Caries management symposium

Caries risk assessment

When
17 November 2018

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Caries risk assessment

Laurence J. Walsh  AO
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Not a simple task

- Not one, but multiple pathogens
- Complex aetiology, with episodic progression
- Holistic assessment includes
  - Past disease history
  - Site factors (tooth and oral cavity, plaque dysbiosis, salivary defence, lesion distribution)
  - Patient biological factors (genetics, medical Hx)
  - Lifestyle factors, family environment food selection
  - SES, social disadvantage, community F

MANAGEMENT FLOWCHART
• Disease occurs in micro-bursts
• Caries risk can change suddenly
• Caries risk is never zero, only low

Figure 1: Illustration depicting the micro biochemical events occurring on the tooth-biofilm interface over time. (a) The mineral loss and gain balanced and lesion not visible (b) The mineral loss and gain not balanced and lesion is visible as white spot.

Dental caries: A complete changeover (Part II) - Changeover in the diagnosis and prognosis
Usaha Carounanidy, R Sathyanarayanan

Identify risk of disease

- Use of fluoridated toothpaste (no > yes)
- Poor oral hygiene and plaque control
- Personal behaviour e.g. smoking
- Systemic diseases and polypharmacy: high number of medical problems
- High number of previous and/or poorly designed restorations
- Irregular maintenance appointments, including denture maintenance
- High frequency consumption of carbohydrates, sugary foods and drinks
- Frequent intake of sugary acidic soft drinks and juices
- Thickened diet at nursing homes
- Salivary gland hypofunction* or Xerostomia*
- Residential status (homebound > independent)
Caries risk assessment & Mx approaches

- Malmo, Sweden
  - Cariogram (Douglas Bratthall, U Malmo)
- California, USA
  - CAMBRA (John Featherstone UCSF)
- USA AAPD
  - CAT (Caries Assessment Tool)
- Europe
  - ICDAS / ICCMS (Nigel Pitts, Dundee); Dundee Caries Risk Assessment Model (DCRAM)
- Australia
  - CMS Caries Management System (Evans and Dennison: USyd)
  - TLM Traffic Light Matrix (H Ngo & LJW: Adl & UQ)
  - STEM (UQ)

Mike Williams (GC) 2001

A SYSTEM FOR TOTAL ENVIRONMENTAL MANAGEMENT (STEM) OF THE ORAL CAVITY, AND ITS APPLICATION TO DENTAL CARIES CONTROL.

LAURENCE J. WALSH

Abstract

The STEM approach is based on the ability to measure, manipulate and monitor key physical, ionic and microbial aspects of the oral environment, in order to reduce the risk for oral disease. While applicable to a range of orodental diseases, this paper focuses on the STEM approach for dental caries, which includes the following components: a structured interview; structured clinical assessment; systematic personalized advice regarding home care; targeted regeneration or incipient lesions; hard tissue repair; and recall and monitoring. The clinical step-by-step implementation of the STEM process is described, with reference to supporting literature. Two cases which illustrate the application of the STEM approach are presented: a teenager undergoing orthodontic treatment, and an older adult with permanent salivary dysfunction.

Walsh LJ. Internat Dent 2008
### Structured interview
- Structured clinical assessment
- Systematic personalized advice regarding home care
- Targeted regeneration
- Hard tissue repair
- Recall and monitoring

### Physical
- Flow of saliva at rest
- Stimulated salivary flow (oral clearance)
- Lubrication from salivary mucins
- Temperature
- Blood flow

### Ionic
- pH
- Ions for buffering (predominantly bicarbonate)
- Ions for remineralization (predominantly calcium, phosphate, fluoride)

### Microbial
- Redox potential
- Composition of the salivary microflora
- Composition of dental plaque biofilms at individual sites
- Synergistic interactions between species
- Bacteriocins and inhibitory interactions

### Saliva factors
- Prescription medicines
- OTC medicines
- Illicit drugs
- Negative fluid balance
- Smoking
- Diseases (HIV, Hepatitis C)
- Autoimmune diseases

### Plaque factors
- Irregular oral hygiene
- High substrate frequency
- Grazing pattern of eating
- Acid exposure
- Acquisition of cariogenic microorganisms
- Low fluoride exposure

### AAPD C.A.T.

**Guideline on Caries-risk Assessment and Management for Infants, Children, and Adolescents**

Each instrument has been found to have limitations, particularly in the prediction of the high risk individual residing in a low caries community.

Most studies conclude that past caries experience is still the most reliable predictor of future caries experience in children and that a clinician’s intuition or ‘gut feeling’ is often more accurate than current diagnostic technologies.
Nobody is perfect!
Low sensitivity, high specificity:  \textit{as with caries}$Dx$

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{sensitivity specificity graph}
\caption{Individual clinician’s sensitivity.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{sensitivity specificity graph}
\caption{Individual clinician’s specificity.}
\end{figure}
Are standardized caries risk assessment models effective in assessing actual caries status and future caries increment? A systematic review

Maria Grazia Cagetti, Giuliana Bonitò, Fabio Cocco, Peter Lingstrom, Laura Strohmeier and Guglielmo Campus

BMC Oral Health 2018 18:123

Results: One thousand three-undred ninety-two papers were identified and 32 were included. In all but one, the Cariogram was used as sole model or in conjunction with other models. All the papers on children (n = 16) and adults (n = 12) found a statistically significant association between the risk levels and the actual caries status and/or the future caries increment. Nineteen papers, all using the Cariogram except one, were classified as being of good quality. Three of four papers comprising children and adults found a positive association. For seven of the included papers, Cariogram specificity and specificity were calculated; sensitivity ranged from low (41.0) to fairly low (75.0), while specificity was higher, ranging from 65.8 to 88.0. Wide 95% confidence intervals for both parameters were found, indicating that the reliability of the model differed in different caries risk levels.

Conclusions: The scientific evidence relating to standardized CRA models is still limited; even if Cariogram was tested in children and adults in few studies of good quality, no sufficient evidence is available to affirm the method is effective in caries assessment and prediction. New options of diagnosis, prognosis and therapy are now available to dentists but the validity of standardized CRA models still remains limited.

How to do better - Look beyond the teeth

Factors involved in caries development. Adapted from Selwitz, oral, and Palo (2015), with permission from Elsevier.
Patterns of past disease


<table>
<thead>
<tr>
<th>Severity zone</th>
<th>Definition (surfaces involved)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Proximal surfaces of mandibular anterior teeth (excluding distal surfaces of cuspids)</td>
</tr>
<tr>
<td>4</td>
<td>Labial surfaces of maxillary and mandibular incisors and cuspids (excluding those of maxillary cuspids)</td>
</tr>
<tr>
<td>3</td>
<td>Proximal surfaces of maxillary anterior teeth (excluding distal surfaces of cuspids)</td>
</tr>
<tr>
<td>2</td>
<td>Proximal surfaces of molars (including distal surfaces of cuspids)</td>
</tr>
<tr>
<td>1</td>
<td>Pit and fissure surfaces of posterior teeth and labial surfaces of maxillary cuspids</td>
</tr>
<tr>
<td>0</td>
<td>None of the above</td>
</tr>
</tbody>
</table>

Rapid breakdown of the dentition: the last survivors?
Site distribution is informative of:

- Plaque dysbiosis in local micro-environments
- Substrate access
- Oxygen tension
- Salivary defence
- Shear force of fluids
- Effects of appliances and prostheses

Missed disease according to the methods used and the threshold applied
Diagnostic performance of existing methods varies widely.

Traditional methods often have high specificity but low sensitivity and miss early forms of the disease.

More sensitive methods find greater prevalence of disease (Fluorescence, DiFOTI, ECM, OCT, etc).

DMF index vs. ICDAS/ICCMS.
Is the lesion active?

<table>
<thead>
<tr>
<th>Enamel</th>
<th>Visual</th>
<th>Tactile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>The lesion is whitish/yellowish; the lesion is chalky (lack of luster); the lesion can be cavitated or not</td>
<td>The lesion feels rough to probing; probing might or might not find cavity</td>
</tr>
<tr>
<td>Arrested</td>
<td>The lesion is more yellowish/brownish than whitish; the lesion is more shiny than matte; the lesion cannot be cavitated or not</td>
<td>The lesion feels more smooth than rough; probing might or might not find a cavity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coronal dentine</th>
<th>Visual</th>
<th>Tactile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>The lesion may manifest itself as a shadow below the intact but demineralized enamel; if a cavity extends into the dentine, the dentine appears yellowish/brownish</td>
<td>Dentine soft to probing</td>
</tr>
<tr>
<td>Arrested</td>
<td>The lesion may manifest itself as a shadow below the intact but demineralized enamel; if a cavity extends into the dentine, the dentine appears brownish</td>
<td>Harder than at the active lesion but not as hard as sound dentine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Root dentine</th>
<th>Visual</th>
<th>Tactile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>Yellowish/brownish</td>
<td>Soft/leathery</td>
</tr>
<tr>
<td>Arrested</td>
<td>Brownish/blackish</td>
<td>Harder but not as hard as sound root dentine</td>
</tr>
</tbody>
</table>
Patient lifestyle risk factors

- Fermentable CHO
- Between meals
- Consistency and retentiveness
- Acid exposure frequency

Sugars include:
- Intrinsic sugars incorporated within the structure of intact fruit and vegetables
- Sugars from milk (lactose)

Free sugars are added to foods and beverages by the manufacturer, cook or consumer, and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates. They refer to all:

- Monosaccharides: One sugar molecule
  - Fructose, Glucose, Galactose
- Disaccharides: Two sugar molecules
  - Sucrose, Table Sugar

Avoid consuming more than:

- **Teenagers & adults:** 60g per day
- **Pre-school & young children:** 30g per day
- **All ages:** 4x per day

Increases rate of dental caries in teenagers and adults

Increases rate of dental caries in pre-school and young children

A practical guide to reduce sugars consumption and curb the epidemic of dental caries
How reliable are traditional diet charts?

A 3-day diet chart

<table>
<thead>
<tr>
<th>Time</th>
<th>Item/quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Before breakfast</td>
<td></td>
</tr>
<tr>
<td>Breakfast</td>
<td></td>
</tr>
<tr>
<td>Before lunch</td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>Evening</td>
<td></td>
</tr>
<tr>
<td>Before dinner</td>
<td></td>
</tr>
<tr>
<td>Dinner</td>
<td></td>
</tr>
<tr>
<td>After dinner</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Indicator (risk factor, condition, adverse outcome) | Latest |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults (19+) consuming too much sugar</td>
<td>47.8%</td>
</tr>
<tr>
<td>Children (9-13 years) consuming too much sugars</td>
<td>70.3%</td>
</tr>
<tr>
<td>Young people (14-18 years) consuming too much sugars</td>
<td>73.1%</td>
</tr>
</tbody>
</table>

Without sugars, dental caries does not occur.
How pathogenic is the dental plaque biofilm?

- MS as a keystone pathogens (GTF role)
- Multiple other species involved
- *Ecological change: Acidic pH provides selective pressure; causes biofilm dysbiosis and reduced diversity*
- Co-aggregation of MS with *Candida albicans*

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**Instructions**

Over a period of **four full days** (which must include one weekend), you should write down the details of all foods, drinks, sweets or candies, chewing gums, medicines, etc, that you place in your mouth. You must write down the date and time, name and quantity of the food or drink, etc, **as accurately as possible.** If you do not know the name of the food or drink then give a brief description.

<table>
<thead>
<tr>
<th>Time</th>
<th>Name of food, drink, etc</th>
<th>Date:</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 am</td>
<td>Toast with banana</td>
<td></td>
<td>2 slices, 1 banana</td>
</tr>
<tr>
<td>11:00 am</td>
<td>Vita-Soy drink</td>
<td></td>
<td>1 bottle</td>
</tr>
<tr>
<td>11:00 am</td>
<td>Egg tart</td>
<td></td>
<td>2 pieces</td>
</tr>
<tr>
<td>11:55 am</td>
<td>Coca-Cola drink</td>
<td></td>
<td>1 can</td>
</tr>
</tbody>
</table>

oral diagnosis and treatment planning: part 2. Dental caries and assessment of risk

K. Yip and R. Smale

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*Clinical example of a 55 year old patient who in the past year had noticed a sudden increase in caries incidence. Deposits of plaque can be seen on the cervical aspect of most teeth.*

Walsh 2006
Multiple bacteria as well as fungi

- Mannoproteins (mannans) in the outer cell wall of Candida will bind to S. mutans in the presence of sucrose.
- GftB enzyme secreted by S mutans, synthesizes glue-like polymers (glucans).
- Candida promotes this process, resulting in a sticky biofilm that allows yeast to adhere to teeth and bind to S mutans.

DENTAL PLAQUE FERMENTATION AND ITS ROLE IN CARIES RISK ASSESSMENT


LAURENCE J. WALSH

Key words: Dental plaque, fermentation, cariology
Short title: Dental plaque fermentation

Abstract
In contemporary dental practice, the role of dental plaque fermentation in the dental caries disease process is well understood, but difficult to assay for and to demonstrate to patients as an educational and motivational tool. This paper provides an overview of the current concepts of dental plaque fermentation with reference to the health/unhealthy biofilm concept of dental plaque. It explains the basis for chairside tests for plaque fermentation, and identifies measures which can be targeted to address production of harmful organic acids by dental plaque.

Walsh 2007
Plaque pathogenicity varies by site

Teenage patient undergoing fixed orthodontic treatment. The patient has been struggling with oral hygiene. Fermentation testing indicates a high level of acid production from the plaque biofilm when exposed to fermentable carbohydrate (causing a red colour in the pH indicator; compare to the control indicator (rear) which shows green, indicating pH 7.0).

Walsh 2007

Plaque pathogenicity can be changed

Steps in using plaque biofilm diagnostics

1. Explain to the patient what the test can show and how it is done
2. Conduct the test
3. Show the patient the results
4. Explain what the results mean
5. Record the results
6. Give practical advice and lifestyle counselling
7. Follow-up with a repeat of the test at the next visit
8. Recognize and reward compliance

Figure 4: A plaque sample taken from the labial aspect of the left maxillary canine tooth (tooth 23) shows a pH drop to less than 5 at 5 minutes when challenged with sucrose, demonstrating the highly acidogenic nature of the plaque. The inset (upper right) shows plaque sampled from the same area 2 weeks after following a home care program which included lifestyle changes.
Red = Rose Bengal  
Blue = Acid Fast Green  
Substrate = sucrose

New plaque
When a plaque biofilm is sparse, the blue pigment is easily washed off.

Old plaque (>48hrs)
When a plaque biofilm has matured, its structure is dense, so both the blue and red pigments are trapped.

Extra high risk plaque
The sucrose in GC Ti Plaque ID Gel will be metabolised by any acidogenic bacteria within the plaque biofilm. The resulting acid produced lowers the plaque pH (<pH 4.5) and this makes the red pigment disappear.

Contemporary Clinical Dentistry

Efficacy of three-tone disclosing agent as an adjunct in caries risk assessment
Mangala Javalthi, Manayantanta Shik gemacht, Venumathy Nava Reddy, Anur Elanov, Rakesh Sathesh, and Phoomma Vasiyakumar

Tabatatee et al. 2016
Is there value in plaque analysis?

• The addition of plaque microbiological testing to ICDAS caries scoring system seemed to significantly enhance the statistical power of the final predictive model for caries risk for preschool children at the d(3) level of lesion detection after four years. This had a sensitivity of 65% and specificity of 69%.

Salivary properties and their influence

CLINICAL ASPECTS OF SALIVARY BIOLOGY FOR THE DENTAL CLINICIAN

International Dentistry 2007;2(3):16-30

LAURENCE J. WALSH

Introduction

Saliva performs a multiplicity of roles within the oral cavity, and like many things in life, its importance is usually not appreciated until it is absent. Impairment of salivary parameters is commonly not recognized by clinicians (Walsh, 2000). Patients may present with a range of signs and symptoms which may be due to an underlying deficit in saliva production at rest. Reductions in salivary production during eating are much more apparent in terms of symptoms, and this generally brings it more to the patient’s attention. In contrast, deficits in the stimulated salivary flow rate to the prevention of dental caries and dental erosion can be also explained by improved clearance of substrate due to more rapid movement of the salivary film, and, in the case of dental caries, greater activity of salivary antimicrobial mechanisms.

Reductions in the quantity of salivary secretions or changes in the properties of saliva are responsible for a host of related oral and dental problems which impact directly upon quality of life. These include:
- difficulties in eating and speaking

A clinical protocol for systematic patient assessment

1. Listen to symptoms
   - Oral dryness during the waking hours
   - Oral dryness on waking
   - Lack of lubrication during eating, talking or swallowing
   - Salivary web formation during swallowing
   - Altered taste perception
   - Impaired retention of full upper dentures
   - Impaired lubrication of lower dentures
   - Mucosal irritation from foods and dental home care products
   - Other potentially related complaints such as halitosis

2. Listen to the history
   - Duration and severity of symptoms
   - Known exacerbating and relieving factors
   - Medical conditions associated with salivary dysfunction
   - Other medical conditions
   - Prescribed medications
   - “Over the counter” medications
   - Past medical treatments
   - Past dental treatment
   - Use of home care products

3. Listen to the patient's lifestyle
   - Patterns of fluid intake
   - Dietary patterns for fermentable carbohydrates
   - Preferred snacking patterns
   - Intake of caffeine
   - Intake of alcohol
   - Intake of acidic foods and drinks
   - Intake of nicotine
   - Intake of illicit substances
   - Patient's occupation
   - Patient's recreational habits
   - Major stressful events in the patient's life

4. Look for Signs
   - Soft tissue changes
     - Dryness of the vermilion border of the lip
     - Dryness of the oral mucosa
     - Loss of filiform papillae of the tongue
     - Crisping and fissuring of the tongue
     - Increased plaque formation on the tongue
     - Related mucosal pathology such as oral candidal infections
     - Absence of saliva in response to gland palpation
   - Hard tissue changes
     - Increased caries rate (particularly cervical caries)
     - Increased rate of non-carious loss of tooth structure by dental erosion
     - Multiple teeth with cervical dentinal hypersensitivity from dental erosion
     - Failure to form supragingival calculus from plaque in the lower incisor region
     - Increased plaque accumulation on the teeth and appliances

Measure Parameters

Salivary resting flow
- Visually assess lower lip labial gland secretion
- Assess resting salivary volume in the oral cavity (pooling)
- Inspect salivary viscosity (frothy, bubbly, sticky)
- Measure resting salivary pH using pH paper or pH meter (N.B. It is important to bear in mind the influence of factors which can affect the resting flow rate, such as position (sitting or supine), proximity to meals/eating, time of day (diurnal variation, medication intake), anxiety level, smoking, and recent physical activity)

Stimulated salivary flow
- Estimate flow rate by volume collected over a defined period
- Measure stimulated salivary pH using pH paper or pH meter
- Determine buffer capacity using challenge strips with weak acids
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

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.

<table>
<thead>
<tr>
<th>pH</th>
<th>5.0</th>
<th>5.2</th>
<th>5.4</th>
<th>5.6</th>
<th>5.8</th>
<th>Highly acidic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6.0</td>
<td>6.2</td>
<td>6.4</td>
<td>6.6</td>
<td></td>
<td>Moderately acidic</td>
</tr>
<tr>
<td></td>
<td>6.8</td>
<td>7.0</td>
<td>7.2</td>
<td>7.4</td>
<td>7.6</td>
<td>7.8</td>
</tr>
</tbody>
</table>

II. TESTING OF STIMULATED SALIVA

TEST 4 – Saliva quantity
Instruct the patient to chew the piece of wax to stimulate salivary flow. After 30 seconds, let the patient expectorate into the spittoon. Continue chewing for a further 5 minutes, collecting all the saliva into the collection cup at regular intervals.
The quantity of saliva can be measured by checking the mL markings on the side of the cup.
Quantity of saliva at 5 minutes:
< 3.5 mL: Very low
Between 5.0 – 3.5 mL: Low
> 5.0 mL: Normal

Note: Normal stimulated saliva flow rate may vary between 1mL/min – 1.6mL/min.

TEST 5 – Buffering capacity
a) Remove a Buffer test strip from the foil package and place onto an absorbent tissue with the test side up.
b) Using a pipette, draw sufficient saliva from the collection cup and dispense one drop onto each of the 3 test pads. Immediately turn the strip 90° to soak up excess saliva on the absorbent tissue. This will prevent the excess saliva from swelling on the test pad and possibly affecting the accuracy of the test result.
c) The test pads will begin to change colour immediately and after 2 minutes the final result can be calculated by adding the points according to the final colour of each pad. See conversion table and examples underneath.

Conversion table:
Test pad colour at 2 minutes
Green: 4 points
Green/Blue: 3 points*
Blue: 2 points
Red/Blue: 1 point *
Red: 0 points

Examples:

Interpreting the result:
Combined total
0-5: Very low
6-9: Low
10-12: Normal / High

*Where a colour combination provides an unclear result, use intermediate scores.
5. Identify Causal factors

Dehydration
- Inadequate fluid intake
- Strenuous physical activity
- Swimming
- Outdoors occupation
- Dehydrating work environment
- Driving/travelling long distances
- Caffeine (black cola softdrinks, energy drinks, coffee, tea, etc.)
- Alcohol
- Polyuria in uncontrolled diabetes mellitus

Salivary gland pathology
- Head and neck or total body irradiation
- Lymphocytic sialadenitis in HIV, hepatitis C, and diabetes mellitus
- Primary Sjogren’s syndrome
- Secondary Sjogren’s syndrome associated with connective tissue diseases including rheumatoid arthritis,
sarcoidosis, systemic lupus erythematosus,
scleroderma, dermatomyositis, and polymyositis.
- Graft-vs-host disease in bone marrow transplant recipients

Medical conditions
- Psychological stress
- Depressive illnesses
- Chronic renal failure
- Menopausal hormone imbalance
- Thalassaemia major
- Chronic protein-energy malnutrition

Side effect of recreational drugs
- Nicotine
- Alcohol (dehydration, liver cirrhosis)
- Cannabis
- Opiates (heroin, methadone, narcotics, etc)
- Amphetamines

Medications
- Anti-convulsants
- Anti-emetics
- Anti-nauseants
- Anti-Parkinsonian agents
- Anti-psychotics
- Anti-depressants (TCA, SSRI)
- Anti-pruritics
- Anti-histamines
- Anti-hypertensives
- Anti-spasmodics
- Anti-neoplastic agents
- Anxiolytics
- Cardiac antiarrhythmics
- Expectorants
- Decongestants
- Diuretics
- Narcotic analgesics
- Monoamine oxidase inhibitors
- Sedatives
- Systemic bronchodilators
- Skeletal muscle relaxants
- Tranquilisers

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Reduced salivary defence

![Image](image_url)

*Figure 7. Patient with Sjogren's syndrome, with depressed salivary pH at rest (A) and when stimulated (B), and with reduced buffer capacity (C), a pattern typical of damaged salivary glands.*

Walsh 2001
The wheel of misfortune: Plaque pathogenic features versus salivary defence

The modulating role of lifestyle factors

Putting all the pieces together !!
The journey is not long...
It's a matter of perception