

Dry Mouth: An Emerging Epidemic

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Abstract

Dry mouth is a common and emerging concern among the young and old alike, causing significant discomfort, oropharyngeal infections and impairing the quality of life of the individual. The etiology ranges from simple obstruction of salivary gland ducts, physiological stress and anxiety to plethora of underlying salivary gland pathologies and systemic conditions. This review is focused to discuss the various clinical conditions predisposing to dry mouth. Understanding the etiology of the condition prompts appropriate early intervention to treat the underlying pathology, alleviate symptoms and prevent undesirable consequences that compromise the quality of life of an individual. Prompt diagnosis helps to alleviate symptoms in both curable and non-curable conditions contributing to dry mouth.

Keywords: Xerostomia, Hyposalivation, Dry Mouth, Etiology

1. INTRODUCTION

Saliva plays a critical role in maintaining the oropharyngeal health. It preserves the homeostasis of the oral environment and helps in mastication, taste perception, deglutition, digestion, speech, immunity, caries protection, lubricates oral mucosa and protects it from desiccation. Three paired major salivary glands (parotid, sublingual, and submandibular) and hundreds of minor salivary glands distributed throughout the oral cavity, contribute to secretion of saliva, under the regulation of the sympathetic and parasympathetic divisions of the autonomic nervous system. The daily secretion of saliva normally ranges between 1.0 and 1.5 L at a rate of 0.5 mL/min.¹

Conditions that interfere with the normal composition or quantity of saliva can cause significant discomfort and adversely affect oral and systemic health. Salivary gland hypofunction (SGH) or hyposalivation is a condition of reduced saliva production due to numerous causes. Dry mouth is a condition when unstimulated submandibular/sublingual or parotid saliva flow of <0.05mL/min; stimulated submandibular/sublingual or parotid saliva flow <0.15 mL/min is present. It usually leads to the subjective complaint of oral dryness which is termed xerostomia.^{2,3}

Xerostomia is a subjective complaint of dry mouth, whereas hyposalivation is an objective decrease in salivary flow. Xerostomia is often associated with hyposalivation, but not always, and many cases of xerostomia have been described in patients with a normal salivary flow rate and their symptoms may be secondary to qualitative and/or quantitative changes in the composition of saliva. Affecting 10–30% of the general population, dry mouth is considered to be one of the most common yet underappreciated, underdiagnosed and undermanaged oral health conditions, which can significantly diminish quality of life.^{2,3}

Decreased salivation is associated with generalized oral discomfort, halitosis, difficulty in chewing and swallowing, altered taste perception, altered speech and compromises retention of prosthesis.⁴ It contributes to increased risk of dental caries, gingivitis, periodontitis, candidiasis, poor oral hygiene, decreased lubrication, dehydration and atrophy of the mucosal surfaces leading to loss of integrity, injury and ulceration, infection risk, difficulty in tolerating dentures, delayed wound healing, and pain. One of the most disturbing consequences of persistent mouth dryness is the rapid and preventable loss of dentition which results from increased risk of dental caries and erosion posed by the dry mouth environment. Intolerance to



spicy foods and food sticking on to the teeth impairs social engagements. Serving many roles, saliva is vital not only to one’s daily functioning but also to one’s general wellbeing. Patients with dry mouth also experience disordered sleep pattern with poor quality of sleep and frequent interruptions in sleep to drink water owing to dryness of the mouth.⁵ Persistent xerostomia and salivary dysfunction can induce significant and permanent oropharyngeal disorders and can impair the routine life of an individual.

Salivary dysfunction and ensuing dry mouth has multi factorial etiology. Medications, poor general health, female sex, and old age influence the development of the condition. Vulnerable elders often suffer from chronic diseases and use multiple medications, both of which can impair the function of salivary glands.⁶ Understanding these causes is important because in some cases, the etiology can be addressed and early intervention can eliminate mouth dryness.

Table. 1 Etiology

S. No	Condition	
A.	Systemic conditions	Diabetes mellitus Hypertension Autoimmune diseases Primary biliary cirrhosis Cystic fibrosis HIV infection Hepatitis C virus infection
B.	Salivary gland pathologies	Autoimmune conditions Hypoplasia or Agenesis Sialolith Atrophy of the glandular structures Salivary gland tumors
C.	Medications	Anti cholinergics Antidepressants, including tricyclic compounds

		Antiemetics Cytotoxic drugs Protease inhibitors Proton pump inhibitors Opioids Antihypertensives Diuretics Antihistamines Drugs with sympathomimetic activity (e.g., ephedrine) Serotonin reuptake inhibitors Lithium
D.	Radiation to head and neck	External beam radiation therapy (head and neck, mantle, whole body) Radioiodine therapy (131I)
E.	Habits	Mouth breathing Chronic alcoholism Chronic tobacco use
F.	Physiological	Age related decrease in salivation Dehydration
G.	Psychological	Anxiety Depression
H	Others	Nutritional deficiency Chronic vomiting Renal dialysis Menopause Spinal cord injury Surgical excision of salivary gland



A. SYSTEMIC CONDITIONS

Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.⁷ DM has become a worldwide public health problem and in the recent years, the global prevalence of DM has increased substantially. DM is probably the most common metabolic disease with salivary implications, due to its high frequency. Thus with rise in the prevalence of DM, there is a greater risk of larger proportion of this population to develop dry mouth. Dry mouth may be a warning sign of diabetes. Chronic hyperglycemia induced polydipsia and polyuria, neuropathy, micro-vascular abnormalities, damage to the gland parenchyma, endothelial dysfunction and medication that is being consumed to keep the diabetes under control may contribute to decreased salivary flow in these individuals. Hyposalivation is also related to the level of HbA1c with significant decrease in the quantity of saliva with increase increase in HbA1c levels particularly in poorly controlled DM (>9% HbA1c).⁸ Increased expression of SGLT1 protein in ductal cells is known to repress salivation by increasing salivary water reabsorption.¹² It is strongly associated with objective measurements of poor salivary flow and with other oral and extraoral symptoms of desiccation.

Several epidemiologic studies have suggested that xerostomia is frequent among DM patients than non-DM population.^{9,10} This salivary disorder in DM patients could be associated with increased susceptibility to caries and oral infections, particularly when there has been dehydration and inadequate blood glucose control.

B. SALIVARY GLAND PATHOLOGIES

Sjogren's syndrome is an autoimmune disorder characterized by lymphocytic infiltration of the exocrine glands, mainly the lacrimal and salivary glands, resulting in reduced secretory functions with oral and ocular dryness. It may be seen alone

or in association with other connective disorders like Rheumatoid arthritis. The misdirected immune system in autoimmunity tends to lead to inflammation of glands that produce the saliva in the mouth (salivary glands, including the parotid glands) which leads to dry mouth and dry lips. Dryness of eyes and mouth, in patients with or without Sjogren's syndrome, is sometimes referred to as sicca syndrome.^{11, 12}

Patients suffering from Rheumatoid arthritis also have shown decreased resting whole saliva and stimulated parotid saliva rates in the absence of Sjogren's syndrome.¹³ Decreased salivary secretion has also been noted in patients suffering from familial amyloidotic polyneuropathy with hyposalivation being positively correlated to the progress of familial amyloidotic polyneuropathy.¹⁴ Fibrosis of the salivary glands and lack of pooling of saliva in the floor of the mouth have also been reported in patients suffering from scleroderma.¹⁵ Primary biliary cirrhosis is a chronic cholestatic disorder predominantly affecting middle aged women, often presenting with autoimmune associations.¹⁶ In a prospective study of 95 patients with Primary biliary cirrhosis, 47.4% presented with dry mouth while 68.4% presented with sicca complex.¹⁷

C. MEDICATION

Xerostomia and SGH are common side effects of prescription drugs.^{2,18} In addition, polypharmacy has been shown to significantly influence patients' saliva flow.⁶ More than 500 medications that are currently in use list mouth dryness as a side effect; however, in the majority of cases, the mechanisms are unknown. Nonetheless, it is predominantly believed to be the result of changes in salivary quality more so than the quantity. Drug induced hyposalivation may be due to inhibition of parasympathetic nervous system with decreased salivation or through sympathetic stimulation that produces little saliva, high in protein content thus giving a sensation of dry mouth. Drug induced hyposalivation accounts for 80.5% of the adverse drug reactions. "Xerogenic" medications most commonly implicated in dry mouth are the



tricyclic antidepressants, antipsychotics, atropinics, beta blockers and antihistamines, and therefore the complaint of dry mouth is common particularly in patients treated for hypertensive, psychiatric or urinary problems.¹⁹

Drugs used to treat cancer can make saliva thicker, causing the mouth to feel dry.²⁰ The drugs implicated to cause dry mouth have an anticholinergic, sympathomimetic action or both. Diuretics limit the transport of water and electrolytes through the cell membrane of salivary acinar cells by causing vasoconstriction in salivary glands.²¹

D. RADIATION

Radiotherapy is commonly employed as the main stay or as an adjunct with chemotherapy and surgery for treatment of head and neck cancers. Incidental radiation also occurs to the salivary glands in such conditions. Depending on the site and extension of primary tumors and the path of lymphatic spread, all or part of the major and minor salivary glands are included within the radiation field. First few weeks of radiotherapy witness a marked and progressive reduction in the salivary flow.²² Xerostomia affects 80% of the patients who need radiotherapy as a primary treatment, as an adjunct to surgery, in combination with chemotherapy, or as palliation. Radiation dose as low as 20 Gy can cause permanent cessation of salivary flow if given as a single dose. At doses above 52 Gy, salivary dysfunction is severe and may essentially reach zero at 60Gy.²³ Serous acinar cells appear to be more sensitive to radiation than mucous cells. Free radical induced disruption of cellular metabolism results in the damage of acinar cells.¹⁶

The quality of saliva is also affected owing to a decrease in its pH that predisposes to demineralization of teeth, dental caries and a change in its consistency. Compensatory hypertrophy of residual salivary gland tissue not exposed to radiation might partially alleviate the symptoms of dry mouth.²⁴ A change in the buffering capacity, electrolyte composition as

well as physical properties ensues that may contribute to change in oral microflora. Following radiotherapy there is an increase in the viscosity of saliva with a change in the color that can be yellow, brown, or even white. Radiation induced dry mouth affects the overall quality of life of individual during and after radiotherapy. A decrease in the quantity of saliva is associated with difficulty in chewing and swallowing and inadequate oral clearance leading to angular cheilitis, cracked lips, periodontal disease, stomatitis, and halitosis.²⁵

E. HABITS

Personal habits like mouth breathing, drinking alcohol, or using tobacco products can cause dry mouth. Chronic alcoholism is associated with hyposalivation and oral dryness. Ethanol induced fatty infiltration of the salivary glands, TNF- α mediated acinar cell apoptosis causes a change in salivary flow. Similarly, a significant decrease in salivary flow rate has also been reported among tobacco users.^{28, 29}

F. PHYSIOLOGICAL

The activation of sympathetic system in conditions of anxiety, stress produces viscous saliva and hence contributes to the symptom of dry mouth.²⁶ Dawes in 1987 proposed that when the amount of water absorption and evaporation exceeds the salivary flow rate the sensation of a dry mouth will be perceived. Individuals with mouth breathing also experience dry mouth as the rate of evaporation exceeds the salivary flow rate.^{26, 27} The progressive age dependent acinar degeneration and atrophy accompanied by replacement of functional parenchyma by fibrous tissue and fatty infiltration may result in hyposalivation in elderly. There is 30%-40% decrease in the number of acinar cells of salivary glands from age 34 to 75 years.^{6, 28} Xerostomia remains an unresolved common complaint especially among the geriatric population, despite seeking medical or dental consultation.

G. PSYCHOLOGICAL STATUS

The association of salivary secretion and



psychological status of the individuals have been elucidated. Various psychological disorders such as depression, obsessive compulsive disorder, cancer phobia and anxiety states have been associated with dry mouth. Depression and anxiety are the two most common mental disorders in the global platform. Depression continues to be the foremost illness and disability among young and middle-aged populations, with 322 million people affected with depression on the global scale with 18% of them from India.^{30,31}

Patients with long term psychiatric illness are on prolonged medications that subjects them to a high risk of xerostomia. Dry mouth is considered as a psycho physiological expression of depression and hence one of the symptoms of depression. Thus the underlying psychological illness could contribute to the sensation of dry mouth.³²

H. OTHERS

Disruption in the neuronal pathway for salivation following trauma and head and neck surgery can also lead to hyposalivation.^{21,33} Nutritional deficiencies like Vitamin A can decrease salivation due to squamous keratinizing metaplasia of the major and minor salivary glands.³⁴ Hyposialia caused by functional impairment of the salivary glands has also been reported in cases of hereditary hemochromatosis with decline in total stimulated salivary flow consistent with the increase in serum ferritin levels.³⁵ Self-induced vomiting, misuse of diuretics and laxatives, and excessive exercise may cause body dehydration resulting in decreased salivary flow in individuals suffering from bulimia nervosa and anorexia nervosa.^{36,37} Conditions like Alzheimer disease, Cerebral vascular accident, Hepatitis, HIV, Hypertension, Liver transplant candidates, Menopause, Osteoarthritis, Parkinsonism, Renal disease/dialysis, Spinal cord injury, Stroke, Systemic lupus erythematosus, Systemic sclerosis have also shown to be associated with dry mouth. Chronic sialadenitis secondary to sialolith, salivary duct stricture, external duct compression, systemic disease, or stasis may lead

to progressive acinar destruction combined with lymphocytic infiltrate resulting in symptoms of xerostomia.^{38, 39}

2. DIAGNOSIS

Understanding the etiology of the condition is critical for appropriate management. A systematic approach with detailed clinical history with emphasis on the general medical condition of the patient along with the drugs taken is mandatory. Oral examination is fundamental to identify clinical signs that are pathognomonic for hyposalivation. Examination of oral mucosa can reveal sticking of an intraoral mirror to the buccal mucosa or tongue; frothy, viscous saliva; absence of saliva pooling in floor of the mouth; loss of papillae of the tongue dorsum; smooth gingival architecture; glassy appearance of the oral mucosa (especially the palate); lobulated or deeply fissured tongue; cervical caries involving more than two teeth; and mucosal debris on palate. Examination of the salivary gland function with measurement of salivary flow rates (stimulated and unstimulated), sialography, Magnetic Resonance Imaging and ultrasonography to visualize architecture and pathology associated with the salivary gland and its ducts are of diagnostic importance.³⁸

3. TREATMENT

The treatment should increase the existing salivary flow or replace the lost secretions, control the state of oral health, arrest dental caries, and other associated conditions. Depending on the etiology and patient associated factors, patient specific treatment is preferred. Pharmacological agents, saliva substitutes and/or lubricants in the form of gel or oral rinses, Transcutaneous electric nerve stimulation, acupuncture, low level laser therapy and herbal medicines are commonly employed to alleviate symptoms by stimulating and/or substituting for the secretion of saliva.³⁹⁻⁴³ None of the currently available management approaches are entirely satisfactory. They provide temporary and intermittent relief with the recurrence of symptoms when the treatment is interrupted.



Addressing the causative or contributing factors is therefore of paramount importance. Professional judgment and patient preferences should ultimately decide the line of treatment. Medical management of underlying condition along with lifestyle modifications improves the symptoms.

4. CONCLUSION

With changing lifestyles, increase in stress and anxiety, Type II DM, dry mouth is emerging as an epidemic condition. Prompt diagnosis, thus help in early intervention to alleviate symptoms in both curable and non-curable conditions contributing to dry mouth. Being aware of the causes and clinical presentation helps Oral medicine specialists to treat this condition at an early stage thus halting further complications.

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