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The suffering caused by chronic dry mouth is vastly underestimated, often dismissed as a minor inconvenience rather than the serious health threat it truly is. Xerostomia or dryness of the oral cavity is now affecting 1 out of every 4 adults and has become one of the most common oral health pathologies. The dental community have struggled to find effective, science-based solutions to offer to those who are suffering in silence until now. Be armed with transformative solutions to combat the silent struggle of xerostomia for so many of your patients. Your patients are counting on you.

#### Learning Outcomes:

- To understand the prevalence and etiology of xerostomia related to today's population
- To recognize the patient's perspective on living with chronic dry mouth
- To define normal salivary function vs. xerostomic conditions
- To incorporate evaluative salivary assessment into clinical practice.
- To effectively treat the xerostomic patient with innovative strategies to employ chairside and at home.
- To be introduced to revolutionary approaches that will transform dry mouth care

#### References & Resources:

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Hales CM, Servais J, Martin CB, et al. Prescription Drug Use Among Adults Aged 40–79 in the United States and Canada. NCHS Data Brief No. 347, August 2019.

# Let's Talk Solutions!

## Uncovering, Addressing, and Treating Dry Mouth

### Prevalence and Etiology of Xerostomia in Today's Population

Approximately **1 in 4** adults suffer from xerostomia, with much higher rates observed among seniors.

### Estimate of Xerostomia Prevalence in the General Population

Xerostomia and hyposalivation are two distinct entities which may exist alone or in combination;

- Xerostomia is a reported, subjective feeling of having a dry mouth
- Hyposalivation, as a result of a low salivary flow, is objectively measured

A 2018 systematic review reported an overall estimated prevalence of xerostomia in 22% of the global population

Prevalence increases with elderly population typically due to polypharmacy and medical co-factors

### Effect of Medications and Polypharmacy

The main culprits are antihistamines, antidepressants, anticholinergics, anorexiant, antihypertensives, antipsychotics, anti-Parkinson agents, diuretics, bronchodilators and sedatives

Among adults aged 40–79, almost 7 out of 10 adults used one or more prescription drugs in the past 30 days and 1 in 5 used five or more



Rx and Non-Rx medications  
 >1100 xerogenic drugs



Diseases and infections  
 Sjögren's syndrome, diabetes, etc.



Medical treatments  
 Radiation, chemotherapy  
 Lifestyle behaviors

### Impact of Autoimmune Diseases

Most common disease-causing xerostomia is Sjögren's syndrome  
 Autoimmune disorder typically affecting women 30 – 50 years of age  
 Characterized by lymphocytic infiltration of salivary and lacrimal glands resulting in xerostomia and xerophthalmia

Enlargement of major salivary glands occurs in about 1/3 of patient with Sjögren's syndrome

Presently no cure; goal is to manage symptoms

### Sjögren's Demographic Profile

Average age when receiving diagnosis was 49.7 years

Average time to receive a diagnosis was 3 years

Complex, multi-system nature of Sjögren's produces 48 symptoms

Majority of study respondents stated that 8 of these symptoms have a major impact on their life being;

## Notes:-

## References:

Xerostomia Voice of the Patient Report  
60-second Type 2 Diabetes Risk Test chrome-  
<https://thancfoundation.org/wp-content/uploads/2021/02/Xerostomia-VOP-Report-11-February-2022.pdf>  
[https://donations.diabetes.org/site/SPageServer/?page=Diabetes\\_Risk\\_Test](https://donations.diabetes.org/site/SPageServer/?page=Diabetes_Risk_Test)  
[www.diabetes.org](https://www.diabetes.org)  
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- Fatigue, dry eyes, dry mouth, joint pain, trouble sleeping, eye discomfort, muscle pain and brain fog.  
70% of respondents had at least one immune-related condition other than Sjögren's
- Almost ½ had two or more

## Primary Symptoms of Sjögren's Syndrome

Dry eye  
Xerostomia  
Burning mouth syndrome  
Increased caries activity  
Swollen parotid glands  
Oral lesions  
Dysphagia, dysphasia  
Joint pain, muscle weakness

## 5 Key Questions if you suspect Sjögren's Syndrome

1. Do you have other dryness in your body? (i.e. skin, eyes)
2. Do you have overall marked fatigue?
3. Do you have joint pain?
4. Do you have any other autoimmune disease?
5. Do autoimmune diseases run in your family?

## Treatment Considerations

Hydration throughout the day  
Chewing gum with xylitol  
Remineralization toothpastes  
Salivary substitutes  
Effective oral hygiene and regular recare intervals  
Avoidance of antihistamines, decongestants, and alcohol

## Xerostomia Related to Disease



Often xerostomia is the first identifiable clinical characteristic.

## Impact of CPAP Machine Use

Importance of staying hydrated, optimizing humidification, managing nasal congestion, ensuring a proper mask fit, limiting alcohol/caffeine etc.

## Impact of Cancer Treatment

### Radiation and Chemotherapy

Typically, patients who receive a cumulative radiation dose of 25 Gy or more will suffer significant loss of saliva production  
Radiation to salivary glands produces fibrosis; serous portion seems to be most affected

Notes:-

Saliva produced is more viscous contributing to food retention and increased plaque formation

### Impact of Ionizing Radiation on Salivary Glands

Irreversible effects to salivary glands are experienced > 25 Gy

50 – 60% decrease

Additional 20% decrease

Salivary Flow

1<sup>st</sup> week

7<sup>th</sup> Week

### Journey of a Head and Neck Cancer Survivor

#### Knowledge Translation into Practice

Assess facial symmetry

Bilateral palpation of head and neck comparing symmetry of structures

Assessment of tissue consistency

Evaluative assessment of saliva

Recommendation of products to combat compromised oral conditions

Follow up evaluation - referral to physician/specialist

BE an ADVOCATE for our patients and our own health!

### Salivary Dysfunction: Diagnostic Measures

Sialography is an imaging technique useful in identifying salivary gland stones and masses

- Involves injection of radiopaque media into the salivary glands

Salivary scintigraphy is used in assessing salivary gland function

- Dye is injected to ascertain the rate of excretion in the mouth

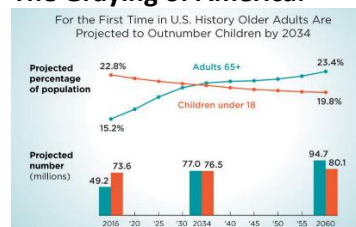
Major salivary gland biopsy is an option where malignancy is suspected

Minor salivary gland biopsy

- Used in the diagnosis of Sjögren's syndrome (SS), human immunodeficiency virus-salivary gland disease, sarcoidosis, amyloidosis and graft-vs.-host disease.

### Xerostomia Related to Physiological Aging

#### The Graying of America:



### Dietary Induced Xerostomia

Frequent combined use of alcohol and energy drinks

Alcohol is a depressant and caffeine is a stimulant – dangerous mix!

Both are diuretics leading to dehydration and further consumption of alcohol

Role played by energy drinks is under-researched

### Normal Salivary Function vs. Xerostomic Condition

#### Salivary Flow Rate

Normal daily production of saliva is between 0.5 and 1.5 litres ( 2 – 4+ cups)

During sleep the flow rate is almost zero

Resting Saliva (RS) vs. Stimulated Saliva (SS)

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Jensen SB, Pedersen AML, Vissink A, et al. A systematic review of salivary gland hypofunction and xerostomia induced by cancer therapies: prevalence, severity and impact on quality of life. Support Care Cancer. 2010 Aug; 18(8):1039-60.

<https://www.dentistryiq.com/dental-hygiene/clinical-hygiene/article/14300874/the-aging-population-and-oral-disease-prevention-are-dental-hygienists-ready>

<https://www.census.gov/library/stories/2018/03/graying-america.html>

## Notes:-

Submandibular glands are the major contributors to resting or unstimulated saliva (70-75%)

- Resting saliva < .1 ml/min

Parotid glands are major contributors to stimulated saliva

- Stimulated < .7 ml/min when chewing on a wax pellet for 5 minutes

## Anatomy and Physiology

### The Secretory System: Major Salivary Glands

**Parotid** (serous) submandibular and sublingual (mixed; mucous/serous)

The parotid gland secretion enters oral cavity via the parotid or Stensen duct

### Submandibular

Pair of major salivary glands located beneath the mandible

**Sublingual** glands are located inferior to the tongue and anterior to the submandibular glands

**Minor salivary glands** scattered throughout

800 – 1000 located throughout the oral cavity within the buccal, labial and lingual mucosa, soft/hard palate and floor of mouth

1 -2 mm in diameter and surrounded not encapsulated by connective tissue

Contribute to remaining 10% and play a significant role in lubrication and protection of the oral mucosa

### Von Ebner Glands

Located in a trough circling the circumvallate papillae on the dorsal surface of the tongue near the sulcus terminalis

Secretion is a purely serous fluid that begins lipid hydrolysis

Facilitates the perception of taste through secretion of digestive enzymes and proteins

### What is the Impact of Xerostomia or Hyposalivation?

Without effective management, a reduced salivary output can significantly damage oral health (dental caries, biofilm growth, periodontitis, halitosis, candidiasis, oral infections, mucositis and oral lesions) and have a major impact on general health

Absence of adequate salivary flow can impede proper digestion (chewing/swallowing) and lead to malnutrition

Xerostomia exacerbated at night by lowered circadian levels during sleep accompanied by mouth breathing

### Why is Saliva So Critical to Our Health?

#### Function and Composition of Healthy Saliva

Bicarbonate, along with phosphate provides a critical buffer neutralizing acid aiding further digestion

- Amylase – starts digestion of starch before food is swallowed – pH of 7.4

- Lipase – pH of 4; not activated until entering acidic environment of stomach

Anti-bacterial compounds such as hydrogen peroxide, lactoperoxidase, lactoferrin aid immune system function

This image shows a vertical sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Navazesh, M., and Kumar, S. K. Measuring salivary flow; challenges and opportunities. JADA 2008;139:suppl 2:35S-40S

Villa A, Connell CL, Abati S. Diagnosis and management of xerostomia and hyposalivation. Ther Clin Risk Manag. 2014;11:45-51.

Woodbeck H, Greenhorn P, McKeown L, et al. Xerostomia: It's A Desert in There! Wound Care Canada Volume 19, Number 1 · Summer 2021.

<http://www.challacombescale.co.uk/Challacombe-Scale-ENG.pdf>

Notes:-

## Assessment of Objective Symptoms

Accelerated wear and erosion

Multiple sites of cervical dentinal hypersensitivity

Coronal and root surface caries

Poorly mineralized calculus or no calculus on lingual aspects of mandibular anteriors despite presence of plaque

Poor output from labial minor salivary glands

Oral mucosa dry, sticky; little or no pooled saliva

Frothy, mucinous saliva

Increased salivary viscosity

Parotid gland enlargement

Inflammation and fissuring of the lips (cheilitis)

Epithelial atrophy (thinning, fissuring of oral mucosa)

Ulcers of the tongue and buccal mucosa

Oral candidiasis

Halitosis

## Chairside Evaluation of Resting or Unstimulated Salivary Flow

Retract the lower lip observing labial mucosa salivary production from minor accessory glands.

Droplets of saliva will begin to form at the orifices of the minor glands.

If the time taken for this to occur is more than 60 seconds, the resting flow rate is below normal.

### Scoring

> 60 seconds

30-60 seconds

< 30 seconds

Low resting flow rate

Normal resting flow rate

High resting flow rate

## Intraoral Evaluation Using the Challacombe Scale

- ✓ Dental mirror sticks to the patient's tongue
- ✓ Dental mirror sticks to the buccal mucosa
- ✓ No saliva pooling in the floor of the patient's mouth
- ✓ Saliva is frothy
- ✓ Patient's tongue shows generalized shortened papillae
- ✓ Altered gingival architecture (i.e. smooth)
- ✓ Patient's oral mucosa, especially the palate, appears glassy
- ✓ Tongue lobuled/fissured
- ✓ Patient has cervical caries on more than 2 teeth
- ✓ Debris sticks to teeth or palate

### Scoring

1 - 3 = MILD

4 - 6 = MODERATE

7 - 10 = SEVERE

## Effectively Treating the Xerostomic Patient

### What's In Your Toolkit to Treat Xerostomia?

#### Checklist:

- ☐ First and foremost, a personalized xerostomia protocol
- ☐ Medical history update containing questions about diabetes and other potential underlying causes of xerostomia
- ☐ Subjective questionnaire re dry mouth

## References:

Osailan S. Subjective Score for Oral Mouth Dryness (SSOD). Medical Science, 2022, 26, ms191e2302.

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<https://www.ada.org/en/resources/ada-library/oral-health-topics/xerostomia>

Managing Dry Mouth. Prepared by the American Dental Association For the Patient | VOLUME 146, ISSUE 2, PA40, 2015.

DOI:<https://doi.org/10.1016/j.adaj.2014.11.019>

## Resources:

PXP (Personalized Xerostomia Protocol)

<https://aquoralspray.com/protocol/>

[illegible]

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Spec Care Dentist 2006 Nov-Dec;26(6):241-6.

- ## Subjective Interview Related to Salivary Function

*How often do you feel that your mouth is dry?*

Never/sometimes/Usually/Always

*Do you have difficulty swallowing any food?*

*Do you sip liquids to aid in swallowing dry food?*

Ask questions that get the patients to tell their story.

*Tell me about how you manage your dry mouth symptoms*

*On a scale of 1 to 10, how much does it disrupt your daily activities?*

*Describe for me what it feels like*

*What is the biggest frustration you have with your dry mouth symptoms?*

*What products have you tried to treat your dry mouth?*

## Initiating the conversation

Sipping water or sucking on ice chips

Using lip lubricants frequently (e.g., every 2 hours)

Avoiding salty, spicy, sticky, sugary or hard-to-chew foods

Avoiding irritants like alcohol, tobacco and caffeine

### Limit use of antihistamines

### Using a humidifier at night

Chewing sugar-free gum or sucking on sugar-free mints (xylitol)

## The Compromised Dry Mouth Environment

Today's compromised patient needs special care and consideration; a proactive approach vs. a reactive approach

## A science-based approach to oral pH balance and natural buffering

A defensive approach to a compromised oral environment with heightened susceptibility to pathogens, sensitivity and caries

## Effective self care protocols

### Mechanical removal of biofilm/Interdental cleaning/healing power of HA

## Oral rinses – water-based vs. evidence-based

## Probiotics

## Remineralization Toothpastes

## pH Stabilizers

Xylitol

## Fluoride Varnishes

## Probiotics

### Benefit of a Power Toothbrush (PTB) in a Xerostomic Environment

**Study:** To determine if using a Sonicare power toothbrush (PTB) was a beneficial treatment of medication-induced xerostomia

Notes:-

## References:

Nayak PA, Nayak UA, Khandelwal V. The effect of xylitol on dental caries and oral flora. Clin Cosmet Investig Dent. 2014;6:89-94.

Park, E., Na, H. S., Jeong, S., & Chung, J. (2019, June 30). Xylitol stimulates saliva secretion via muscarinic receptor signaling pathway. International Journal of Oral Biology. Korean Academy of Oral Biology.

Martin M, Marin A, Lopez M, et al. Products based on olive oil, betaine, and xylitol in the post-radiotherapy xerostomia. Reports of Practical Oncology and Radiotherapy. 2017;22(1):71-76.

Bowen WH. The Stephan Curve revisited. Odontology. 2013 Jan;101(1):2-8

Ruan, Z., Xie, J., Yu, J. et al. The association between poor dental health and gastric cancer risk: a nationwide cohort and sibling-controlled study. BMC Med 23, 434 (2025).

Han Z, Hu Y, Lin X, et al. Systematic analyses uncover robust salivary microbial signatures and host-microbiome perturbations in oral squamous cell carcinoma. mSystems10:e01247-24. (2025)

**Methods:** 61 subjected with medication induced xerostomia randomly assigned Sonicare (SC) or a manual toothbrush (MTB). Followed for four months; saliva flow was measured by subjects at four collection periods.

**Results:** End-of-study questionnaire showed that 98.2% of subjects found enhanced salivary flow and 92.7% would use it to increase salivary flow. After three years, subjects rated the cleaning effect of the Sonicare to > 4.5 (5 = excellent).

**Conclusions:** The use of a Sonicare resulted in statistically significant increase in post brushing salivary flow rates in persons with medication-induced xerostomia

## Power Flosser

180x more effective than string floss at improving gingival health; Quad Stream Technology

## Science Driven Product Innovation – Hyaluronic Acid (HA)

Natural physiological constituent of connective tissue

Active in tissue regeneration, bacteriostatic, anti-inflammatory

Hyaluronic acid (HA) is a natural physiological constituent of connective tissue which is made up of mostly collagen

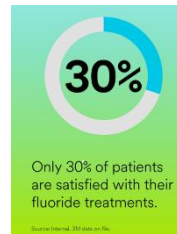
Active in tissue regeneration and influences the migration of fibroblasts and fibrinogenesis, facilitating faster healing

Performs 3 synergistic effects:

- anti-inflammatory, accelerates the healing process and provides a protective barrier.

Contributing to the barrier function and tensile strength of the periodontal ligament, HA is essential for healthy gingival tissues. In the initial stage of inflammation and periodontal disease, tissue's requirement for HA increases by 200%. When lacking HA, healing will be delayed and inflammation will continue.

## Science Driven Product Innovation – Water-Based vs. Rosin/Colophony Based Fluoride



2.1% Sodium Fluoride (NaF)

Neutral pH/water based – ions immediately available (15 min contact time)

Water-based with neutral pH

## Salivary pH: Risk Assessment and Management

### Are you at risk? Patient Self-Assessment

1. How often do you drink fruit juice?
2. Do you drink wine regularly?
3. How many sodas do you have in a given day?
4. Do you make sure to get enough servings of vegetables and fruits every day?
5. Do you hold or swish drinks in your mouth?
6. Do you brush your teeth less than 1 hour after eating or drinking?

## Stephan Curve

Following the sucrose challenge, characteristically the Stephan Curve reveals a rapid drop in plaque pH followed by a slower rise until the resting pH is attained

## Product Information

### Lipid-Based OGT Technology Trial Offer



### Oral Probiotics Practice Samples



### Water-Based Fluoride Varnish



### Resources:

Get Your Spit Together

[www.getyourspittogether.com](http://www.getyourspittogether.com)

Order online [www.amazon.com](http://www.amazon.com) Obtain 4 CE credits for reading book

Sjogren's Society Educational Resources:

<https://www.sjogrens.org/understanding-sjogrens/resources/brochures-resource-sheets>

Head & Neck Cancer - Insights from Dr. Mike Milligan, a Survivor

LINK to full document may be found here;

<https://aquoralspray.com/head-amp-neck-cancer-insights-from-dr-mike-milligan-a-survivor/>

Side Effect Support – Assistance on the Road to Recovery

[www.sideeffectsupport.com](http://www.sideeffectsupport.com)

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The critical pH is the pH below which enamel dissolution begins to occur  
pH recovery and return to neutrality can take 15 to 40 minutes

One of the most important factors impacting pH recovery is salivary flow rate

### Testing pH of Saliva

The xerostomic patient is compromised due to lack of buffering capabilities of saliva

Healthy saliva should measure no lower than pH of 6.5

Demineralization occurs below a pH of 5.5

Elderly patients or those with exposed dentin need to know that root demineralization can occur when pH levels fall to 6.0

### Science Driven Product Innovation

#### Xylitol Inhibition of Pathogenic Oral Bacteria

Five-carbon natural sugar alcohol or polyol, unable to be metabolized by predominant cariogenic bacteria, has ability to;

Reduce MS (mutans streptococci) in plaque biofilm, diminish energy cycle leading to cellular death

Reduces the adhesion and acid production potential

Acts as a prebiotic or food source for beneficial bacteria

Inhibition of growth of pathogenic oral bacteria – P. gingivalis

Low glycemic index making it a healthier nutritive sweetener for diabetics

Recommended dose is 6 – 7 grams of xylitol daily separated into three to five exposures (professional vs. OTC therapeutic dose)

### Science Driven Product Innovation

#### The Lipid-Based Advantage – OGT Technology

**Water-based vs. Evidence-Based?** A systematic Cochrane Review, published comparing xerostomia interventions and concluded greater efficacy with lipid-based OGT technology

Adheres and protects restoring viscoelasticity of oral mucosa

Studies conducted by 3M researchers measuring moisture loss over time demonstrated significantly less water loss with lipid-based OGT technology compared to mainstream OTC products

#### The Compromised Oral Environment – The Oral Microbiota

Second largest microbial community

Consists mainly of bacteria, which live and thrive in the oral biofilm

Most of the bacteria are commensals, but a small proportion are pathogens associated with periodontal disease

Imbalance, or dysbiosis allows the pathogenic bacteria to thrive increasing inflammation and periodontal destruction


Increasingly recognized for role in cancer development (oral, gastric)

#### Science Driven Product Innovation - Reactive vs. Proactive Treatment

Elevating commensal bacteria through oral probiotics for oral dysbiosis, following SRP, etc.

Thank you for your time and participation today. If I may assist you with anything further, please don't hesitate to contact me.

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