

## DRY MOUTH

### Definition

Dry mouth and oral dryness are general terms that encompass 2 medical entities: xerostomia and hyposalivation.

Xerostomia is the *subjective* complaint of oral dryness, and is medically classified as a symptom.

Hyposalivation is the *objective* reduction in salivary secretion, as the consequence of reduced salivary gland function.

Generally, these conditions are closely related to each other: a reduced salivary flow is the most frequent cause of xerostomia, and it is generally accepted that hyposalivation causes the symptom of oral dryness when salivary secretion rate is reduced by at least 50%. Nevertheless, in certain cases these entities do not seem to be interrelated, since some patients complaining of dry mouth do not show any objective evidence of a reduced salivary flow and, in turn, some patients with proven salivary gland hypofunction do not report symptoms of xerostomia.

It should be stressed that the variability of normal salivary secretion rate in the population is very large. Ideally, reduction in salivary secretion should be established on an individual basis when compared to the normal secretion of every single patient in the past (Figure 1).

### Epidemiology

Population studies on xerostomia are based on questionnaires asking if and how frequently the screened persons suffer from dry mouth symptoms. According to recent reports the prevalence (occurrence) of xerostomia (which means persons complaining of dry mouth either “frequently” or “always”), in the adult population is as follows:

- 24% of females and 18% of males, 19-88 years old Rochester (New York, USA) residents.
- 27.3% of females and 21.3% of males, 20-80 years old Swedish residents.
- 29% of 18-83 year old New York City residents.
- 9.7% of adult Barcelona (Spain) residents.

Xerostomia is especially frequent in the elderly. In this specific population, xerostomia has been reported to occur in 17 to 39% of the persons aged 65 years or more. In addition, xerostomia is more frequent among women than men.

Based on available data, a conservative analysis of the occurrence of xerostomia in the developed world shows a prevalence of 80 million people. The following table summarises the results of the analysis:

Age (years)	% of total population	Population (millions)	% of xerostomia complainers	Number of xerostomia complainers (millions)
20-40	25	285	5	14
40-60	20	230	10	23
60 and more	25	285	15	43
<b>Total</b>	<b>70</b>	<b>800</b>	<b>10</b>	<b>80</b>

As to the prevalence of hyposalivation, very few population-based data are available. This condition has been found in over 22% of older South Australians and in almost 12% of Israeli elderly people.

### **Clinical presentation**

Saliva is a crucial protective factor of the oral cavity and enables its normal functioning (speech, alimentation) due to its lubricatory and defensive properties.

- Taste perception is facilitated by saliva carrying food particles onto the taste buds in an appropriate dilution.
- Salivary amylase and lipase start the digestion of starch and fat.
- Saliva is also important in the formation of the food bolus, assisting in food mobility and reducing friction between the different oral structures (teeth, tongue, cheeks, lips) and between these structures and foreign elements (food, dental prostheses).
- Salivary lubrication, repair, lavage, antimicrobial and buffering properties contribute significantly to the maintenance of oral hard and soft tissue integrity.

The full accomplishment of these functions depends on proper salivary flow rate and composition.

Consequently, hyposalivation may induce a variety of oral hard and soft tissue pathological changes, generally classified as “complications”.

The lower the salivary flow rate, the less salivary defense and lubrication components enter the oral cavity.

### Soft tissues changes:

- The mucosal tissues may become painful, “burning”, dry and atrophic. A typical complication of hyposalivation is the occurrence of cracked lips.

- Hyposalivation may trigger a painful salivary gland infection called “sialoadenitis”, characterized by facial swelling, pain and, in certain cases, fever. The most frequent salivary gland infection is located on the parotid glands and is therefore named “parotitis”.
- Another frequent oral infection in patients affected by hyposalivation is candidosis. It is a fungal infection due to the *Candida* species of fungi, which can clinically present as white patches, redness (erythema and/or atrophy) and burning of the oral mucosa. Candidosis is more common in denture wearers.

#### Hard tissues changes:

An increased rate of dental caries with a distinctive cervical pattern of decay, which is extremely difficult to treat, is typically seen.

#### Other symptoms:

- Denture wearers often complain of severe discomfort with their dental appliance.
- Decreased salivary secretion often leads to difficulties in chewing, swallowing and speaking and a diminished taste sensation. Furthermore, patients frequently have to wake up at night repeatedly to sip water.
- Another relevant symptom that have been related to hyposalivation is halitosis (bad breath; oral malodour)

In summary, the consequences of a reduced salivary flow compromise not only the biological integrity of the individual and the oral health status but also the general quality of life and well-being and can lead to reclusion and loneliness.

### **Etiopathogenesis**

Xerostomia, as the symptom of oral dryness, results most frequently from hyposalivation.

Other causes of xerostomia not related to hyposalivation are habits (such as mouth breathing), sensory impairment, and psychological or unknown (idiopathic) factors.

Hyposalivation can be caused by systemic diseases or by their treatment.

#### Systemic diseases as causes of hyposalivation

Sjögren’s syndrome (SS), an autoimmune disease causing oral and ocular dryness, is the second most frequent cause of hyposalivation.

Hepatitis C virus (HCV) infection is estimated to affect about 3% of the world population. HCV-infected patients may present a chronic inflammation of the salivary glands, which may lead to hyposalivation. This condition assumes particular importance in those nations where HCV infection is common.

Others diseases with associated hyposalivation are Alzheimer’s disease, autonomic neuropathies, cystic fibrosis, depression, diabetes, graft-versus-host disease, HIV infection, sarcoidosis and others.

#### Medical treatments as causes of hyposalivation

Drug induced hyposalivation is the most frequent type of hyposalivation. At least 400 kinds of medications have been reported to cause dry mouth. Salivary flow is particularly reduced when two or more hyposalivatory drugs are taken simultaneously. As appreciated in the following listing, many of these agents are taken for long periods of times, often lifelong, and their deleterious effects increase with time.

**List of xerogenic medications**

- Cardiovascular agents, including antihypertensives drugs
- Tranquilizers and hypnotics
- Antidepressants
- Anti-psychotic agents
- Amphetamine derivatives
- Anticonvulsants
- Anti-Parkinsonian drugs
- Some gastro-intestinal and genitourinary systems agents
- Respiratory system and anti-allergic agents, including antihistamines
- Some steroidal and nonsteroidal anti-inflammatory drugs, anti-infective agents and narcotic analgesics
- Anti-neoplastic agents

Head and neck radiotherapy to treat head and neck cancer, accounts for the third most frequent cause and results often in the most severe type of hyposalivation.

Other therapies inducing hyposalivation are antineoplastic chemotherapy and bone marrow transplantation.

The question of whether age, *per se*, is a causative factor of hyposalivation has not been completely determined. However, it is clear that increased age is mostly accompanied by coexistent diseases and medication intake, many of them produce xerostomia.

**Diagnosis**

Xerostomia

The diagnosis of xerostomia is based mainly on a thorough questionnaire. In the absence of spontaneously expressed complaints, astute clinicians may suspect the occurrence of xerostomia, based on relevant anamnestic (historical) and clinical findings, such as medication intake, complaint of bad breath, extensive and/or recurrent dental caries, or the presence of oral fungal infections (candidosis).

Relevant questions to ask are:

- Have you had a daily feeling of dry mouth for more than 3 months?
- Have you had recurrently or persistently swollen salivary glands?
- Do you drink liquids to aid in swallowing dry food?
- Is the amount of saliva in your mouth too much, normal or too little?
- Do you wake up at night to drink liquids?

## Hyposalivation

Hyposalivation may be diagnosed with the aid of salivary collection tests (called sialometry), while other tests as scintigraphy or sialography can be useful to further assess salivary glands. Salivary flow rate should be measured by standardized techniques. As salivary secretion fluctuates between minimal and maximal rates during the day, it is important to assess the salivary secretion consistently at an established time of the day, in order to properly examine the evolution of the condition and its treatment in every patient.

Whole saliva can be collected by spitting, blotting, suctioning or draining the oral fluid. In this case, the collected fluid represents the saliva secreted jointly by all salivary glands and other materials present in the mouth. It is also possible to collect separately saliva secreted by each of the major salivary glands - parotid, submandibular, and sublingual – or by the minor salivary glands, which are spread throughout the oral mucosa.

Salivary secretion can be assessed in unstimulated or stimulated conditions. The stimuli that enhance salivation are related to eating: tasting, smelling or seeing food, and chewing.

Therefore it is crucial to consistently assess salivary function at fixed periods after such stimuli. Most units assess whole unstimulated sialometry.

## **Treatment**

Xerostomia/hyposalivation are often chronic disorders, requiring long-term, if not a life-long, management by health care providers with experience in the field of Oral Medicine. Treatments of oral dryness are firstly aimed at restoration of normal salivary flow, due to the difficulty in obtaining an artificial fluid that mimics natural salivary properties, such as lubrication and oral soft and hard tissue defense. In addition, the hyposalivation-induced complications need to be managed (see under “Prevention”).

### Pharmacological therapies

The parasympathetic agents pilocarpine and cevimeline are utilized primarily for the treatment of xerostomia in patients with Sjögren’s syndrome and after head and neck radiation. Even if very effective, pilocarpine administration is burdened by potential side effects involving gastrointestinal, cardiovascular, respiratory and urinary systems. Adverse effects must be strongly considered before administering pilocarpine.

Published data of trials on the effectiveness and safety of cevimeline in the treatment of xerostomia are few. However, it is expected that the drug adverse effects are similar to pilocarpine. Several other drugs have been tested to treat xerostomia. However, no conclusive evidence on the utility of these agents has been reported.

### Non-pharmacological therapies

- Local treatment: These methods (mouthwashes, sugarless chewing gums and candies) are readily available and most oral dryness sufferers can use them. However, their effectiveness is

only temporary and often not satisfactory, thus demanding a permanent repeated use. As a consequence, patients' compliance is usually very low.

- Acupuncture: Recent studies have suggested that acupuncture may improve xerostomia with an increase in the salivary flow rate and sustained symptom relief.
- Electrostimulation;

A stimulator for inducing salivation by intra-oral neural stimulation has been tested and approved in the US. Theoretically, this therapeutic modality may represent the ideal treatment of hyposalivation since it might restore the salivary flow without dangerous side effects. However, the device is cumbersome and difficult to carry and stimulation is not constant (e.g. salivary secretion is not constantly enhanced): thus it is rarely used among xerostomic patients. To overcome these problems, the European Commission is currently funding a European multi-national project, aimed at developing a long-lasting salivary stimulating miniaturized device, which will reside in the oral cavity and stimulate salivary secretion in a controlled and automatic fashion

### **Prognosis**

When xerostomia is not caused by hyposalivation, the prognosis is related to the treatment outcome of the underlying factors, which are mostly psychological or sensory impairments. If these factors are severe and/or difficult to detect, their prognosis is poor and, as a result, also the prognosis of xerostomia is not encouraging.

The prognosis of xerostomia with a pure biological background (namely, hyposalivation-induced dry mouth) is related to the odds to treat successfully the factor involved. Grossly, the factor can be destruction of the salivary gland tissues (as in Sjögren's syndrome and head and neck radiation) or malfunction of the nervous control of salivary glands (as in drug-induced hyposalivation). The greater the degree of tissue destruction or of nervous malfunction, the lower are the odds of successful treatment outcome.

Tissue destruction is generally considered an irreversible condition, since the regeneration capability of salivary tissue is almost null. However, in most cases there is still remaining salivary functional tissue, which can be stimulated by drugs or other therapies to increase saliva secretion.

It may be possible to revert the neuro-functional effects of medications, by changing or stopping their administration. In some cases, salivary glands can be stimulated to compensate for the functional loss caused by xerogenic medications.

### **Prevention**

The majority of the cases of xerostomia/hyposalivation are not preventable, as the causing factor is often unavoidable (e.g. drug induced hyposalivation) or cannot be eradicated (e.g. Sjögren's

Syndrome). However, few interventions may partially prevent hyposalivation induced by radiotherapy:

- A better arrangement of irradiation portals in order to spare contralateral major salivary glands, as well as the application of a novel dosimetric method (e.g. Intensity-modulated radiation therapy) may significantly reduce radiotherapy-induced salivary glands damage.
- Pilocarpine-treated patients undergoing radiotherapy to the head and neck have a lower frequency of oral dryness during and after treatment. A radiation protector, amifostine, has been reported to reduce the incidence of acute and delayed xerostomia. It can be administered by intra-venous infusion or sub-cutaneous infiltration. However, amifostine can present serious adverse reactions and its potential influence on tumor cells growth is still a matter of debate.

Furthermore, the management/prevention of hyposalivation's complications is another important issue, since in most patients salivary secretion cannot be fully restored, and they often experience the consequences of saliva absence or reduction.

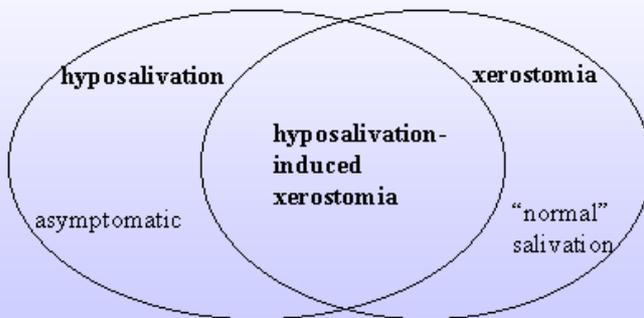
Preventive approaches for hyposalivation-related dental caries include improved personal and professional oral hygiene, fluoride administration and dietetic adjustments. Dry mouth patients should visit the dental office at least every 3 months for oral examination, cleaning and fluoride application.

The frequency and intensity of fluoride application depends on the degree of hyposalivation. Patients with severe hyposalivation should rinse their mouth daily with a fluoride mouthwash, apply a fluoride gel on their teeth for 4 minutes once a week with the aid of a specially prepared dental appliance, and be given fluoride and/or chlorhexidine varnish as a professional application on their teeth. In addition, they should rinse their mouth with the antimicrobial agent chlorhexidine for one week (during one minute every day) out of every month. More intense and frequent rinsing with chlorhexidine may lead to microbial resistance to this agent and tooth staining.

The diet of people suffering of hyposalivation should be adjusted in such a way to reduce the risk of dental caries. The principles of such a diet include avoidance of snacks between meals and minimising the intake of sticky and sweet food and beverages.

Oral candidosis and bacterial sialoadenitis are generally easily managed with antimycotic and antibiotic drugs. Adequate fluid hydration and topical application of antimicrobial agents together with early diagnosis and therapy can prevent more serious progression of these conditions.

# Oral dryness



**Figure 1.** Scheme describing the typical distribution of patients suffering from dry mouth. They may be classified in 3 different groups:

- Those having asymptomatic hyposalivation, i.e. a reduction in salivary secretion not significant enough to cause xerostomia.
- Those with symptomatically significant hyposalivation, thus suffering of xerostomia.
- Those suffering of xerostomia, but with no evident decrease in salivary secretion.



**Figure 2.** Cervical and incisal caries and plaque accumulation as a result of hyposalivation



**Figure 3:** Tongue dryness resulting from medication intake



**Figure 4.** Cracked lips after radiotherapy to the head and neck

## Further reading

- 1 Atkinson JC, Baum BJ: Salivary enhancement: current status and future therapies. J Dent Educ 2001; 65:1096-1101.
- 2 Guijarro B et al: Treatment of xerostomia: a review. Medicina Oral 2001; 6:7-18.
- 3 Nederfors T et al. Prevalence of perceived symptoms of dry mouth in an adult Swedish population--relation to age, sex and pharmacotherapy Community Dent Oral Epidemiol 1997; 25:211-216.
- 4 Sreebny LM, Schwartz SS. A reference guide to drugs and dry mouth. 2nd edition, Gerodontology 1997; 14:33-47.
- 5 Wolff A et al: Correlation between patient satisfaction with complete dentures and denture quality, oral condition, and flow rate of submandibular/sublingual salivary glands. Int J Prosthodont 2003; 16:45-8.

## Links

[http://www.eastman.ucl.ac.uk/~eaom/clinical\\_support.html](http://www.eastman.ucl.ac.uk/~eaom/clinical_support.html)

<http://www.nidr.nih.gov/health/newsandhealth/xerostomia.asp>

<http://www.nlm.nih.gov/medlineplus/mouthdisorders.html>