

Xerostomia

It's a Desert in There!

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Dry, cracked hands from repeated washing are a familiar problem for health-care providers. With the protective layer of sebum removed, the stratum corneum layers of the skin get damaged. These open areas become reddened and sore as secondary infections take hold. Just like the outside skin, the tissues in the mouth break down when they dry out and become desert-like.

Dry mouth, or xerostomia, can be very distressing for patients. Foods don't taste right, dry foods are hard to eat, dentures fit poorly, cavities form, teeth break and gums thin. Like so many other things in life, one doesn't know how important spit/saliva is until one doesn't have any. This article discusses the importance of saliva in preventing and healing oral wounds, how dry mouth (or xerostomia) occurs and what can be done to prevent or minimize it. Ways to promote optimal oral outcomes, oral assessments and individualized comprehensive oral care plans are described.

Saliva and Its Importance

Saliva is a fluid that keeps the epithelial tissues lining the inside of the mouth from sticking together. A healthy mouth is continuously bathed in saliva. According to Mandel, "Spit is the underdog of body fluids"; saliva or oral fluid "lacks the drama of blood, the sincerity of sweat and the

emotional appeal of tears."¹ Saliva may not be as exciting as blood, but it is essential for healthy living. It aids in flushing away food debris, dead tissue and biofilm in the mouth.

Saliva is mostly water along with a complex mixture of protein, enzymes, antimicrobial peptides, mucins and lubricants. The major and minor



salivary glands produce an astounding 0.5–1.5 L of saliva per day.² The basic secretory units of salivary glands are acini, which are clusters of specialized epithelial cells. Secretions accumulate within the glands and flow into the mouth through special ducts.² The saliva from each major salivary gland has its own composition. Saliva is made on demand. Chewing food stimulates saliva production, while less saliva is produced during sleep.

The main salivary glands are the paired parotids, submandibular and sublingual. The fluid from the parotid glands comes through the Stensen's duct located on the buccal mucosa next to the second upper molars. The Wharton's duct from the submandibular gland comes out at the anterior of the mouth under the tongue behind the lower front teeth. These three glands generate about 95% of all salivary fluids. More saliva is produced in the minor glands, distributed throughout the mouth.³

Saliva has many functions, including:

- Lubricating and moistening the oral cavity. This protects the tissues from trauma and enables swallowing and speech. Continuous lubrication of the teeth and mucous membranes promotes comfort and prevents infection.⁴
- Promoting microbial homeostasis to support a healthy, balanced microbiome within the mouth. Antimicrobial proteins prevent entry of bacteria and other exogenous pathogens into cells. Mucins in saliva also help to prevent micro-organisms from physically attaching to oral tissues.⁴
- Starting digestion, and promoting food bolus formation and clearance out of the oral cavity. Salivary enzymes begin the digestion process by breaking down starches, sugars and fats. When saliva is mixed with food through chewing, it creates a soft mass that enables swallowing and reduces the risk of aspirating food.²
- Enabling tasting and smelling of food. Saliva dissolves the taste components in the food and diffuses them to the taste bud receptor sites.⁴
- Maintaining the acid levels in the mouth at a constant pH level between 6.5 and 7. This buffering system decreases acid levels in foods, and protects the teeth from decay and the soft tissues from damage. Saliva has the capacity to

Figure 1: Martin's Story



Photos courtesy of Lynda McKeown. Used with permission.

Martin's story illustrates the challenges of dry mouth. He is a 50-year-old male with multiple sclerosis and a brain injury who lives in a long-term-care home. He is non-communicative, tube fed and fully dependent on care. He receives weekly professional dental hygiene care.

Martin suffers from dry mouth. On the outside, his lips appear shiny and taut, with cracking and fissuring. When his mouth is examined, it is dry and painful for him to open. His lips stick to his teeth and to the examiner's gloves. Inside Martin's mouth, there is a thick crust of debris stuck to his palate, tongue and teeth. No saliva is visible.

Martin gets minimal oral care. Staff have repeatedly expressed concerns about the aspiration risk from toothpaste and fear of tissue bleeding. Some staff don't think Martin needs oral care because he doesn't eat anything. So, the dried mucous and bacteria accumulate in large crusts, requiring regular debridement, just like a wound.

Weekly oral care from a registered dental hygienist helps to keep Martin's mouth more comfortable. The hygienist uses moistened gauze to gently remove the caked debris from his fragile mouth tissue. This process can be uncomfortable, and appropriate technique is needed. Sadly, Martin's experience represents a large population of residents of long-term care homes who don't receive adequate oral care. Martin's situation is preventable with daily oral care and help from oral health professionals.

buffer bicarbonate, phosphate and protein systems.⁴

- Remineralizing and repairing tooth enamel. Proteins and peptides in saliva help to use calcium and phosphate in the diet to strengthen and repair tooth enamel. Fluoride speeds up the process of tooth remineralization and decreases demineralization.⁵
- Healing wounds. Cytokines and growth factors in saliva promote healing of mouth wounds. These factors in saliva aid in healing by causing

re-epithelialization and regulation of the extracellular matrix.⁶

What is dry mouth/xerostomia and why is it important?

When there is insufficient saliva to bathe the mouth, dry mouth—or xerostomia—occurs. *Dry mouth* is a broad, overarching term that encompasses the perspectives of both the patient and the health-care provider. Dry mouth has several components in its meaning. Xerostomia is clin-

ically defined as the subjective perception of dry mouth related to mucosal dehydration and reduced oral lubrication.⁷ Salivary gland hypofunction is a condition in which salivary flow is significantly reduced. Oddly, this condition may not be recognized by the patient as a problem. Xerostomia is a subjective condition that can only be assessed by direct questioning of the patient.^{7,8}

Oral wounds are slow to heal when there is xerostomia. The link between optimal moisture and wound healing is well-established. The importance of moisture was first recognized in the 1960s, when research showed that moist wounds healed faster than dry ones.⁹

Dry mouth/xerostomia can be disabling. It can have significant negative effects on a person's quality of life:

- Dry oral tissues are easily torn by hard and/or dried food, dentures, etc. The dry mucosa is more susceptible to trauma and infection. Patients can suffer from painful mucositis.¹⁰
- Rapid onset of dental caries along with more oral wounds may occur. Pockets of infection can develop between the teeth.
- Candidiasis and other secondary infections can occur in oral wounds. In the mouth, erythematous candidiasis predominates, along with angular cheilitis and pseudomembranous candidiasis (thrush), and can cause tissue breakdown in skin folds and wreak havoc in the mouth.
- Higher rates of upper respiratory infections occur in people with xerostomia.¹¹
- Xerostomia can cause difficulty in wearing dentures. Saliva is important for adhesion and retention of dentures. Denture wearers often report pain and discomfort due to dry mouth.¹⁰ Poorly fitting dentures can cause dry mouth by physically blocking the ducts of the salivary glands in the floor of the mouth. Dentures can also cause pressure injuries and/or frictional reactive hyperplasia in a dry mouth. These pressure injuries are just like those on the outer skin. Frictional reactive hyperplasia, or an epulis, occurs when there is an overgrowth of mucosal tissue around a foreign object such as a partial

Figure 2: Epulis in lower jaw caused by denture



Photo credit: David Banting. Used with permission.

plate or denture (see Figure 2).¹² If an epulis or ulcer is noted, an oral professional must be involved to adjust the denture in order to promote healing.

- Swallowing difficulties may be present, particularly for stroke and Parkinson's patients who are at risk for dysphagia.
- Xerostomia can result in speech problems and decreased ability to make sounds.
- Food that sticks to the buccal mucosa can pocket in the cheek. Removing the food can cause tissue abrasions.

Causes of Xerostomia/Dry Mouth

Xerostomia in the elderly is not a natural part of aging. However, seniors are predisposed to xerostomia due to underlying systemic diseases, multiple medications and decreased sensation of thirst.¹³ Intracellular fluid volume is regulated by osmoreceptors in the hypothalamus. With aging, there can be a decrease in sensitivity of these receptors that results in a loss of the thirst sensation.¹⁴

As life expectancy increases, people are more likely to develop systemic diseases. Xerostomia may be directly caused by diseases and/or the use of xerogenic drugs to treat them. Having more systemic diseases means that elderly people are often prescribed more medications than people in other age groups. Residents living in Canadian long-term care facilities take an average of 9.9



classes of drugs versus seniors at home getting 6.7 drug classes.¹⁵

Patients with dry mouths should be screened for polypharmacy. The risk for xerostomia increases with the number of medications, even if the individual drugs are not xerogenic. But the question arises: Is the xerogenic effect due to the medication, or is the dry mouth a side effect of underlying medical conditions? An example would be bronchodilators for emphysema-mouth breathing due to effort to breathe.¹²

Although dry mouth is a possible side effect of dozens of medications, information on which medications cause xerostomia is limited. Xerogenic medications may decrease the saliva volume produced and/or alter the perception of mouth dryness.¹⁶ Antihypertensives, antiulcer agents, anticholinergics and antidepressants, all very commonly prescribed in the elderly, pose a high risk of causing dry mouth.¹⁷

Medication delivery systems can contribute to xerostomia. Tube feeding, masks, inhalers and respiratory therapy medications tend to dry out mucous membranes. Oxygen administration in particular causes dry mouth. Continuous positive airway pressure (CPAP) masks for sleep apnea can be drying for oral tissues. Cancer chemotherapy, radiation therapy and surgery to the head and neck are all risk factors for xerostomia and salivary gland hypofunction. Alcohol use, including alcohol in mouthwashes, increases the risk for xerostomia.¹²

Many systemic diseases are associated with xerostomia, including autoimmune disorders

such as Sjögren's syndrome, diabetes mellitus, HIV/AIDS, sarcoidosis, connective tissue disease, graft-vs-host disease, cystic fibrosis, end-stage renal disease (ESRD), Alzheimer's disease, and anxiety or depression. The prevalence of xerostomia related to systemic diseases varies greatly: HIV/AIDS 1.2–40%, systemic lupus erythematosus (SLE) 75%, sarcoidosis 6%, graft-vs-host disease 16–59%, ESRD 28–59%, and diabetes 14–62%.¹⁸ Smoking also dries the mouth.

Xerostomia may directly be caused by diseases and/or the use of xerogenic drugs to treat them.

A dry mouth can be evidence of dehydration. Clinically, *dehydration* is defined as "the rapid decrease of >3% of body weight."¹⁹ Total body dehydration is directly linked to dry mouth. Even moderate dehydration can decrease salivary flow rate by 60–70% as the body tries to maintain its fluid balance.¹¹ This amount of fluid can be easily lost by athletes during prolonged exercise.

Dehydration has been identified as a major factor relating to many clinical issues. It has a huge impact on quality of life for older adults. Many chronic health problems in older adults, such as falls, fractures, confusion, heat stress, constipation,

urinary tract infections, kidney stones, renal failure, drug toxicity, malnutrition, stroke and poor wound healing, are exacerbated by dehydration.²⁰ Even minimal dehydration of only 1–2% of total body fluid volume is associated with impaired cognition, psychomotor and memory skills.²¹

Moderate dehydration can trigger the classic symptoms of headaches, dizziness on

standing, dry mouth, diarrhea and weight loss.²⁰ Dehydration is commonly seen in long-term care homes and among elderly people in general. It is estimated that up to one-third of long-term care residents are dehydrated.¹⁴ It is important to monitor long-term care residents for signs of dehydration by recording intake and output. Screening residents with a tool that looks at headaches, orthostatic hypotension and dry mouth can be helpful.²⁰

Table 1: Xerogenic Medications (Adapted from Wolff et al.¹⁶)

Medications with strong or moderate evidence according to site of action
<ul style="list-style-type: none"> • alimentary tract and metabolism • cardiovascular system • genitourinary system • sex hormones • systemic anti-infectives • antineoplastics • immunomodulating agents • musculoskeletal system • nervous system • respiratory system • sensory organs
Medications with strong or moderate evidence based on therapeutic action
<ul style="list-style-type: none"> • gastrointestinal drugs • antiemetics • anti-nauseants • anti-obesity preparations • anti-hypertensives • diuretics • beta-blocking agents • calcium channel blockers • urologicals • muscle relaxants • drugs for bone diseases • analgesics • anti-epileptics • anti-Parkinson's drugs • psycholeptics • psychoanaleptics • other nervous system drugs • antimuscarinic drugs for obstructive airway diseases • antihistamines for systemic use • ophthalmologicals

Xerostomia Assessment: What to Look For and How to Recognize it Clinically

The Wound Prevention and Management Cycle can be applied to the assessment of xerostomia. Clinicians need to both assess the mouth for xerostomia and ask the person if they are experiencing a feeling of dryness in the mouth. It is important to carefully consider each case—listen to the patient, gain insight into their experience and observe their signs and symptoms.

It is estimated that up to one-third of long-term care residents are dehydrated.

Regularly assessing residents can uncover xerostomia. The Oral Health Assessment Tool (OHAT) is a standardized assessment tool in which the tongue and saliva are assessed.²² In long-term care, quarterly oral assessments are mandated.

Clinicians using an oral assessment tool such as the Subjective Evaluation of Xerostomia should consider adding specific questions on dry mouth to their oral assessment tool, such as:²³

- Do you have difficulties swallowing any foods?
- Does your mouth feel dry while eating a meal?
- Do you sip liquids to aid in swallowing dry foods?
- Does the amount of saliva in your mouth seem to be too little?

- Does the amount of saliva in your mouth seem to be too much?

Clinicians should begin their objective observations by looking at the face, hands and outside the mouth. Table 2 provides a systematic approach to oral assessment.

Evidence-based resources on oral assessment can be found in the [Oral Care Section of the RNAO's Long-Term Care Best Practices Toolkit, 2nd edition](#). There is a three-part YouTube series on how to do an oral assessment with informative pictures of [oral conditions](#). The [Oral Health Assessment Toolkit for Older People](#) from South Australia Health is another nicely illustrated resource. The Ontario Dental Association has a simple oral assessment fact sheet with pictures. Reach out to your local oral health professional for hands-on help with assessments.

Treating Xerostomia and Dry Mouth

Assemble an integrated oral care team that includes nurses, physicians, personal support

workers, dietitians, dental hygienists, dentists and/or denturists, respiratory therapists and, most importantly, patients and their families.

Assess your organization's oral care program using the Registered Nurses' Association of Ontario's best practice guideline, *Oral Health: Supporting Adults Who Require Assistance Second Edition*.²² A gap analysis can both find areas for improvement and help to set program goals. Develop a plan to address priority issues.

Address dehydration. Monitor fluid intake in patients at risk for dehydration. Ensure staff know who has not been taking in adequate fluids. Some long-term care homes have found that adding residents at risk for dehydration to the daily bowel record helps alert staff to offer more fluids. The sip-and-go approach has been successfully used in many long-term care homes. The idea with this program is to provide fluids at the bedside. Everyone who comes into a resident's room offers fluids, including housekeeping and other team members. Brightly coloured water jugs have been shown to be helpful as fluid reminders to

Table 2: Assessment for Xerostomia/Dry Mouth

Assessment steps: How to do it	Look for these clinical signs	Look for these symptoms
Extra oral: <ul style="list-style-type: none"> • Watch for breathing with mouth open—investigate if transient or habitual. • Check for dry skin on face and hands and other signs of dehydration. • Check for dry, cracked lips. • Check for angular cheilitis (see Figure 3). Intra oral: <ul style="list-style-type: none"> • Use a tongue depressor to examine the mouth. If it sticks to buccal mucosa, this indicates a lack of saliva. • Gloves sticking to buccal tissues is another sign of low salivary flow. • Palpate the parotid papilla. • Milking the gland and duct can reveal if there is little or no saliva output. • Check for food debris sticking to teeth, tongue, cheeks and palate. • Check for pooling of saliva in floor of mouth—absence is a cause for concern 	Intra oral: <ul style="list-style-type: none"> • Oral mucosa may appear dry and shiny • Tongue has cracks, bare patches or heavy coating • Mucus accumulation • Saliva is thick and ropey • Food debris retained in teeth, cheeks and under tongue • Plaque accumulation • Tissue trauma/ulcers • Teeth are broken, cracked, decayed • Oropharyngeal infections – Candida patches (plaques) • White patches of candidiasis on the tongue and mucosa (see Figure 4) 	Difficulties in oral function <ul style="list-style-type: none"> • Dysphagia • Altered speech • Nocturnal oral discomfort • Difficulties wearing dentures • Oropharyngeal burning • Taste disturbances

staff and residents. Red jugs alert staff that the patient is at risk of dehydration and the jugs should be filled at every opportunity. The bright red is also easy for patients to see, as vision can

Figure 3: Angular cheilitis



Photo credit: David Banting. Used with permission.

Figure 4: White patches of candidiasis on the tongue and mucosa



Photo credit: Pat Greenhorn. Used with permission.

decline with age or dehydration, and lightly coloured cups are not easily visible.²⁴

Work with dietitians and direct care staff to optimize fluid intake. Limit caffeine and alcohol intake for patients with xerostomia. Offer water or milk rather than juice, pop or other sweetened fluids. Milk is especially helpful for dry mouth and dehydration.²⁵ Food supplement drinks high in sugar should be avoided, if possible, as these supplements cause imbalances in the oral ecosystem that promote rapid tooth decay and oral wounds in a dry mouth. The diabetic versions of supplement drinks are a better choice.

Cheese and milk help to reduce acidity in the mouth after eating. They can change the pH balance in the mouth in about 10 minutes rather than the usual 40 minutes. Provide water to all patients at the end of a meal and after a snack to help cleanse the palate. At a minimum, rinse or wipe the mouth with water after eating to clear food debris.

Avoid strong flavourings such as mint, lemon and cinnamon in chewing gum or breath mints. For residents who are capable of using chewing gum, chewing sugarless gum with xylitol every four hours can stimulate salivary flow and help alleviate the discomfort of dry mouth. It also reduces the risk of tooth decay.²⁶

Work with physicians, nurse practitioners and pharmacists to address polypharmacy. Identify medications that contribute to xerostomia and consider alternatives where possible. For patients with dry mouth, sialagogues and other salivary stimulants can be prescribed, if appropriate.

Over-the-counter oral moisturizing products and/or saliva substitutes are useful for xerostomia. Gels and sprays are designed to protect the oral mucosa, promote comfort and replace some components of the saliva. Moisturizing sprays used after meals can have a good effect. Overnight, gels work well.

Residents and families should be instructed to purchase mouthwashes that contain fluoride but no alcohol. For residents with dry mouth who have natural teeth remaining, consult with an oral health professional about the use of specialized oral care products, such as chlorhexidine, to

reduce the risk of periodontal infection and tooth decay.

Assess for the overgrowth of yeast in the mouth due to antibiotics, chemotherapy and even denture use. If candidiasis is present, treat both the mouth and the dentures. Adding a thin layer of nystatin ointment inside the denture before inserting into the mouth can treat both the tissues and the denture effectively. A diluted nystatin solution can also be used to soak dentures overnight.

When using respiratory therapy, assess for xerostomia in the oral and nasal mucosa. Ensure that patients stay hydrated. Use water-based moisturizers to relieve dryness in the nose and mouth. Avoid oil-based preparations such as petroleum jelly.²⁷


For cognitively well people, oil pulling is an ancient Ayurvedic technique that can help xerostomia. Researchers have concluded that oil-pulling with virgin coconut oil offers the xerostomic patient a more pleasant oral condition and a somewhat protective effect against xerostomia-related demineralization.²⁸

Develop an individualized oral care plan focused on xerostomia. Involve the resident and their family in the oral care plan. Family members can offer fluids and be trained to properly assist with oral care.

Conclusion

Saliva matters! A healthy mouth contributes to and reflects total body health. Saliva has a clear link to wound prevention. Understanding normal salivary composition, flow and function is extremely important when caring for patients. Without adequate salivary function, an individual may endure unnecessary and preventable oral issues.

Embrace the magic of saliva. Call upon oral health professionals to evaluate if you suspect an oral abnormality. Establish and incorporate tools to help assess for signs and symptoms of dry mouth and offer solutions. Recognize saliva's contributions to oral and systemic health. Watch

for evidence of a “desert” in patients' mouths to prevent tooth decay and oral wounds. 

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