

# Hyposalivation in Elderly Patients

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### ABSTRACT

Saliva is a key element in oral homeostasis, oral function and maintenance of oral health. Dry mouth has multiple oral health consequences and affects quality of life. The incidence of dry mouth and its public health impact are increasing due to the aging population, the effects of some systemic diseases, and medical management and commonly prescribed medications that reduce saliva production. In this paper, we review the causes of dry mouth and its impact on health. The role of dental providers and current management of dry mouth is presented.

**MeSH Key Words:** aging/physiology; salivary glands/secretion; xerostomia/etiology; xerostomia/therapy

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**S**aliva helps maintain a neutral oral pH and provides a reservoir of calcium and phosphate ions to remineralize teeth. Saliva protects oral mucosa and teeth against harmful substances; lubricates the mouth to facilitate chewing, swallowing and speech; and reduces tissue trauma. Saliva contains enzymes, immunoglobulin A, lactoferrin, histatins and defensins, which provide local antimicrobial activity. Saliva also acts as a solvent to enhance taste and facilitate the initial steps in digestion.

A decrease in salivary flow (hyposalivation), leading to a complaint of dry mouth (xerostomia), is common in older people. Salivary function was thought to decline with age, but it is now accepted that the production of saliva and its composition are largely age independent in healthy people.<sup>1–8</sup> Salivary dysfunction in old age is mainly a consequence of systemic diseases, medications and head and neck radiotherapy; it also reflects reduced functional reserve. Current treatment approaches for management of xerostomia are directed toward providing relief of symptoms

and resulting conditions. They include gustatory, masticatory and pharmacologic stimulants,<sup>9</sup> replacement therapies (mouth-wetting agents) and prevention of effects on oral health due to hyposalivation.

### The Burden of the Disease

The prevalence of xerostomia increases with age and is approximately 30% in those aged 65 years and older.<sup>9</sup> Drugs are the most common cause, because most elderly people take at least 1 medication that adversely affects salivary function.<sup>10</sup> Almost all patients with Sjogren syndrome (SS) complain of xerostomia and show impaired salivary function on examination. The prevalence of SS is 1% to 4% in older adults<sup>11,12</sup> and is more common in females. Head and neck radiotherapy causes permanent damage to salivary glands in all patients receiving this treatment<sup>13</sup> when salivary glands are in the radiation field.

Hyposalivation contributes to a number of health problems. It can produce serious negative effects on the patient's quality of life by affecting dietary habits, nutritional status,

**Box 1** Consequences of xerostomia

Dry mouth  
Thirst  
Difficulties in oral function  
Dysphagia  
Altered speech  
Difficulties wearing dentures  
Nocturnal oral discomfort  
Oropharyngeal infections  
Oropharyngeal burning  
Mucus accumulation  
Food retention in the mouth  
Plaque accumulation  
Changes in oral microbial flora  
Mucosal changes  
Hyposalivation-associated caries  
Taste disturbances

**Table 1** Subjective evaluation of xerostomia<sup>15,16</sup>

Do you have difficulties swallowing any foods?	Yes/No
Does your mouth feel dry while eating a meal?	Yes/No
Do you sip liquids to aid in swallowing dry foods?	Yes/No
Does the amount of saliva in your mouth seem to be too little?	Yes/No
Does the amount of saliva in your mouth seem to be too much?	Yes/No
Dryness of lips	Present/Absent
Dryness of buccal mucosa	Present/Absent

speech, taste and tolerance to dental prosthesis and increasing the risk of oral infection, including candidiasis, and susceptibility to dental caries, periodontal disease and tooth loss (**Box 1**).

Patients may have problems while eating, speaking, swallowing and wearing dentures. It is particularly difficult for people with hyposalivation to eat dry foods such as biscuits (cracker sign). Denture wearers may have problems in denture retention, denture sores and the tongue sticking to the palate. Patients also complain of halitosis, a chronic burning sensation and intolerance of spicy foods.<sup>14</sup> Complaints of xerostomia are more common at night because salivary production is at its lowest circadian level during sleep; the problem may be compounded by mouth breathing. Speech and eating difficulties can impair social interactions and may cause some patients to avoid social engagements.<sup>9</sup>

### Diagnosis

Diagnosis of hyposalivation is based on the patient's history and clinical examination. Diagnosis may be facilitated by asking simple questions (**Table 1**). It is very important to elicit an accurate drug and family history.

Extraoral findings include dry and cracked lips, which may be infected with *Candida*, and occasionally enlarged salivary glands. Some older people may develop acute parotitis after undergoing extended periods of dehydration and anesthesia due to secondary retrograde salivary infection. Patients may also report dryness of the eyes along with xerostomia, which is suggestive of primary SS. Other systemic autoimmune diseases, such as rheumatoid arthritis, polyarthritis nodosa, scleroderma

(systemic sclerosis) and systemic lupus erythematosus may also be present in secondary SS.

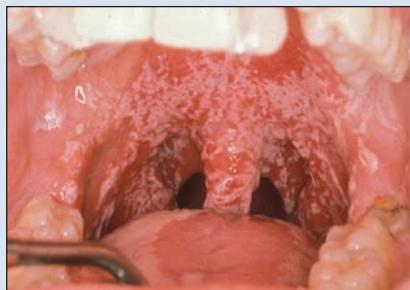
The oral mucosa may appear dry and shiny (**Fig. 1**). The clinical manifestations of candidiasis include angular cheilitis and erythematous candidiasis, which may be more common than pseudomembranous candidiasis (thrush), which is more readily recognized.<sup>17–20</sup> The tongue can become furrowed, dry and sticky or it can undergo partial or complete depapillation of the dorsum (**Fig. 2**). Palpation of the parotid papilla and milking of the gland and duct may reveal little or no saliva output. Food debris may stick to teeth or soft tissue and the normal pooling of saliva in the floor of mouth is absent. A tongue depressor, used to examine the mouth, can stick to the buccal mucosa. The dry mucosa is more susceptible to trauma and infection, and the patient may be suffering from painful mucositis.

Recurrent carious lesions are seen on the cervical margins or neck of the teeth (Class V), incisal margins and cusp tips (Class VI) (**Fig. 3**). These lesions are more common in today's elderly, because of the increasing prevalence of retained natural teeth and previously restored carious dental surfaces.<sup>9</sup>

Salivary flow rates can be measured (sialometry). Resting saliva can be collected by asking the patient to dribble into a measuring container for 3–5 minutes, and stimulated saliva can be collected by having the patient chew unflavoured wax or chewing gum base during collection for 3–5 minutes. In healthy people, the unstimulated whole saliva rate exceeds 0.15 mg/min.<sup>21</sup> When glandular fluid production is decreased by about 50%, a person will have symptoms of dry mouth.<sup>22</sup> The best strategy is to monitor a patient's salivary health (objectively and subjectively) over time. Sialographic studies, which involve injection of a radiopaque medium into the glands, can be employed to assess ductal obstruction and damage to the gland seen in SS. Quantitative salivary



**Figure 1:** Patient with hyposalivation, dry mucosa and chronic ulceration on lateral border of the tongue.



**Figure 2:** Candidiasis in patient taking antidepressant medications that cause dry mouth. Oral findings include pseudomembranous candidiasis with white adherent patches on the palate and erythematous candidiasis presenting with erythema and depapillation on the mid-dorsum of the tongue.



**Figure 3:** Extensive demineralization and cavitation of teeth in a patient with hyposalivation.

scintigraphy can be used to assess salivary gland function. Biopsy of minor salivary glands may be useful in diagnosis of SS and is required for diagnosis of salivary gland neoplasms. Fine-needle aspiration biopsy may be useful to identify lesions suspected of malignancy.<sup>23</sup>

## Common Causes of Hyposalivation

### Medications

Medications are the most common cause of decreased salivary function (**Table 2**). It has been reported that 80% of the most commonly prescribed medications cause xerostomia. Xerostomic drugs can be found in 42 drug categories and 56 subcategories.<sup>24,25</sup> The use of medications increases with age, with more than 75% of people aged 65 and older taking at least 1 prescription medication<sup>26</sup>; therefore, the prevalence of medication-induced xerostomia is high in the elderly.<sup>27</sup>

The most common medications causing hyposalivation are those with anticholinergic activity. Although cancer chemotherapy has also been associated with reduced salivary function,<sup>28,29</sup> these changes appear to be transient in most patients. Radioactive iodine used for thyroid cancer treatment can affect parotid function in a dose-dependent fashion.<sup>30</sup>

Substitution of xerostomia-causing drugs with similar types of medication with fewer xerostomic side effects should be considered whenever applicable. For example, serotonin-specific reuptake inhibitors have been reported to cause less dry mouth than tricyclic antidepressants.<sup>31</sup> Milnacipran, used in combination with noradrenaline-serotonin reuptake inhibitor in cases of depression, has been shown to improve outcome and was associated with fewer dry-mouth symptoms than clomipramine.<sup>32</sup> Use of anticholinergic drugs during the day will minimize

symptoms at night. Also, divided doses can eliminate the side effects of a single large dose.

### Head and Neck Radiotherapy

Hyposalivation is a common side effect of fractionated radiation therapy of head and neck.<sup>33</sup> Acute xerostomia is usually due to acute inflammatory reaction, whereas late xerostomia following radiation therapy results from fibrosis of salivary glands, loss of acinar cells and reduced blood flow.<sup>34</sup> Within 1 week of the start of irradiation (after 10 Gy have been delivered), salivary function declines 60% to 90%,<sup>35</sup> with later recovery only if the total dose to salivary tissue is less than 25 Gy.<sup>36</sup> After a high radiation dose (> 60 Gy), degenerative changes progress and the glands atrophy and become fibrotic. Patients often develop thick, sticky saliva after starting head and neck radiotherapy, due to loss of serous secretion initially, followed by lack of any secretion and xerostomia. The degree of salivary gland damage depends on the number of salivary glands exposed to radiation and the dose. Radiation doses of 23 and 25 Gy are the threshold, above which permanent salivary gland destruction occurs.

Intensity-modulated radiotherapy and 3-dimensional treatment planning and dose delivery techniques can minimize radiation exposure of salivary glands, sparing salivary function and improving xerostomia-related quality of life.<sup>36,37</sup> Use of a radioprotective agent, amifostine, provides cytoprotection to the gland and has been shown to reduce hyposalivation following radiation therapy.<sup>34</sup> Surgical replacement of submandibular glands can be used to remove them from the path of radiation.

### Other Conditions

SS is the most common disease causing xerostomia in the elderly. It is an autoimmune chronic inflamma-

tory disease with preponderance among females (female to male ratio 9:1). The disease is characterized by lymphocyte infiltration of salivary and lacrimal glands resulting in hypofunction. The disease can occur in 2 forms: primary, which involves the salivary glands, or secondary, which occurs along with other autoimmune disorders (mainly rheumatoid arthritis). Xerostomia and xerophthalmia are the main symptoms of primary SS. Secondary SS also presents with symptoms of associated systemic conditions.

Dehydration due to impaired fluid intake, emesis, diarrhea or polyuria can result in hyposalivation. Dry mouth is also a common complaint in patients with diabetes mellitus.<sup>38</sup> Psychogenic causes, such as depression, anxiety, stress or fear, can also result in xerostomia. In cases of Alzheimer's disease or stroke, patients may complain of dry mouth in the presence of normal salivary secretion due to altered perception.

### Management of Hyposalivation

The management of dry mouth should begin with identification and management of the underlying cause, although this is not always possible. There is no definitive treatment for patients with dry mouth due to radiation therapy or SS. Treatment is directed toward local and systemic salivary gland stimulation, symptomatic relief and preventing and treating complications due to hyposalivation.

Patients with xerostomia should undergo frequent dental evaluations for early diagnosis of oral complications. Patients should be encouraged to carry out daily oral self-examinations for any mucosal ulcers, lesions or tooth decay and to report any unusual findings.

The mainstay of prevention of dental caries is meticulous plaque control through excellent oral hygiene. Patients should be instructed to brush their teeth at least twice a day using a soft-bristled toothbrush and a low-abrasive highly fluorinated toothpaste or gel<sup>12</sup> such as Prevident (Colgate Palmolive Co., New York, N.Y.). In addition, use of sodium fluoride rinses or fluoride gel may reduce tooth decay.<sup>39</sup> The most suitable topical fluoride gels contain 0.4% to 1.25% fluoride, have neutral pH and are applied in mouthguards (custom-made fluoride carriers). In high-risk patients, such as those undergoing daily radiation therapy, high-potency fluoride treatment is recommended. Use of both fluoride and chlorhexidine is effective in high-risk irradiated patients.<sup>40</sup> Patients should be advised against using alcohol and tobacco and to adopt a low-sugar diet to control dental caries. Xylitol-sweetened gums are effective in caries prevention and can be easily incorporated into a patient's routine.<sup>41</sup>

Denture use at night should be discouraged. Denture hygiene should be maintained with brushing and denture cleansers. In the case of candidiasis, dentures may be cleaned with 0.2% chlorhexidine solution overnight or a

**Table 2** Drugs associated with dry mouth

Drugs that directly damage salivary glands
Cytotoxic drugs
Drugs with anticholinergic activity
Anticholinergic agents: atropine, atropinics and hyoscine
Antireflux agents: proton-pump inhibitors (e.g., omeprazole)
Central-acting psychoactive agents
Antidepressants, including tricyclic compounds
Phenothiazines
Benzodiazepines
Antihistamines
Bupropion
Opioids
Drugs acting on sympathetic system
Drugs with sympathomimetic activity (e.g., ephedrine)
Antihypertensives: alpha-1 antagonists (e.g., terazosin and prazosin); alpha-2 agonists (e.g., clonidine); beta blockers (e.g., atenolol, propanolol), which also alter salivary protein levels
Drugs that deplete fluid
Diuretics

Adapted from Scully and Felix.<sup>21</sup>

1% chlorhexidine gel twice a day. Oral candidiasis can be treated with topical antifungal agents, such as nystatin cream and azole gel and, if refractory, systemic therapy with fluconazole may be provided.

Salivary stimulation is the preferred treatment in patients with residual capacity in the salivary glands. Salivary secretion is increased by nonspecific mechanical and gustatory stimulants. The combination of chewing and taste, as provided by gums and mints, can be effective in relieving symptoms. Citric acid can stimulate salivation, but its use is limited because of attendant mucosal irritation and the risk of demineralization in patients with teeth. Sugar-free chewing gums, candies and mints are useful in patients with residual salivary capacity. A disadvantage of local saliva stimulants is their limited effectiveness during the night when the symptoms are most severe.

Pharmacologic agents stimulate salivary output and produce a lasting effect throughout the day. Pilocarpine (Salagen, MGI Pharma Inc., Bloomington, Minn.) and cevimeline (Evoxac, Daiichi Pharmaceuticals, Tokyo, Japan) have been approved for use in xerostomic patients.<sup>42-44</sup> Pilocarpine is a nonspecific muscarinic agonist and has widespread pharmacologic effects on the body. When taken as tablets of 5–10 mg, 3 times a day, such adverse effects as sweating, chills, nausea, dizziness, rhinitis

**Table 3** Commercially available mouth-wetting agents (saliva substitutes)

Carboxymethyl or hydroxyethyl solutions
Moi-Stir spray; Moi-Stir Oral Swabsticks (Kingswood Laboratories, Indianapolis, Ind.)
Optimoist spray (Colgate-Palmolive, Canton, Mass.) — sodium-free
Saliva Substitute (Roxane Labs, Columbus, Ohio) — liquid
Salivart (Gebauer, Cleveland, Ohio) — preservative-free aerosol
Salix (Salix Pharmaceuticals Inc, Morrisville, N.C.) — tablets
VA OraLube (compounding pharmacies) — sodium-free liquid
Entertainer's Secret (KLI Corp, Carmel, Ind.) — spray
Biotene products
Oral Balance Gel (Laclede Pharmaceuticals, Gardena, Calif.)
Animal mucin product
Glandsane (Bradley Pharmaceuticals, Fairfield, N.J.)
Mucopolysaccharide solutions
MouthKote (Parnell, San Francisco, Calif.) — spray

Adapted from Bartels<sup>51</sup> and Epstein and Stevenson-Moore.<sup>52</sup>

and asthenia in patients suffering from irradiation-induced xerostomia have been observed. The recommended initial dose is a 5-mg tablet 3 or 4 times a day; the usual dose range is 3–6 tablets (15–30 mg) a day, not exceeding 2 tablets (10 mg) per dose. Slow-release preparations of pilocarpine have been developed to minimize side effects and prolong the drug's duration of action. Nanoparticles loaded with pilocarpine are being investigated as a new mode of drug delivery.<sup>45</sup>

Cevimeline is a cholinergic agonist with high affinity for M<sub>3</sub> muscarinic receptor subtypes, which are located on salivary and sweat glands. Thus, it can cause salivary stimulation while minimizing adverse effects on cardiac and pulmonary function. It is contraindicated in patients with asthma and narrow-angle glaucoma. It is used during pregnancy if the benefits are considered acceptable, although animal studies show adverse effects on the fetus. The recommended dose is 30 mg 3 times a day. Bethanechol, another cholinergic-muscarinic sialogogue has increased salivary secretion in irradiated patients when taken at the rate of 25 mg 3 times daily. Anethole trithione (Sialor, Paladin, Montreal, Que.) is used for the treatment of xerostomia in patients with SS. Unlike other sialogogues, it increases receptor sites on salivary acinar cells. Its beneficial effects in SS patients taking 25-mg doses 3 times a day have been reported.<sup>46</sup> A combination

of pilocarpine and anethole trithione has shown a synergistic effect on salivary secretion.<sup>47</sup>

Human interferon-alpha, used as low-dose lozenges, has significantly increased salivary secretion in SS patients.<sup>48–50</sup> In 1 study, oral administration of 150 IU interferon-alpha 3 times a day for patients with primary SS improved saliva production, relieved symptoms of xerostomia and xerophthalmia and was well tolerated.<sup>49</sup>

If saliva secretion cannot be stimulated, symptomatic treatment involves the use of saliva substitutes (**Table 3**). Patients should be encouraged to take frequent sips of water throughout the day. Use of water during meals can aid in swallowing and improve taste perception. Commercially available saliva substitutes containing thickening agents, such as carboxymethyl cellulose or mucin, are the most common. Recently, saliva substitutes based on polyacrylic acid and xanthan gum have been developed and are recommended for patients with extremely low salivary production rates. Although there is clearly a role for saliva replacements, particularly in those who have no residual salivary gland function, this is not a highly effective therapy.

Use of bedside humidifiers, particularly at night, may lessen discomfort due to oral dryness.

Oral health and function depend on salivary function. Although hyposalivation is common in elderly patients, it is frequently not assessed and managed. ♦

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