

# Quality Resource Guide

## Managing Dental Patients with Xerostomia and Hyposalivation

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### Educational Objectives

Following this unit of instruction, the learner should be able to:

1. Recognize the functions of saliva in maintaining oral health.
2. Recognize the prevalence and causes of xerostomia.
3. Recognize the symptoms of xerostomia and signs of hyposalivation.
4. Understand techniques to manage symptoms of xerostomia and hyposalivation.
5. Prevent and treat the complications of hyposalivation.

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Published December 2022. Expiration date: December 2025.

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## Introduction

This Quality Resource Guide provides readers with a summary of the current knowledge regarding xerostomia and hyposalivation. It contains “evidence-based” recommendations for the practitioner as determined from the latest research and clinical outcomes studies. Practitioners should be aware that evidence continues accumulating that supports current therapies’ efficacy for managing xerostomia and hyposalivation. Over-the-counter (OTC) saliva substitutes and muscarinic agonists are the predominant agents available for the relief of the symptoms of dry mouth. Innovative gene therapies for producing saliva are being evaluated but are not yet available.

## Saliva

Saliva consists primarily of water that continuously irrigates, lubricates, and physically cleanses oral structures. It is essential to oral health. The flow of saliva clears food debris and its degradation products, including bacteria, from the surfaces of the teeth. Enzymes and water in saliva aid digestion, and several innate immune molecules in saliva help fight infection. Bicarbonates, phosphates and proteins in saliva serve as buffering agents against acids that are ingested or generated by bacterial fermentation of simple carbohydrates. Saliva’s electrolytes, calcium and phosphate, help prevent the dissolution of enamel and promote remineralization. Consequently, loss of saliva and these critical constituents can lead to significant dental complications and reduced oral health-related quality of life.<sup>1</sup>

## Salivary Flow Rate and Hypofunction/Hyposalivation

At rest, unstimulated saliva is produced at a rate of about 0.3 to 0.4 mL/min as measured by sialometry (the method for measuring the amount of saliva collected within a specified time). Stimulated saliva (by chewing a piece of paraffin/gum) is produced at a rate of 1.0 to 2.0 mL/min. *Hypofunction* or *hyposalivation* is defined as the production of < 0.7 mL/min stimulated whole saliva flow or ≤ 0.1 mL/min of unstimulated whole saliva flow.<sup>2</sup> Hyposalivation is often accompanied by a change of taste, oral burning sensations, and xerostomia.

## Xerostomia

Xerostomia is the subjective, self-reported complaint of a “dry mouth.” Xerostomia and hyposalivation are typically interrelated, with salivary flow reduced by 50%, creating dry mouth symptoms. However, hyposalivation may be absent despite the complaint of xerostomia, and patients may complain of dryness irrespective of the amount of saliva in the mouth. This can occur because of low humidity, mouth breathing, sensory variability, and inconsistent patient descriptions of their symptoms. Saliva is a complex fluid composed of major and minor salivary glands secretions. These secretions differ in composition, particularly their water, salivary proteins, and mucin content, which may result in varying perceptions or sensations of “wetness” or “dryness.”<sup>3</sup> Clinicians must know that patient symptoms or perceptions may not be reliable measures of xerostomia or salivary gland hypofunction.

## Prevalence & Etiology

Xerostomia is an age-related symptom affecting about 10% of 30-year-olds and up to 20% of older adults.<sup>4,5</sup> Xerostomia is commonly associated with medical conditions, medication use, stressful conditions, and hyposalivation. There are numerous causes of hyposalivation that can produce symptoms of xerostomia, and the etiologies can variably affect the function of the major and minor salivary glands:

**Use of xerogenic medications.** There is a large number of medications (over-the-counter [OTC] or prescription) that are xerogenic (Table 1). These medications reduce saliva flow from the major and minor salivary glands through their anticholinergic effects. The effect of xerogenic medications is compounded by polypharmacy used to treat common chronic conditions such as hypertension, cardiovascular disease, diabetes, chronic obstructive pulmonary disease, and urinary incontinence, particularly in an elderly patient.

Table 1 - Therapeutic Categories of Drugs That May Reduce Saliva

Anorexiant.....	Amfepramone (Tenuate®)
Anti-anxiety agent.....	Alprazolam (Xanax®), Chlordiazepoxide (Librium®), Lorazepam (Ativan®)
Antispasmodic/anticholinergic agents.....	Benzatropine (Cogentin®), Tolterodine (Detrol®)
Anticonvulsants.....	Carbamazepine (Tegretol®), Gabapentin (Neurontin®)
Antidepressants.....	Fluoxetine (Prozac®), Trazodone (Desyre®), Bupropion (Wellbutrin®)
Antiemetics.....	Dimenhydrinate (Dramamine®), Meclizine (Antivert®)
Antihistamines.....	Brompheniramine (Dimetane®), Loratadine (Claritin®)
Antihypertensives.....	Clonidine (Catapres®), Enalapril (Vasotec®)
Anti-inflammatory analgesics.....	Ibuprofen (Advil®), Naproxen (Aleve®)
Antineoplastic agents.....	Busulfan (Myleran®), Interferon-a (Roferon®-A)
Antiparkinsonian agents.....	Carbidopa / Levodopa (Sinemet®)
Antipsychotics.....	Chlorpromazine (Thorazine®), Prochlorperazine (Compazine®)
Bladder control.....	Oxybutynin (Ditropan XL®) - Tolterodine (Detrol®), Solifenacin (Vesicare®), Tamsulosin (Flomax®)
Bronchodilators.....	Ipratropium bromide (Atrovent®), Albuterol (Ventolin®)
Decongestants.....	Pseudoephedrine (Sudafed®), Fluticasone propionate/Salmeterol (Advair®)
Diuretics.....	Bumetanide (Bumex®), Chlorothiazide (Diuril®), Furosemide (Lasix®), Triamterene (Dyazide®)
Muscle relaxants.....	Cyclobenzaprine (Flexeril®), Orphenadrine (Norflex®)
Narcotic anal.....	Hydrocodone/acetaminophen (Norco®), Oxycodone/acetaminophen (Percocet®)
Sedative hypnotics.....	Diazepam (Valium®), Zolpidem (Ambien®)

Multiple psychotropic drugs used for mood disorders, as well as opioid analgesics and other agents affecting muscarinic neurotransmission used for the management of chronic pain, may reduce salivary flow. Patients often have more than one concurrent medical condition or ailment for which they may take several prescriptions and OTC xerogenic medications. Reports indicate that among patients taking one to six or more medications, the odds of developing xerostomia increase from 1.4- to 4.6-fold, respectively.<sup>6</sup> Furthermore, many chronic medical conditions require continuous medication use, resulting in long-term exposure to the drug's xerogenic side effects.

In addition to xerogenic prescription medications, innumerable products are available OTC that have the potential to reduce salivary function. These include antihistamines, decongestants, and preparations for gastrointestinal ailments such as reflux. The therapeutic categories and examples of drugs that have been reported to cause xerostomia are summarized in **Table 1**.<sup>7</sup>

**Mouth breathing** is unique in that it causes symptoms of a dry mouth, either in the presence of normal or abnormal salivary flow. Mouth breathing is often associated with restriction in nasal airway breathing due to congestion or anatomic abnormalities. Many people experience mouth breathing when lying down and while asleep. Mouth breathing is most detrimental to the oral cavity when persistent and can lead to prolonged drying of the oral mucosa, gingiva, and teeth.

**Aging** impacts salivary gland function. Unstimulated and stimulated whole salivary flow decreases as we age,<sup>8</sup> however, parotid and minor gland salivary flow rates do not appear to be significantly reduced with increasing age.<sup>9</sup>

**Dehydration** is known to be associated with decreased salivary gland flow rates.<sup>10</sup> The effect is age-independent; however, the elderly are known to have a lowered thirst response, drink less fluids, and have less water reserve, which, combined with polypharmacy, can result in xerostomia and significant hyposalivation.<sup>11</sup>

**Viral infections** can cause a dry mouth. Most recently, dry mouth has been reported to occur during infection with Sars-CoV2 (Covid-19). Human immunodeficiency virus infection also damages salivary glands, leading to various manifestations, including HIV salivary gland disease (HIV-SGD) and significantly reduced salivary flow rates.<sup>12</sup>

**Sjögren syndrome** is a chronic autoimmune disorder involving dryness of the eyes and mouth. It is estimated to affect 0.5 to 1% of the population, more commonly in women than men (9:1). Symptoms generally develop after the age of 35 years, and up to half of those affected develop extra-glandular involvement of the joints, lungs, gastrointestinal tract, and kidneys. *Secondary Sjögren syndrome* occurs when a person has an autoimmune disease such as rheumatoid arthritis or lupus erythematosus and develops sicca syndrome (dry eyes and dry mouth). It is estimated that 30% of patients with systemic lupus erythematosus, 25% with systemic sclerosis, and 15% with rheumatoid arthritis become xerostomic due to the development of secondary *Sjögren syndrome*.<sup>13</sup>

**Diabetes mellitus** is associated with hyposalivation and xerostomia due to poor hydration, frequent urination, increased blood sugar levels, increased blood osmolality, kidney dysfunction, and eventually renal failure and dialysis. The Centers for Disease Control and Prevention (CDC) estimate that 37 million people (11.3%) of the U.S. population have diabetes. The incidence of hyposalivation and xerostomia increases in persons whose diabetes is poorly controlled. Other diseases associated with salivary gland dysfunction and xerostomia are listed in **Table 2**.

**Radiation therapy** used to combat cancers of the oral cavity and oropharynx leads to cell death by damaging tumor cell DNA. Radiation is used when surgery alone is insufficient or contraindicated, or for radiosensitive cancers. Many head and neck cancers are treated with external beam radiation therapy delivered in daily fractions that total 55 - 70 grays (Gy) over 6 to 7 weeks. The effect on salivary glands is dose and location-dependent. External beam radiation above 25 Gy that encompasses or is in

**Table 2 - Diseases Associated with Xerostomia**

<b>Primary Sjögren's Syndrome</b>
<b>Sjögren's Syndrome (secondary),</b> in conjunction with:
Rheumatoid arthritis
Systemic lupus erythematosus
Systemic sclerosis (scleroderma)
Fibromyalgia
Chronic fatigue syndrome
Primary biliary cirrhosis
Hepatitis C
Autoimmune hepatitis
<b>Diabetes mellitus</b>
<b>Renal failure; renal dialysis</b>
<b>HIV infection or AIDS</b>
<b>Sarcoidosis</b>
<b>Graft-versus-host disease</b>
<b>Sleep apnea</b>

proximity to the parotid or submandibular salivary glands can permanently damage the glands and cause loss of saliva production. In the more than 30,000 patients undergoing head and neck cancer radiation protocols annually, xerostomia typically becomes apparent within two weeks of radiation therapy.<sup>14</sup>

Radioactive iodine (<sup>131</sup>I) is used to treat thyroid cancer. Currently, about 60,000 new cases of thyroid cancer occur annually in the U.S., with women being diagnosed about 2.5 times more frequently than men. <sup>131</sup>I is typically administered orally in a single dose. Radioactive iodine has an affinity for accumulating in the major salivary glands (parotid > submandibular), targeting sodium/iodine symporters. Evidence suggests that a significant and persistent degree of salivary gland hypofunction can occur when the dose of <sup>131</sup>I exceeds 100 microcuries. Generally, salivary hypofunction is evident within four weeks of therapy, and significant progression of salivary gland dysfunction occurs within three years of a <sup>131</sup>I ablation.<sup>15</sup>

## Recognition

Recognition of xerostomia begins by asking the patient, “Do you experience a dry mouth?” This is followed by a review of the medical history and their list of medications to determine potential associations. If the patient is experiencing a dry mouth, the clinician should consider administering a questionnaire that explores the symptoms a bit more. For example, the Fox criteria<sup>16</sup> explores four questions where the patient would indicate having at least one or more symptoms related to dry mouth:

- Does your mouth usually feel dry?
- Does your mouth feel dry while eating a meal?
- Do you have difficulties swallowing (dry) foods?
- Is the amount of saliva in your mouth too little most of the time, or don't you notice it?

Patients may report the need to sip or drink liquids while eating and problems with speaking. Since less saliva is typically produced at night, awakening and experiencing a dry mouth may be another manifestation. Saliva is also required to mediate taste perception, which can lead to a loss of or altered taste. A perception of malodor (bad breath) is a frequent complaint of dry mouth patients.

Additional questionnaires that can be used to explore these complaints include the Xerostomia Inventory, which consists of 14 questions involving swallowing, eating, drinking, burning sensations, whether the eyes, lips or mouth feel dry or itch, and what provides relief. The Xerostomia Inventory uses five choices from “Never”, “Hardly Ever”, “Occasionally”, “Fairly Often”, to “Very Often” to determine the frequency of the complaint.

Alternatively, clinicians can use the Xerostomia Inventory-Short Form, which consists of five questions:

- “My mouth feels dry when eating a meal”
- “My mouth feels dry”
- “I have difficulty in eating dry foods”
- “I have difficulties swallowing certain foods”
- “My lips feel dry”

Patients select among three choices, “Never”, “Occasionally” and “Often” for each question. Two or more “Often” positive responses indicate xerostomia.<sup>17</sup>

After the medical history and symptomatology are explored, the clinical examination should include assessing the size and shape of the major salivary glands, palpation of the glands, and milking of fluid from the salivary glands. An enlarged major salivary gland, saliva that appears “frothy”, “thick”, or “stringy” (**Figure 1**), or difficulty in eliciting secretions from the parotid or submandibular gland duct orifices is associated with Sjögren syndrome, blockage of a salivary gland, and hyposalivation.

Clinicians should be aware that salivary secretions from the submandibular, sublingual and minor salivary glands contain high levels of mucins that lubricate and contribute to the “moistness” of the oral mucous membranes.<sup>2</sup> As a result, hyposalivation may lead to various oral manifestations (**Table 3**). One common sign is erythema of the tongue, with loss of filiform papillae and increased fissuring (**Figure 1**). The oral mucous membranes may appear parched; rubbing a finger or mouth mirror over their surfaces may result in sticking rather than sliding over the tissues. Lack of saliva also contributes to the development of oral infections, including dental caries, candidiasis and sialadenitis (see Complications). However, the onset of these features is typically insidious, and patients often demonstrate several of these features before they complain of xerostomia.

## Diagnosis

The term xerostomia is the subjective complaint of a dry mouth by the patient; it is not a diagnosis. When the patient reports this complaint, the clinician should perform assessments to formulate a diagnosis consistent with the complaint. The clinician should carefully review the medical history to rule out medical conditions, medical treatments, and the use of xerogenic medications associated with a dry mouth (**Table 1**).

Figure 1



This xerostomic patient exhibits an inflamed and fissured tongue with atrophy of the filiform papillae and frothy saliva. There is also angular cheilitis secondary to candidiasis. Courtesy of Dr. J. Guggenheimer.

Table 3 - Manifestations of Xerostomia and Hyposalivation

### SYMPTOMS

- Complaint of dry mouth during day or night
- Complaint of lack of moisture in the mouth
- Complaint of a rough, dry or sore tongue
- Complaint of change in taste or loss of taste
- Complaint of bad breath
- Difficulty with eating, swallowing or speaking
- Increased need to keep the mouth moist
- Sensations of burning, tingling or soreness

### SIGNS

- Loss of lingual filiform papillae, fissured tongue
- Frothy, stringy saliva
- Erythema of the oral mucosa
- Accumulation of plaque
- Gingivitis, bleeding
- Evidence of candidiasis
- Cervical decalcification
- Cervical caries
- Crack and chapped lips



Questionnaires such as the Fox criteria, the Xerostomia Inventory, and the Xerostomia Inventory-Short Form help identify the diverse symptoms of xerostomia. Next, the clinician should perform a thorough examination to determine if extraoral or intraoral manifestations are consistent with dehydration or disturbances of salivary secretion.

The use of the Clinical Oral Dryness Score developed by Osailan and Challacombe, as shown below, helps to determine the presence of oral dryness and its severity.<sup>18</sup>

- 1) mirror sticks to the buccal mucosa
- 2) mirror sticks to the tongue
- 3) frothy saliva
- 4) no saliva pooling on the floor of the mouth
- 5) tongue shows loss of papillae
- 6) altered/smooth gingival architecture
- 7) a glassy appearance of other oral mucosae, especially palate
- 8) tongue lobulated/fissured
- 9) active or recently restored (last six months) cervical caries (2 teeth)
- 10) debris on the palate (excluding under dentures).

The scoring system reflects an approximate severity scale; each feature scores 1 point, and the total is determined.

Measures of unstimulated and stimulated salivary flow by sialometry are required to establish the diagnosis of hyposalivation. Hyposalivation is defined as  $\leq 0.1$  mL/min as determined by collecting unstimulated saliva during a specified time. A simple method involves asking the patient to swallow, then starting a timer and asking them to allow saliva to pool in their mouth and spit the saliva every 20 to 30 seconds into a small (3-ounce) disposable cup. After 5 minutes, the collected saliva is poured into a graduated

cylinder or a 5 mL plastic syringe, and the total amount is measured. The total unstimulated flow rate (mL/min) is determined by dividing the total amount by five.

Stimulated salivary flow is measured similarly while the patient is chewing on paraffin wax, chewing on a piece of sugarless chewing gum, or sucking on a lemon-flavored sugar-free lozenge. Alternatively, 2% citric acid can be painted or dropped onto the tongue every 30 seconds to stimulate whole saliva flow rates (the standard flow rate is 1.0 to 3.0 mL/min).

Salivary gland disturbance may be assessed by imaging techniques such as sialography, radionuclide scintigraphy, magnetic resonance sialography, computerized tomography, and ultrasonography. These specialized studies are notably time-consuming and costly. Clinicians should determine whether the results of these tests may be of additional value for the diagnosis or management of patients who have developed xerostomia or definitive manifestations of hyposalivation.

Additional testing is appropriate when one needs to rule out Sjögren syndrome. The diagnosis of Sjögren syndrome is made when the following two criteria are met, and other causes of ocular or oral dryness have been excluded: 1) objective findings of ocular or oral dryness or glandular parenchymal damage, and 2) serologic or histopathologic evidence of autoimmunity (patient has anti-Ro/SSA antibodies with or without anti-La/SSB antibodies). The patient with Sjögren syndrome may or may not have bilateral enlargement of the major salivary glands, reduced tear production, the presence of other autoantibodies, a positive rheumatoid factor, or an elevated antinuclear antibody titer.

The following ICD-10-CM Diagnosis Codes are used for medical billing:

- **K11.7** - disturbance of saliva secretion
- **R68.2** - dry mouth, unspecified

## Complications

**Dental caries.** Loss of saliva, along with its caries-protective electrolytes, calcium and phosphate, buffering proteins, and antimicrobial enzymes, can increase susceptibility for the development of dental caries, which can be devastating and irreversible. This is compounded if patients initially resort to frequent use of sugar-containing candies, lozenges, or similar products to stimulate saliva and keep the mouth moist. The ingestion of fermentable carbohydrates creates an environment that increases the cariogenic oral flora in conjunction with a reduced capacity to recalcify dental enamel. A preference for carbonated soft drinks, fruit juices, and sports drinks has an additive effect on caries susceptibility. Initially, areas of demineralization at the cervical areas develop that can progress (**Figures 2 & 3**) and subsequently extend to the interproximal surfaces (**Figure 4**) and even involve the cusp tip (Class VI caries).

Hyposalivation following head and neck radiation therapy places patients at the most significant risk for developing a particularly aggressive form of “radiation caries” that has been reported to begin within weeks after initiation of radiation therapy.

Increased susceptibility to dental caries also places xerostomic patients at a greater risk for tooth loss. Dental implants are the preferred replacements over other types of fixed or removable prostheses. Studies of xerostomic patients have determined that lack of saliva does not adversely affect the integrity of dental implants, osseointegration or implant survival. Dental implants are successfully retained in patients with Sjögren syndrome and those practicing adequate oral hygiene who have had radiation therapy.<sup>19</sup>

**Gingivitis.** Decreased saliva results in increased supragingival dental plaque, leading to susceptibility to gingivitis, often accompanied by bleeding upon brushing or flossing. Persistent plaque retention can lead to gingival recession with exposure of the root surfaces. The large multicenter OraRad study, which prospectively examined over 500 participants receiving

radiation therapy for head and neck cancer, found reductions in salivary flow correlated in a dose-dependent manner with an increase in gingival recession.<sup>20</sup> As a consequence, xerostomic patients appear to be more susceptible to gingival recession and root caries development (Figure 3).

**Candidiasis.** Colonization by the fungus *Candida albicans* is more likely to develop in xerostomic patients. Extraorally, this can manifest as angular cheilitis (Figure 1). Within the oral cavity, candidiasis appears as erythematous, inflamed mucosa. It also can appear as dense, raised white plaques with erythematous borders. The hard and soft palate are often the first sites to be affected. The infection on the tongue may appear as a well-defined area of atrophy of the keratinized filiform papillae that is usually confined to the midline of the dorsal surface (median rhomboid glossitis, Figure 1).

Xerostomic patients are at increased risk of developing oral candidiasis if they smoke, wear dentures, have diabetes, or take antibiotics or medications with immunosuppressant properties such as corticosteroids. Inhalers for asthma or chronic obstructive pulmonary disease (COPD) not only contain bronchodilators that can cause dry

mouth, but may be combined with a corticosteroid that increases the risk of developing candidiasis. Treatment of candidiasis is with topical antifungal agents.

**Dentures.** Hyposalivation is associated with a decreased performance of complete dentures and removable partial dentures.<sup>21</sup> Edentulous xerostomic patients also are at greater risk for developing candidal infections.

**Sialadenitis.** The elderly, chronically ill, and persons with hyposalivation due to radiation treatment or the use of xerogenic medications are at risk for acute bacterial infections of the salivary glands (sialadenitis). These persons often develop obstructions in the ducts of the parotid and submandibular glands. Features include pain, swelling, tenderness, redness and either no flow from the salivary gland duct or visible pus emanating from the duct orifice. Treatment is with broad-spectrum antibiotics, moist heat, and mucolytic agents.

**Sjögren syndrome.** Persons who have Sjögren syndrome are at increased risk for developing non-Hodgkin lymphoma. The dentist and physician should routinely monitor these patients.

Figures 2 & 3



Cervical decalcification with progression to dental caries in a xerostomic patient. Courtesy of Dr. J. Guggenheimer.



An elderly patient with xerostomia-related cervical caries involving multiple teeth. Courtesy of Dr. J. Guggenheimer.

Table 4 - Fluoride Products for the Prevention and Control of Dental Caries\*

Over-the-Counter Fluoride Supplements
ACT® mouth rinse
ACT® anticavity zero alcohol fluoride mouthwash
Fluorigard® alcohol-free mouth rinse
Gel-Kam® fluoride gel to be brushed on teeth
Karidium® chewable tablet
Lozi-tab® chewable tablet
Thera-Flur® drops
Xerostom® anticavity mouthwash
Prescription Only Fluorides
Fluororinse®
Fluoritab® drops
Karidium®
Karigel®
PreviDent® 5000

Fluoride gels can be used with custom trays to be worn overnight for patients who have developed hyposalivation secondary to radiation therapy.

\* For additional information, access MetLife QRG – Amaechi B. The Role of Fluoride Therapy for Adults. July 2020

Figure 4



A radiograph of a xerostomic patient with advanced rampant cervical and interproximal caries. Courtesy of Dr. J. Guggenheimer.

## Prevention & Treatment

Ongoing dental care for patients with xerostomia must be provided with an emphasis on preventing dental caries, irrespective of the cause of xerostomia. The practitioner can provide guidance and monitor the patient, but patients must comply with and adhere to a meticulous oral hygiene regimen. Hygiene can be augmented with a power toothbrush and other oral physiotherapy aids. It is essential that patients frequently apply fluoride-containing dentifrices augmented with OTC or higher concentrations of prescription fluoride mouth rinses, chewable tablets, or gel applications with custom tray carriers for the prevention of the initial demineralization process (**Figure 2**) (**Table 4**). Fluoride applications also enhance the remineralization of exposed root surfaces. Carious lesions can be restored with glass ionomer materials that provide ongoing fluoride release to the teeth.

Recall visits at shorter intervals should be encouraged to monitor compliance with home care, promptly identify areas of demineralization, and restore early carious lesions. Office visits should include prophylaxis and the application of fluoride varnish. Dietary counseling should reinforce avoiding foods and beverages that contain fermentable carbohydrates and “hidden sugars.” The detriment of frequent sugar intake should be explained, and between-meal snacks discouraged.

The patients’ physicians should be consulted to determine if their medication(s) can be substituted with alternate classes of drugs with less xerogenic side effects or if the dose can be reduced. Patients also should be educated about beneficial foods, weight loss, and exercise that could replace the need for medications. Alternatively, taking medication(s) in divided doses and not taking them before bedtime may provide additional benefit since saliva production is diurnal, with less secreted at night.

Protocols for dry mouth generally include informing the patient to drink 6 to 8 glasses (8 ounces) of water daily and frequently sip dissolved ice chips, use emollients (coconut oil), and a humidifier in

the bedroom. Frozen water can provide additional benefits. Small ice cubes containing a drop of lemon flavoring cool and moisten the mouth and stimulate salivary flow. Patients should be advised to avoid caffeine, tobacco, and alcohol, which are dehydrating and avoid certain dentifrices that contain sodium lauryl sulfate, which removes the protective mucin layer of the oral mucosa. Alcohol-free mouthwash products are advised.

Patients are encouraged to use citrus-flavored sugarless gum/mints/candies. One sugar-free chewing gum (Mighteaflo gum and lozenges) stimulates salivary flow. However, this can only be effective if the patient has residual and functional salivary gland tissue with some natural salivary flow.

Many OTC products are available as oral solutions, aerosols, sprays, gels, lozenges or troches to alleviate the discomfort associated with xerostomia (**Table 5**). They are formulated to function as saliva substitutes and replicate some of the constituents in natural saliva. These moistening agents may have a limited duration of action and require frequent re-administration; thus, the cost can be a consideration. The relative effectiveness of these products is patient and use-dependent and generally is best when combined with additional aspects of a dry mouth protocol.

Two pharmacologic agents, pilocarpine and cevimeline (**Table 5**), can stimulate salivary secretions provided the patient has residual and functional glandular tissue. Since these drugs require systemic administration to stimulate the cholinergic receptors of the salivary glands, they can cause side effects such as flushing, sweating, rhinitis, abdominal cramping, nausea, vomiting, and increased frequency of urination. It is advisable to consult with the patient’s physician before prescribing these drugs because of potentially medically significant systemic effects, including dizziness and blurred vision. Furthermore, they are contraindicated in patients with narrow-angle glaucoma, obstructive urinary or gall bladder disease, or a history of cardiovascular disease, particularly cardiac arrhythmias.

Saliva electrostimulation devices are available OTC for extraoral or intraoral use. One intraoral device designed to stimulate the lingual nerve effectively increased salivary flow and reduced xerostomic symptoms among patients with Sjögren syndrome and other causes of xerostomia. A similar device, by prescription, can be embedded in a prosthesis, but both types can only be effective if the patient has residual salivary gland function.

Complications such as dental caries and candidiasis are best managed by prevention. If dental caries develop, patients are optimally served if restorations are completed early in the course of the infection and accompanied by a thorough explanation of the importance of diet, saliva, and fluoride. Candidiasis is managed with antifungal agents listed in **Table 5**. These should be used daily for at least two weeks for the infection to resolve. If tolerated, alcohol-free chlorhexidine gluconate-containing mouthwash (Peridex®) can prevent recurrent infections in more susceptible patients. Keeping the mouth moist and using any of the agents listed in **Table 5** may also reduce the risk of reinfection.

The future holds much promise for patients who have hyposalivation. A clinical trial using viral vector delivery of an aquaporin gene is underway for patients with radiation-induced dry mouth. *Aquaporin* is a transmembrane channel protein that helps water diffuse across cell membranes.

## Conclusions

This Guide provides the practitioner with information to help identify the causes, diagnosis, and management of xerostomia and hyposalivation and their complications. It is evident that managing patients with xerostomia and hyposalivation is challenging, and therapies continue to be developed. Irrespective of its cause, xerostomia or hyposalivation most often becomes a chronic condition that may be irreversible. Treatment should be focused primarily on the causes so that complications can be prevented.

Table 5 - Products and Preventive Strategies for Xerostomic Patients

**Alcohol-free mouth rinses**

Biotene Dry Mouth Oral Rinse®  
 Biotene Dry Mouth Gentle Oral Rinse®  
 Crest Pro-Health Multi-Protection Refreshing Mouthwash®  
 Listerine Total Care Zero Anticavity Mouthwash®

**Artificial Saliva/Moisturizing Saliva Substitute Sprays**

Biotene Oral Balance® Moisturizing Products  
 Biotene Dry Mouth Moisturizing® Spray  
 Lubricity® Dry Mouth Oral Spray  
 MEDActive® Oral Relief Spray For Dry Mouth  
 Moi-Stir® Oral Spray Mouth Moistener  
 Mouth Kote® Dry Mouth Spray  
 NeutraSal®  
 Oralube®  
 SalivaMax® powder dissolved in water  
 TheraBreath Dry Mouth® Oral Rinse  
 Xerostom Dry Mouth Saliva Substitute

**Candidal Infections**

Mycostatin® oral suspension  
 Mycostatin® pastilles  
 Mycelex® troches  
 PerioGard®, Peridex® alcohol-free oral rinse

**Lozenges and Patches**

ACT Total Care Dry® Mouth Lozenges  
 MEDActive® Oral Relief Lozenges  
 OraMoist® Patches  
 Optimoist Oral Moisturizer-Colgate Oral®  
 TheraBreath Dry Mouth® Lozenges

**Salivary Stimulants**Prescription Pharmacologic Agents

Pilocarpine (Salagen®)  
 Cevimeline (Evoxac®)

Prescription Electrostimulation Devices (GenNarino Saliwell Ltd™)Over-the-Counter Electrostimulation Devices (Saliwell™)**Xylitol-containing Lozenges**

ACT Dry Mouth Lozenges®  
 Mightteaflow Natural Dry Mouth Lozenge with Xylitol®  
 Oracoat Xylimelts®

**Xylitol-containing Candies/Mints**

Dr. John's Inspired Spray®  
 PRO-SYS Xylitol Lollipops®  
 Spry Xylitol Mints®  
 3M ESPE TheraMints 100% Xylitol®

**Xylitol-containing Chewing Gums**

Epic Dental 100% Xylitol Gum®  
 Ice Cubes from Ice Breakers® (not 100% xylitol)  
 Mightteaflow® chewing gum  
 PUR Gum Aspartame Free®  
 Spry Xylitol Gum®  
 XyliChew Soft Chewing Gum®

**Xylitol Sprays**

Allday 100% Xylitol Dry Mouth Spray®  
 Spry Xylitol Moisturizing Mouth Spray®



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## Additional Online Resources

- <http://www.nidcr.nih.gov/oralhealth>
  - o Dry mouth/xerostomia
  - o Saliva and Salivary Gland Disorders • Sjögren's Syndrome
- Sjögren's Syndrome Foundation: <http://www.sjogrens.org>
- <https://oralcancerfoundation.org/complications/xerostomia/>
- <https://www.mayoclinic.org/diseases-conditions/dry-mouth/diagnosis-treatment/drc-20356052>
- Oral Complications of Chemotherapy and Head/Neck Radiation (PDQ®)—Health Professional Version <https://www.cancer.gov/about-cancer/treatment/side-effects/mouth-throat/oral-complications-hp-pdq#:~:text=The%20most%20common%20oral%20complications,dehydration%2C%20dysgeusia%2C%20and%20malnutrition.>

## Other Reading

- Clinician's Guide to Salivary Gland and Chemosensory Disorders. 2nd edition (2019) Brennan MT, Fox PC, eds. Available from the American Academy of Oral Medicine 2150 N 107th St Suite 205, Seattle, WA 98133.

## POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the “Online Exam.” We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(1.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. **Xerostomia is:**
  - a. a symptom.
  - b. a sign.
  - c. a diagnosis.
  - d. always associated with hyposalivation.
2. **Which of the following is TRUE?**
  - a. Xerostomia occurs in about 20% of 60-year-olds.
  - b. Xerostomia is equivalent to hyposalivation.
  - c. The most common cause of xerostomia is Sjögren syndrome.
  - d. Treatment of xerostomia requires the production of more saliva.
3. **Features of a dry mouth include the following EXCEPT:**
  - a. A dental mirror sticks to the tongue or buccal mucosa.
  - b. Thick stringy saliva.
  - c. Loss of filiform papillae of the tongue.
  - d. Loss of gingival papillae.
4. **Which of the following is the LEAST viable option for managing patients with xerostomia and concurrent cardiac arrhythmia?**
  - a. Changing their medications.
  - b. Stimulating more saliva production.
  - c. Providing artificial substitutes for saliva.
  - d. Providing sources for consistent oral moisture.
5. **The most reliable method for determining if the patient has hyposalivation is to:**
  - a. examine the oral mucosa.
  - b. perform sialometry.
  - c. determine the number of xerogenic medications being taken.
  - d. establish the presence of diseases linked to secondary Sjögren syndrome.
6. **At rest, unstimulated whole saliva is normally produced at a rate of:**
  - a. 0.1 to 0.2 mL/min.
  - b. 0.3 to 0.4 mL/min.
  - c. 0.5 to 0.6 mL/min.
  - d. 1.0 to 2.0 mL/min.
7. **The most reliable method for validating a patient’s symptoms of xerostomia should be based on:**
  - a. Measuring the amount of saliva production.
  - b. The ability to elicit secretions from the salivary gland ducts.
  - c. Patient responses to a xerostomia questionnaire.
  - d. Positive laboratory tests for any of the diseases associated with xerostomia.
8. **Radiation caries have been reported to begin:**
  - a. when the salivary flow rate drops below 1.0 mL/min.
  - b. within weeks after initiation of head and neck radiation therapy.
  - c. on occlusal surfaces, then spreading apically.
  - d. after a single dose of radiative iodine therapy for thyroid cancer.
9. **Several specific and specialized laboratory studies are available to determine:**
  - a. which medications cause xerostomia.
  - b. which patients are more susceptible to dental caries.
  - c. which patients have developed Sjögren syndrome.
  - d. which patients have lost oral lubrication.
10. **Treatment of oral candidiasis requires:**
  - a. an adequate amount of saliva.
  - b. prophylactic use of an antifungal agent.
  - c. daily use of antifungal treatment for about five days.
  - d. daily use of antifungal treatment for 14 days.

## Registration/Certification Information (Necessary for proper certification)

Name (Last, First, Middle Initial): \_\_\_\_\_

Street Address: \_\_\_\_\_ PLEASE PRINT CLEARLY Suite/Apt. Number \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Telephone: \_\_\_\_\_ Fax: \_\_\_\_\_

Date of Birth: \_\_\_\_\_ Email: \_\_\_\_\_

State(s) of Licensure: \_\_\_\_\_ License Number(s): \_\_\_\_\_

Preferred Dentist Program ID Number: \_\_\_\_\_  Check Box If Not A PDP Member

AGD Mastership:  Yes  No

AGD Fellowship:  Yes  No Date: \_\_\_\_\_

Please Check One:  General Practitioner  Specialist  Dental Hygienist  Other

FOR  
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## Evaluation - Managing Dental Patients with Xerostomia and Hyposalivation 1st Edition

Providing dentists with the opportunity for continuing dental education is an essential part of MetLife's commitment to helping dentists improve the oral health of their patients through education. You can help in this effort by providing feedback regarding the continuing education offering you have just completed.

Please respond to the statements below by checking the appropriate box, using the scale on the right.

1 = POOR

5 = Excellent

	1	2	3	4	5	
1. How well did this course meet its stated educational objectives?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. How would you rate the quality of the content?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Please rate the effectiveness of the author.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. Please rate the written materials and visual aids used.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. The use of evidence-based dentistry on the topic when applicable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> N/A
6. How relevant was the course material to your practice?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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10. How likely are you to recommend MetLife's CE program to a friend or colleague? *(please circle one number below:)*

<b>10</b>	<b>9</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>
extremely likely				neutral						not likely at all

What is the primary reason for your 0-10 recommendation rating above?

11. Please identify future topics that you would like to see:

Thank you for your time and feedback.

