testing and Caries Susceptibility Test:
- Unstimulated Flow Rate: 0.2ml/min (1ml/5min)
- Unstimulated pH: 6.6
- Stimulated Flow Rate: 0.7ml/min (3.5ml/5min)
- Stimulated pH: 7.2
- Buffer (stimulated): Normal/High
- S.mutans Test: Positive

Recommendations: 1) Drink Lots of Water (>1.7L/day). 2) Chew Sugar-Free Gum, 3) 4-day Diet Diary 4) Brush 3x Daily 5) Chlorhexidine Rinse



Root caries



Oral mucosal changes in Diabetic patients

Tongue is smooth and fissured
Keratinized epithelium has lost its keratinization

Migratory glossitis

"Atraumatic" extractions

- Luxators
  - Periotome-like "knife"
  - If at all possible, avoid surgical extractions
  - Use of Luxator for extractions

Senior Center Geriatric Dental Clinic
Diabetic patients

- **Caries**
  - Root caries
  - ACP-containing toothpaste (Arm & Hammer: Enamel strengthening toothpaste, Enamelon)
  - Preventive home care: 5,000 ppm NaF gel or toothpaste (Rx), Xylitol gums
  - Professional application: NaF varnish (22,500 ppm)
  - DIET – Refer to Senior Services Dietician
- **Mucosa**
  - Migratory glossitis
- **Periodontitis**
  - 1 – 2 months recall
  - 0.12% Chlorhexidine gluconate rinse (may cause excessive formation of calculus and discoloration)
  - Electric toothbrush
  - Interproximal brushes
- **Extractions**
  - Slow healing
  - Need antibiotics following extractions
  - If root canal treated, roots "crumble"
  - Use of luxators to avoid surgical flap (due to poor healing)
  - Schedule procedures in the morning following a normal meal!

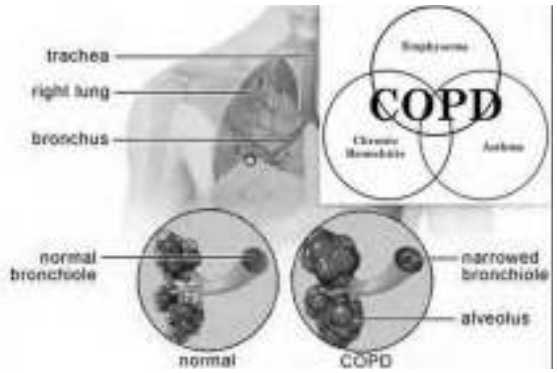
GERD
~ 10%

Source: http://images.agoramedia.com

Dental Treatment of patients with GERD

- Promote adequate saliva production
- Dental erosion with possible thermal sensitivity occurs in many individuals. There is a strong association between GERD and dental erosion.
- Use remineralization protocols such as
  - Fluoride varnish or gels
    - Gels containing 0.4% Stannous fluoride: Enamelon (OTC)
    - High NaF toothpaste 1.1% Sodium fluoride (Rx)
  - Toothpaste containing extra Calcium
- Encourage diet changes

COPD
~ 10%

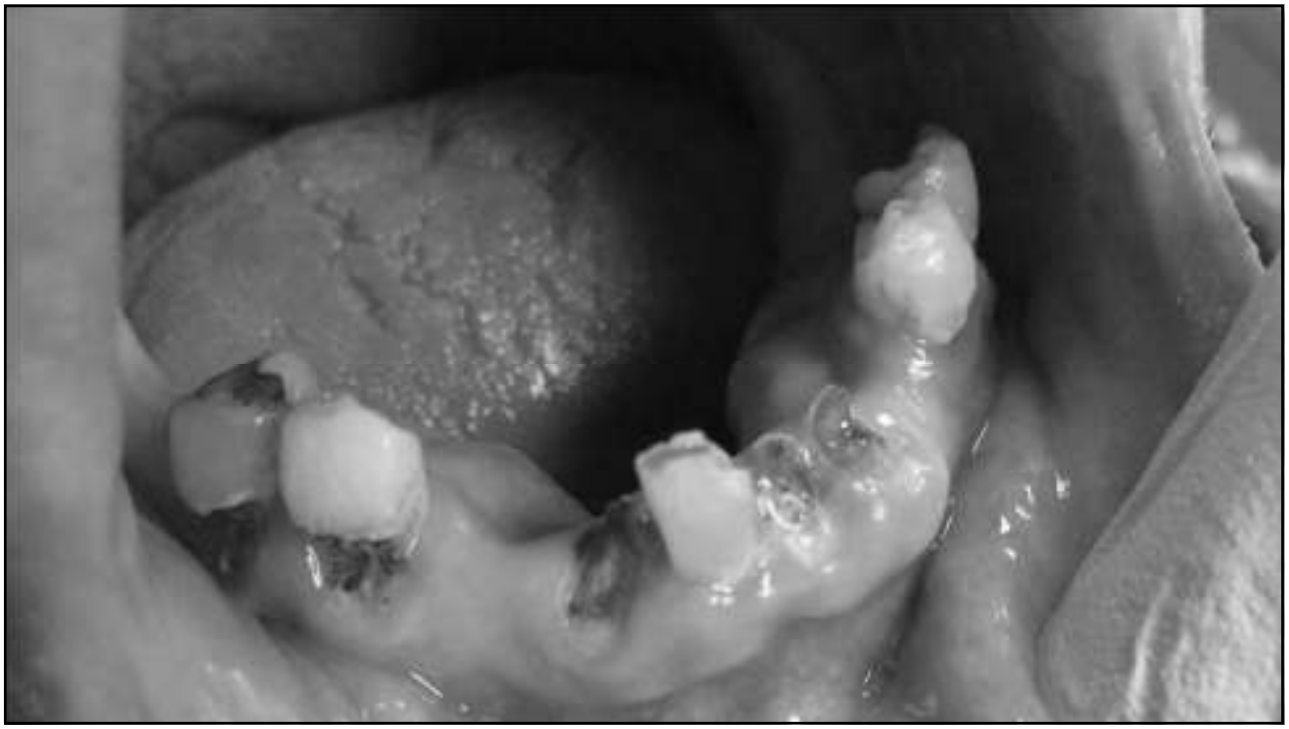


Source: https://s-media-cache-ak0.pinimg.com

1. Establish contact with patients physician
2. Patients should be treated in a semisupine or upright position
3. Limit epinephrine if significant cardiovascular disease is present. (Avoid bilateral mandibular or palatal blocks – may cause unpleasant airway constriction in some patients).
4. Stress reduction including use of low-dose oral lorazepam (Ativan ®) or nitrous oxide delivered at an overall rate of 3 L/ min can be used with caution in anxious patients.
5. Ask patient to bring oxygen tank to clinic if supplemental oxygen is needed (less than 95%), low flow rates of 2– 3 L/ min should be used. Use Pulse oximeter during appointment.
6. If patient displays shortness of breath, a productive cough, upper respiratory infection, or oxygen saturation below 91% - Reschedule patient.

Key questions to ask the patient's physician

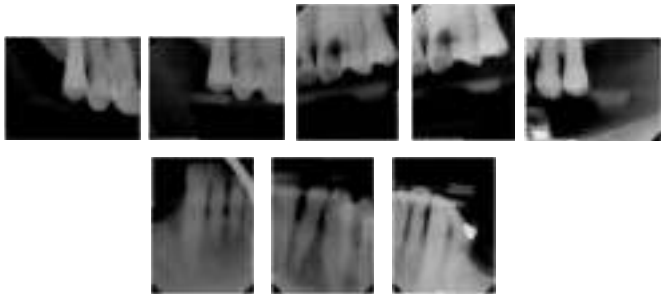
1. Is the patient on home oxygen therapy?
2. Is the patient's COPD stable?
3. What is the patient's baseline oxygen saturation level (on pulse oximeter) on room air or on supplemental oxygen?
4. Does the patient have frequent bacterial infections?
5. Does the patient have hypertension or heart failure?



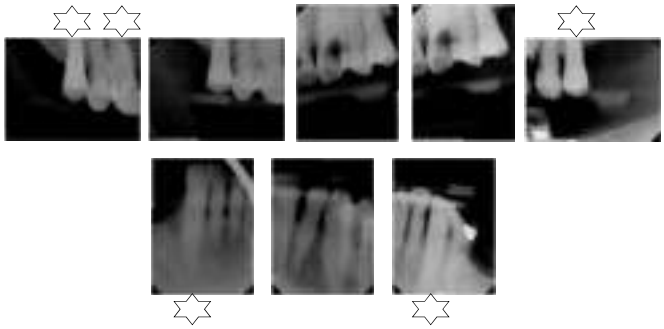
M78
OSCAR: Oral tissues, Capability (Self-care), Autonomy

- EM presents to Senior Center clinic in December 2014
- Is bringing brand new ICD/ICD with him
  - Denturist-made
  - Has just paid $1,700 for his dentures
- CC: Wants full mouth extractions
  - Does not want to be bothered by his teeth any longer
  - Doesn't know if he has made the right decision
- *Dental observation: Lower ridge, non-tooth supported, is resorbed*

EM (M78)



EM (M78)



ICD turned into RPD

Do not extract teeth that can be saved by simple restorative treatment!

Update Sept, 2016

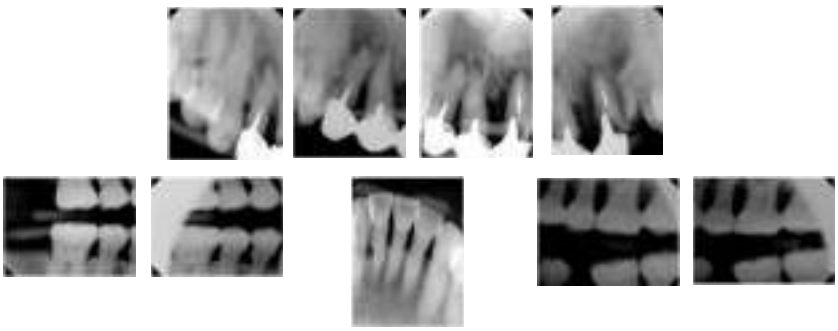
- We continuously see EM, approx. every 3-6 months for Adult prophylaxis and NaF varnish
- Relined RPD/RPD with Coe-Soft (~ 6 months)
- Next, we will reline with Tokuyama Rebase II (in clinic hard reline material).

MHC (F62)
OSCAR: Oral, Reality - Financial

- MHC presents to the Senior Center clinic in November 2013
- CC: Her front bridge is failing, #9 and #10 has fractured, bridge is very loose.
- She was terrified to loose her appearance
- We extracted the root tip
- Cemented the bridge back using RelyX (lasted for approx. 6 month)

MHC (F62)

November 2013



MHC

Treat Abscesses
Treat Soft tissue lesions

Teach Preventive care

Extraction of non-restorable teeth

Treat Gingivitis/Periodontitis
Excavation of deep caries lesions

Re-evaluation

Permanent restorations

Re-evaluation

Crowns/bridges/RPD/CD

Treat PARL

Extraction of non-restorable teeth

Treat Gingivitis/Periodontitis

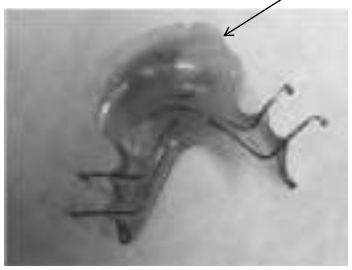
MHC (F62)

- MHC presents to the Senior Center clinic in November 2013
- CC: Her front bridge is failing, #10 has fractured, bridge is very loose.
- She was terrified to loose her appearance
- We extracted #9 and #10
- Re-cemented the bridge (#10 hanging pontic) using RelyX (lasted for approx. 6 month)

MHC (F62)

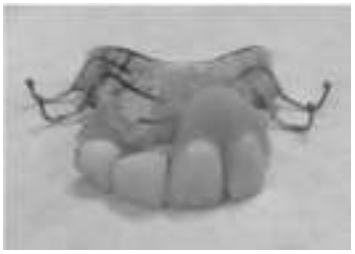
- She said she had a tRPD to replace the fractured #10 – it had been given to her previously. She did not like it and didn't want to use it.
- After the bridge came loose again, she finally agreed to let me use the tRPD and to have the abutment teeth extracted.

MHC (F62)



Previously inserted #10

I inserted #7, #8 and #9 using our hard reline material Tokuyama rebase II



Soft reline of tRPD using CoeSoft

Update Sept 2016

- *I have needed to re-insert the front anterior denture teeth and we have adjusted the soft reline to fully cover her gingiva*
- *She has been part of the Dental Hygiene clinic this Spring*
  - *I have waited for her bone to heal following extractions*
- *Re-evaluate her dentition (#15 has furcation involvement)*
  - *Due to Endo/Perio communication, #4 has needed antibiotic treatment and pulpectomy*
- *We now have funding for RPD/RPD*

VH (F97)

OSCAR: Autonomy, Capability, Reality (Life Span)

- VH presents in Faculty Practice for oral pain and difficulties chewing
- CD/CD

- Pain: Raspberry red oral mucosa and raspberry red smooth tongue, Keratinized denture wound due to overextended dentures
    - Rx: Nystatin ointment and solution (continue 2 weeks after symptoms disappear)
    - Tx: Adjusted flanges
    - Rx: Following check-up visit, I prescribed 0.12% Chx rinse (Sat/Sun)
- Difficulties chewing: Food trapped underneath denture
    - Tx: Soft reline using CoeSoft
    - NV: Hard reline in 6 months

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Update Sept 2016

- VP has been in hospice
- Her health returned, and she is now in assisted living
- She is using 0.12% Chlorhexidine gluconate rinse every day
- Time for a new check up, and exchange of the soft reline (Coe-Soft)

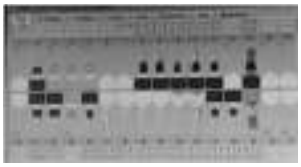
TJ (M66)
OSCAR: Oral Tissues, Systemic, Capability, Reality



TJ has been our patient at the Senior Center Geriatric Clinic since 2013. His hypertension has previously been out of control (200/100), and we have occasionally needed to refuse dental care. His BP is now under control. He has received preventive care, restorative care and extractions of non-restorable teeth. He does not priorities his home care, and is now in a situation where all teeth are non-restorable.
Last visit: August 2016
Vital signs: BP: 111/72, P:98
Medications: Metoprolol, Metformin, Hydrochlorothiazide
Diagnosis: Generalized chronic periodontitis, Rampant caries, Xerostomia

He does not have any means to pay for dental care. What would you do?

MP (F93)
OSCAR: Oral Tissues, Autonomy, Reality

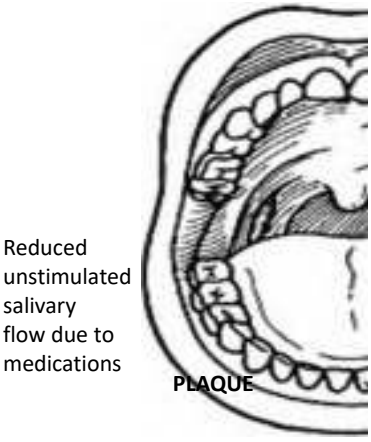


- MP is very conscious about her appearance, and came to the Senior Center Clinic due to a failing bridge, #7 - #2. She did not want to be without front teeth, and did not want to leave the house when the bridge came loose.
- We cemented the failing bridge temporarily 2x with RelyX before we found a way to finance a tRPD.



Summary

- Keep as many natural teeth as possible
  - Better masticatory function with fixed prosthetics (crown/bridge) compared to RPD or CDs
- Re-evaluate the initial treatment before start of more definitive dental care
- Remember OSCAR when you treatment plan!
  - *O – Oral tissues: Status of oral tissues*
  - *S – Systemic: Medical diagnoses, IP communication, Medications*
  - *C – Capability to self-care, oral hygiene, transportation to appointments*
  - *A – Autonomy, Decision-making ability, Co-dependence*
  - *R – Reality: Prioritization of oral care, financial ability, life-span*



Preventive Care

Reduced unstimulated salivary flow due to medications

"Acidic Saliva"

Dietary
Acidic Foods

Simple Sugars

Bone loss

Exposed root surfaces

STRATEGIES

1. ***Strengthen enamel and root cement/dentin*** w/
   a. NaF (Toothpaste, rinse, varnish, SDF)
   b. Aid in remineralization with Ca^{2+}-containing toothpaste and/or cream, if low salivary flow
2. ***Compensate for loss of saliva***
   a. Drink water
   b. Lubricate oral mucosa
3. ***Compensate for low pH of saliva (or loss of buffer capacity)***
   a. Alkalize water with baking soda, avoid carbonated drinks
   b. Brush with baking soda-containing toothpaste (Arm & Hammer)
   c. Change of diet to foods with a more neutral pH
4. ***Reduce glucose intake***
   a. Instead use Xylitol (Sorbitol)
5. ***Reduce bacterial growth***
   a. Antimicrobial rinse, 0.12% Chlorhexidine gluconate (or brush teeth and tongue with Chx)
   b. Chx varnish

1. Strengthen enamel and root cement/dentin

- Sodium Fluoride
- ACP

EVIDENCE
NaF

- In erupted teeth, fluoride is known to reduce caries in three ways:
  - 1. Inhibiting bacterial metabolism of fermentable carbohydrates;
  - 2. Enhancing re-mineralization by incorporation of available fluoride into the tooth structure during acid attacks;
  - 3. Reducing the tooth's solubility during subsequent acid attacks.

EBD: Gibson, G et al., 2011

EVIDENCE
NaF toothpaste

- 1100 ppm (Every day toothpaste ~ 1100 ppm)
  - An RCT involving 810 adults aged 54+ years reported that a dentifrice containing 1100 ppm F reduces ***coronal caries by 41%*** and ***root caries by 67%*** when compared with a non-fluoride dentifrice

- **5,000 ppm (ex. Prevident gel or paste)**
  - A recent RCT demonstrated that ***57% of adults*** with one or more root caries lesions who had, for 6 months, used a dentifrice/gel containing 5000 ppm F had reversal of root caries compared with 29% of those who had used a dentifrice containing 1100 ppm F.

Increase of 500 ppm NaF --- a further 6 – 7% reduction in caries (in young people)

EBD: Davies, 2004

EVIDENCE
Daily rinse with 0.05% NaF

- RCT, 164 adults, aged 60+ years living in a non-fluoridated area. They were all supplied with toothpaste containing 1500 ppm F; one group was requested to rinse twice a day with 10 ml of a 0.05% NaF solution in addition to brushing.
- *After **2 years** the caries increments were 0.3 (coronal) and 0.4 (root)* in the test group compared with 1.0 and 1.4, respectively, in the control.
- *They also reported that 67% of those in the rinsing group developed no new carious lesions compared with 16% in the control.*
- RCT, individuals aged 60+ years living in a fluoridated area, focus: root caries lesions
- Over a period of ***4 years*** one group used a 0.05% NaF rinse once a day whilst the control used a placebo rinse
- *The increment in root caries after 4 years was 0.26 in the fluoride rinse group compared with 0.91 in the control. The fluoride rinse group also had significantly more reversals (1.53) than the control group (1.11).*

EBD: Davies, 2004; Gibson, G et al., 2011

EVIDENCE
NaF Gels – irradiated patients

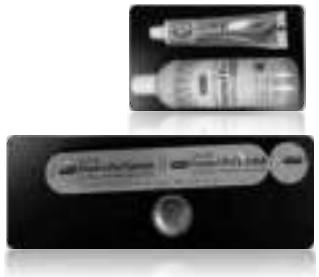
- A study by Spaak et al. involved subjects following head and neck radiation therapy, which is a high risk population
- 5,000 ppm NaF gel (as in Prevident gel) was sufficient to *inhibit caries almost completely* in *compliant* xerostomic patients that had an unstimulated salivary flow rate of <0.1 mL/min

EBD: Davies, 2004; Gibson, G et al., 2011

Amorphous calcium phosphate (ACP)

ACP

- Normally saliva is supersaturated with Calcium and phosphate
- Xerostomia patients (many diabetic patients and patients on HBP medication) and patients who have undergone head and neck radiation therapy
  - Calcium phosphate-based remineralization systems commercially available
    - 1. Amorphous Calcium Phosphate stabilized by a Casein phosphopeptide (CPP-ACP): *Recaldent (Australia*); Trident Xtra Care chewing gum; line of preventive care products
      - Slowing progression of enamel caries
    - 2. unstabilized Amorphous Calcium Phosphate (ACP, science supported by ADA, US); *Enamelon*; Arm&Hammer's *Complete care Enamel strengthening toothpaste*; Premier Dental line of preventive care products
      - Preventive effect on root caries
    - 3. Bioactive glass containing Calcium Sodium Phospho silicate (NovaMin)
      - No published studies supporting remineralization
- Recommended as preventive therapy for root caries in dry mouth patients



EC Reynolds (2008): Calcium phosphate-based remineralization systems: Scientific evidence?
Papas et al.(1999 and 2008): Double blind study and Clinical trial; See website

MI Paste

PREVENTION OF ROOT CARIES IN OLDER ADULTS: A SUMMARY

Table 4. Recommendations for Clinicians for use of root caries preventive agents or combination of agents in vulnerable elderly.

Preventing root caries

1° Prevention				
Agents or combination of agents [a,b]	EFFECTIVENESS in Preventing Root Caries	FEASIBILITY for use in Vulnerable Elderly	Current Cautions	Overall Rating
38% SDF solution [c] Annually	72% ↓ vs placebo for 1° root caries	Very High- professionally applied annually	only 1 study on root caries[1]	BEST CHOICE for 1° prevention
→ ACP toothpaste + 230 ppm NaF rinse[d] Daily	98% ↓ vs NaF toothpaste + NaF rinse combination	requires daily use by patient	only 1 study	best alternative if no professional application possible

Tan et al. (2010): 200 elderly followed over 3 yrs.

Three groups:	SDF	NaF varnish	Chx varnish
Reduction in root caries:	71%	64%	57%

ACP toothpastes: ex. Arm & Hammer: Complete care + Enamel Strengthening, approx. $4
Walmart Generic NaF rinse 0.05%, approx. $3

Gluzman et al., 2013

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1° Prevention				
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38% SDF solution [ref] Annually	72% ↓ vs placebo for 1° root caries	Very High: professionally applied annually	only 1 study on root caries*	BEST CHOICE for 1° prevention
ACP toothpaste + 250 ppm NaF rinse** Daily	98% ↓ vs NaF toothpaste + NaF rinse combination	requires daily use by patient	only 1 study	best alternative if no professional application possible
2° Prevention				
Agents or/and their combinations [ref]	EFFECTIVENESS in Preventing Root Caries	FEASIBILITY for use in Vulnerable Elderly	Current Cautions	Overall Rating
22,500 ppm NaF varnish [refs] Every 3 mo with or without NaF rinse or toothpaste	~78% arrested	Moderately High: professionally applied at 1–3 mo	none	BEST CHOICE for 2° prevention
4,500–5,000 ppm NaF toothpaste/gel [refs] Daily	~64% arrested	requires daily use by patient	none	best alternative if no professional application possible

Arresting root caries

Gluzman et al., 2013

2. Compensate for loss of saliva

- Drink water
- Lubricate oral mucosa

pH of (bottled) Water

Seattle water sources: Analysis of Cedar and Tolt's water supply, May 24, 2011: pH 7.75 – 8.64, Target is 8.2

Two different Biotene products

- "Green"
  - OLD FORMULATION
  - pH: 5.2
  - Purified water, propylene glycol, xylitol, hydrogenated starch hydrolysate, poloxamer 407, hydroxyethylcellulose, sodium benzoate, flavor (peppermint oil), benzoic acid, disodium phosphate, zinc gluconate, lactoferrin, lysozyme, lactoperoxidase, potassium thiocyanate, aloe vera, calcium lactate, glucose oxidase.
  - Enzyme System: Lysozyme, Lactoferrin, Lactoperoxidase

- "Blue"
  - NEW FORMULATION
  - pH: 7
  - Water, Glycerin, Xylitol, Sorbitol, Propylene Glycol, Poloxamer 407, Sodium Benzoate, Hydroxyethylcellulose, Methyparaben, Propylparaben, Flavor, Sodium Phosphate, Disodium Phosphate

Saliva substitutes w/ "workable" pH

• Biotene	pH	5.15 (Note that enamel demineralizes below pH 5.2, and root surfaces below 6.7)
• Saliveze spray (UK)	pH	6.88 (Aqueous solution of electrolytes)
• Artisial (FR)	pH	6.66 (Carboxymethylcellulose and electrolytes)
• Oralube (AU/NZ)	pH	6.89 (Carboxymethylcellulose and electrolytes)

- *Cochrane Review (2011) Thirty-six randomized controlled trials involving 1597 participants met the inclusion criteria*
  - Oxygenated glycerol triester (OGT) (oxygenated oil) saliva substitute spray shows evidence of effectiveness compared to an electrolyte spray, which corresponds to approx. a mean difference of 2 points on a 10-point visual analogue scale (VAS) for mouth dryness.
  - *Aquoral: 2 sprays PO TID/QID PRN* (launched Oct 15, 2014 by pharmaceutical company in San Antonio, TX; Made in France)
  - Chewing gum: Xylitol (Sorbitol)-containing (No evidence that gum is more or less effective than saliva substitutes)

Kielbassa et al., 2000; Smith et al., 2001; Furness et al., 2011 (Cochrane database for systemic reviews)

3. Compensate for loss of pH (and buffer capacity)

- Alkalize water and use baking soda-containing toothpaste
- Diet

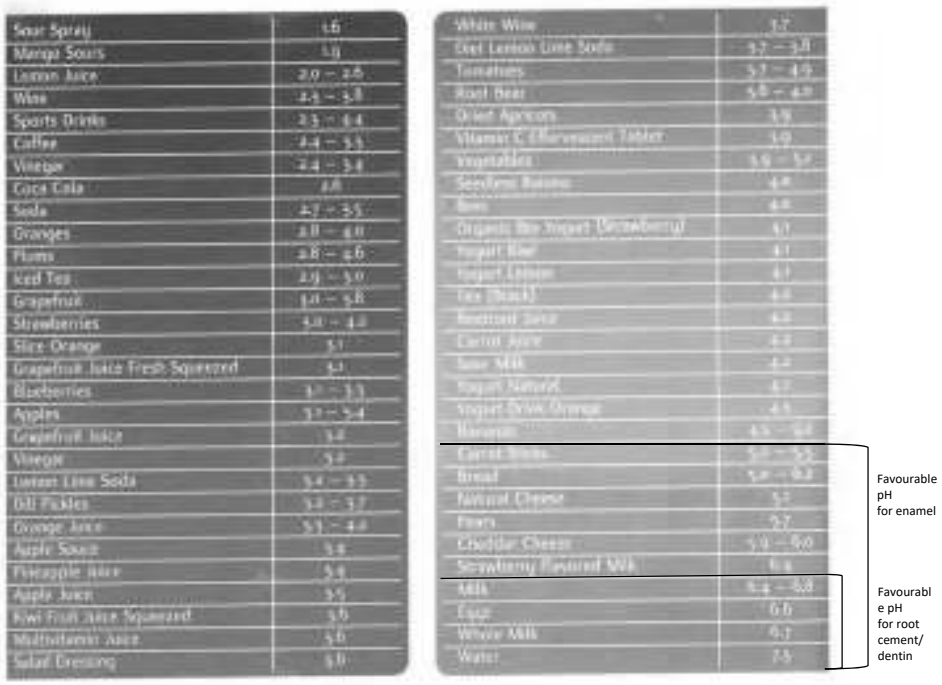
Alkalize

- Alkalize water with baking soda
  - pH: 9
  - 2 tsp in 1 glass of water

- Use toothpaste containing baking soda
  - pH: 8
  - Arm & Hammer

Diet

- Frequency of sugar intake, ie. sweetened snacks
- Chewy and sticky foods
  - Dried fruits
  - Candy
  - Sweet rice
- Sour (combination of sweet and sour)
  - Vinegar
- Individuals with root caries eat a greater number of meals/day, and have higher sugar intake
  - Higher lactobacilli counts (Dentocult LB)
  - Lower salivary buffering capacity (GC Saliva check BUFFER)
  - Higher amounts of Str. Mutans in saliva (GC Saliva check MUTANS)



Low acidity foods – High acidity foods

pH above 6

- Asparagus
- Broccoli
- Clams
- Corn
- Kale
- Milk
- Peas
- Shrimp
- Avocado
- Chicken
- Crabmeat
- Hominy
- Lentils
- Mushrooms
- Rice
- Tea

pH below 6

- Most fruits and vegetables:
  - Carrots
  - Beans
- Potatoes
- Most meats

Source: www.pickyourown.org/ph_of_foods.htm

4. Xylitol

Xylitol

Chewing gums and mints are ADA approved

- Lozengers have caries preventive effect on root surfaces (Ritter et al., 2013)
  - OraMoist (1.5 gm Xylitol/mint)
  - **Ice Breakers FROST (0.31 gm Xylitol/mint) = Grocery stores**

- Xylitol containing chewing gum 5x daily x 5 min
  - **Ice Breakers Ice Cubes (1.15 gm Xylitol/gum)= Grocery stores**
  - Epic (1.06 gm Xylitol/gum)
  - Need 5 – 10g daily to be effective in reducing Str. Mutans levels

5. Reduce bacterial growth

Chlorhexidine

- 0.12% Chlorhexidine gluconate (Rx in US; OTC in Europe – 2% solution, 1% gel)

- Potent antiseptic antibacterial agent
  - Destabilizes bacterial membranes
    - Outer membrane ruptured
    - Inner membrane's functionality breached
  - Inhibits oxygen utilization of bacteria
  - Inhibits outgrowth of bacterial spores
- If possible, swish 15 mL (.5 fluid once) CHX for at least 30 sec (1 minute), OR
- Brush both gums and tongue with CHX solution for 1 minute 2x daily

EVIDENCE
Chlorhexidine

- Mouth rinses, containing either 0.12 or 0.2% Chlorhexidine digluconate, are very effective in reducing plaque and improving gingival health. Their effectiveness, either as an adjunct to mechanical oral hygiene procedures or when used alone, has been extensively documented in RCTs but, in most instances, their long-term use is precluded by the development of extrinsic tooth stain.

- "Non-staining" protocols:
  - Rinsing 1 week /month
  - Rinsing every other week
  - Rinsing every weekend (Saturday and Sunday)

- *Caries reducing effect in high-caries-risk patients, but not in low-caries-risk.*
- *SLS in tooth paste inactivates Chlorhexidine – 30 min to 120 min betw/ applications*
- *Combine with Sodium fluoride; Monofluorophosphate (MFP) precipitates Chlorhexidine and renders its useless*

EBD: Davies, 2004; Walls and Meurman, 2012

Base prophylaxis

- Removal of soft plaque (biofilm):
  - Tooth brushing (2x or 3x daily)
    - Battery/Electric driven tooth brush with a small round brushing head
  - Interproximal cleaning
    - Flossing
    - Interproximal brushes
    - Soft picks

EVIDENCE
Toothbrushes

- A recent Cochrane Review (Type 1) concluded, following a systematic review of 29 studies involving 2547 participants, that *powered toothbrushes with a rotation-oscillation action are more effective than manual brushes*.

- Toothbrushes with this mode of action reduced *plaque by 7%* and *gingival bleeding by 17%* when compared with manual brushes.

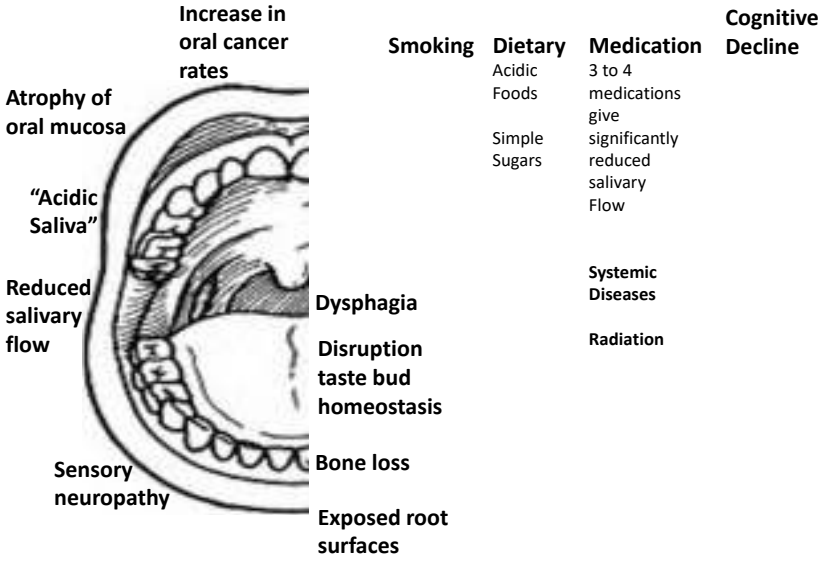
EBD: Davies, 2004

Dietary Interventions

Dietary interventions –Teeth for life

- *LOW IN SODIUM* - Hypertensive patients
- *LOW ACIDITY* - Patients with GERD
- *HIGH IN CALCIUM AND VITAMIN D* - Women following Menopause
- *LOW RISK FOR DEVELOPING CANCERs – Adventists Health Study - 2*

- Caries active patients
  - *LOW IN FERMENTABLE CARBS, LOW ACIDITY* - Patients with High Caries risk
  - *LOW ACIDITY* - Patients with Root surface caries
  - *LOW ACIDITY* - Patients with Hypersensitive teeth
  - *HYDRATION, LOW ACIDITY* - Patients experiencing a Dry mouth



The Tokyo Metropolitan Institute of Gerontology Index of Competence

- Instrumental self-maintenance (0-5 points)
  - Can you use public transportation by yourself?
  - Are you able to shop for daily necessities?
  - Are you able to prepare meals by yourself?
  - Are you able to pay bills?
  - Can you handle your own banking?
- Intellectual activity (0-4 points)
  - Are you able to fill out forms for you pension?
  - Do you read newspapers?
  - Do you read books or magazines?
  - Are you interested in news stories or programs dealing with health?
- Social role (0-4 points)
  - Do you visit the homes of friends?
  - Are you sometimes called on for advice?
  - Are you able to visit sick friends?
  - Do you sometimes initiate conversations with young people?

Total points possible: 13

Moriya et al. (2013)

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Moriya et al. (2013)

An overall score of 11 points or less OR an intellectual activity score of 3 or less was significantly related to poor oral health behaviours:

1. Lack of regular visits to a dentist
2. Not using extra cleaning devices

Increase in oral cancer rates

Atrophy of oral mucosa

"Acidic Saliva"

Reduced salivary flow

Sensory neuropathy

Dysphagia

Disruption taste bud homeostasis

Bone loss

Exposed root surfaces

Smoking

Dietary
Acidic Foods

Simple Sugars

Medication
3 to 4 medications give significantly reduced salivary Flow

Systemic Diseases

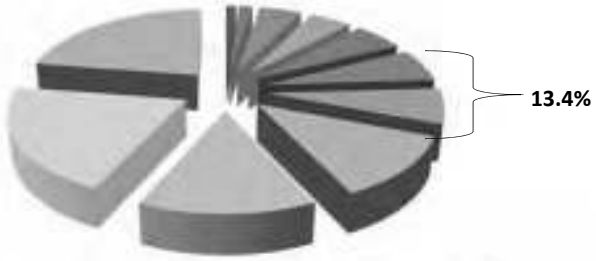
Radiation

Cognitive Decline
No dental visits

Not using extra cleaning devices

Nursing home dentistry improving quality of life

Motives for dental consultations in a palliative care unit



- Halitosis (1.1%)
- Chewing difficulties (1.5%)
- Denture missing (4.7%)
- Oral hygiene (4.7%)
- Not specified (5.5%)
- Lack of denture retention (6.5%)
- Denture reline and repair (6.9%)
- Problem with natural teeth (12%)
- Check-up visit (13.8%)
- Denture fabrication (20.7%)
- Pain/toothache (22.5%)

After Schimmel et al. (2008)

Dementia

- 10 to 20% of Americans over 65 show mild to moderate mental impairment
- 17.9% of American over 65 are severely dement
  - Of these, 70% show pathological findings consistent with AD (12.5%)
- Approx. 30% of Americans over 80 show significant dementia

Does dementia and type of newly diagnosed dementia influence caries prevalence?

	Coronal and root surface caries (DS)	**Root surface caries (DS)**	
No dementia	2.7	1.7	
Dementia	7.0	2.3	
Alzheimer's dementia	7.8	4.9	

The prevalence of caries was related to both the type of dementia and to severity of cognitive decline.

A linkage between cognitive decline and oral health.

Ellefsen et al., 2008

Barriers?

- Are the barriers to good oral hygiene in nursing homes within the care-givers or the patients?
- Dementia is one of the toughest barriers! Main focus is plaque control.

Development of instrument to support oral care in dement nursing home patient.

Oral B toothbrush + Extra tubing to supply mouthwash

Pace and McCullough (2010); Sumi et al. (2003)

Learning to Speak Alzheimer's

- Early
  - Not remembering appointments
  - Not recognizing familiar faces
  - **Losing track of time**
  - **Not storing recent information**
  - Getting lost
  - **Having difficulties finding words**
  - Misplacing needed items
- Middle Early
  - Being unable to make decisions
  - Finding it hard to concentrate
  - Acting paranoid
  - Being unable to separate fact from fiction
  - Being unable to translate thoughts into actions
  - Misunderstanding what is being said
  - Making mistakes in judgment
- Late Early
  - Withdrawing, being frustrated and/or angry
  - Losing ability to sequence tasks
  - Speaking in rambling sentences
  - Misusing familiar words
  - Having difficulty writing
  - **Requiring supervision for ADL**
  - Reacting less quickly

- *Since both Dementia and Alzheimer's dementia has a downward course*
- *- Major dental procedures needed should be undertaken in the early stages of the disease*

By Joanne Koenig Coste

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  - Misusing familiar words
  - Having difficulty writing
  - **Requiring supervision for ADL**
  - Reacting less quickly
- Early Middle
  - Loosing fine motor skills (buttoning a shirt)
  - **Not recognizing objects for what they are**
  - **Being unable to understand written words**
- Middle Middle
  - Repetitious speech and action
  - Having hallucinations and delusions
  - Altered visual perception
  - Frequent changes of emotions
  - Minimal attention span
  - Overreacting, having outbursts
  - **Assistance with all ADL**
- Late Middle
  - Incontinent
  - Unable to separate or recognize sounds
- Late or Final
  - Losing all language
  - Losing gross motor skills (sitting, walking)
  - Having swallowing difficulties
  - Needing total care

By Joanne Koenig Coste

Oral health concerns increase with severity of Dementia

Severity of Dementia →

- ***Use of dentures***

+ Denture-related oral mucosal lesions
+ Plaque accumulation
+ Prevalence of coronal and root caries
+ Decayed root tips

Changes in composition of biofilm?


• Plaque ***accumulation*** may be due to:
Less control of muscular activity/Less muscular activity (Facial muscles)
Difficulty swallowing (Dysphagia)
Loss of sensitivity (Sensory neuropathy)
Unable to brush teeth (Inability to perform ADL)

• Association between poor oral hygiene and respiratory disease, such as aspiration pneumonia

• Aspiration pneumonia occur when oropharyngeal secretions are directed into the trachea and subsequently into the lungs. Results in either bi- or unilateral pneumonia.

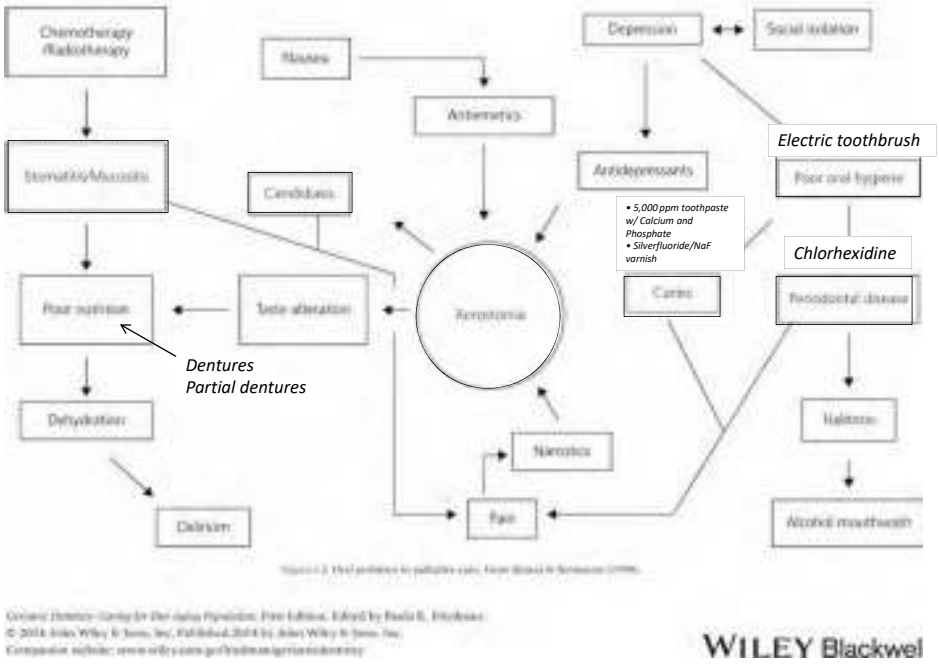
Aspiration Pneumonia is the leading cause of death in Nursing home residents.
10% of deaths may be prevented by increased oral hygiene

Indicators for aspiration

INDICATORS	**SIGNIFICANCE**
Repeated coughing or clearing of the throat	Insensitive reflex or weak muscles
Choking, cyanosis or teary eyes	Respiratory distress
Constant swallows during a meal	Residue from food or liquid in the mouth or throat
Change in respiration	Inhaling food
Gurgling voice	Food liquid (incl. saliva) in the larynx
Food pocketing in the mouth	Reduced awareness of food in the mouth
Food stuck in the throat after swallowing	Food in the pharynx
Drink or food from the nose	The soft palate is incompetent
Missing teeth or poorly fitting dentures	Food is inadequately chewed and moistened

Dysphagia

- Poor nutritional status
  - Weight loss
  - Leads to dehydration
- Drooling, choking, and coughing after drinking fluids or eating
  - Signs of dental plaque and residues of food around the mouth
- Dehydration disturbs swallowing and nutrition intake and increases dependency on others for eating
  - 30 mL of fluid/kg body weight to maintain hydration and good health.
  - A 55 kg (121 lbs) person need to consume ~ 1,680 ml of fluid per day (1,7 L)
  - Tea, coffee and alcohol all have diuretic effects



Two different patient scenarios, showing treatment of AD patients

- *F76, AD for 10 years*
  - Unable to walk or to feed herself
  - Non-verbal, non-responsive (to words)
  - Cared for by her husband
- *F98, AD Recent memory changes – F100, AD Middle stage*
  - Walks every day
  - Daughter has responsibility for her care (does not want care to be costly)
  - Last seen by a dentist in Oral Medicine in 2010

Lisa(F76)

- S: Lisa and her husband David presents for a problem-focused exam. A previous dentist has recommended full mouth extraction. L has fractured restorations, but L seems not to be in obvious pain. Last cleaning 3 yrs ago.
- O: Medical
  - Diabetes
  - BP well controlled
  - AD was diagnosed in late 2005, about 10 yrs ago. Advanced AD: non-responsive, non-verbal
  - Drug allergy: Sulfa, Opiates/Codeine

Patient moved her head when Pano was taken. Multiple radiographic lesions notes: #2, #13, #19, #31 (From Radiology)

Lisa (F76)

- P: Limited exam, problem-focused. I was able to open L's mouth and to brush her teeth with 0.12% Chx without any difficulties. She has been to the dentist frequently in the past, and her motor reflexes are still intact. She reacts well to movements in her mouth, and opening reflexes are functioning.
- Discussed the need for extractions with her husband. A full mouth extraction at this point seems to be doing more harm than good. L is still eating and chewing, and a full mouth extraction would put her into a situation that she has not known in the past, which would not serve her well in terms of reflexes and cooping with the extractions. I could not notice that any probing that I did was painful for her.
- NV: Regular cleanings with Dr. Jeffrey
- Rx: 0.12% Chx solution for antimicrobial cleaning of gums and teeth 1-2x daily.

Sara (F98): February, 2014

- S:
  - Sara presents for a new patient comprehensive exam. She has walked to the clinic together with her caregiver. Started review of health history. Sara was last seen by us in 2010.
- O:
  - Sara has AD, and presently hypotension (102/50) and is needing additional help with ADL. Daughter will help complete health history form. Care giver was unaware that Sara has a tRPD, and she needs additional help with her oral hygiene.
  - EO and IO exam. Oral mucosa and tongue – wnl. Oral cancer screen – wnl.
  - Radiographic findings:
    - Primary caries: #2M, #5M, #8D, #9M, #13D, #14MFD, #15M, #28M, #30MBD – not deemed restorable, #31M;
    - Fractured teeth: #3, #4

Sara (F98): February, 2014

- P:
  - EO and IO exam. Heavy plaque and calculus throughout. Brushed teeth with Chx solution to facilitate visibility. #3 and #4 are fractured to gum-line and needs extraction.
  - Recommended OralB electric toothbrush, and to rinse and brush with 0.12% Chx solution 2x daily, every other week. Recommended use of Xylitol gum and mints as additional help to keep teeth clean. Also not to wear "flipper" over-night; clean with Polident/Soap and water.
- NV: Tx plan:
  - 1. SRP 4 quadrants with dental hygienist – to reduce bacterial load
  - 2. #8 and #9 Composite restorations – to see how Sara responds to dental treatment.
  - 3. Further restorative needs and necessary extractions

Sara (F100): May, 2016

- May, 2016: Sara presents for limited exam. #13 fractured to gumline.
  - IO: General soft plaque interproximal. High plaque levels. General supra- and sub-gingival calculus. Removed upper tRPD, which had build-up of plaque on the palatal side. Pink attached gingiva in hard palate, and normal keratinization on dorsal part of tongue. General root caries lesions on all exposed root surfaces.
  - Tooth mobility: Unremarkable
  - Tooth percussion: Unremarkable
  - Tooth and root palpation: Unremarkable
  - Adviced caregiver to ask Sara to brush 3x daily (after each meal), and to brush with Chx at night. To minimize intake of sugar, and substitute with Xylitol, and less cookies.
  - Sara was able to handle tx well until she felt some discomfort, then she started to be negative, and she said no to taking x-rays.
  - NV: Use vaseline for lips. Show Sara the prophy cup before we start. Use Oraquix as LA for scaling. I used the hygroform suction and cotton rolls. We also said to talk as little as possible.

Sara (100): Aug, 2016

- Aug 2016:
  - Gave Sara a head pillow. Applied vaseline to lips. Started by polishing her lower teeth with Colgate Sensitive. Continued by applying Oraquix to premolars and molars. Interproximal and buccal scaling. Huge blocks of semihard/hard calculus removed. Applied Oraquix to incisors and continued scaling. Rinsed with water to removed debris. At this point Sara said that she had enough. Was able to finish by polishing her teeth one more time with Colgate sensitive. Cleaned her tRPD.
  - NV: Treat Sara in a room with a door, so that we do not disturb other patients.

Summary

- If patients are non-cooperative, there is not much that the dentist can do. The dentist need to work through a person that they trust, being present in the operatory during the appointments. A good way is to teach the caregiver how to care for the dental needs of the patient.
- Rinses or brushing with 0.12% Chlorhexidine gluconate, either 1 daily or every other day, will help prevent aspiration pneumonia, and keep the gums from bleeding.
- To prevent caries, brush with Prevident 5,000 ppm toothpaste (Rx)
- 38% SDF applications and/or NaF varnish are also good treatments that the patient might find easy to tolerate, and also regular cleanings.
- Try to keep the diet as free from sugar and really soft foods as much as possible.
- AD patients usually have a very short treatment window, ca 30 mins or less, before they have had enough and walk away.
- For more advanced dentistry, need to use General anesthesia. This may be a very stressful experience for the patient. Most important is their home care and the relationship the dentist can build with the patients caregiver.