ABSTRACT
Xerostomia is a condition of dry mouth that is experienced by many patients and is frequently encountered in medical practice. It often develops when the amount of saliva that moistens the oral mucous membrane is reduced. A number of commonly prescribed drugs with a variety of pharmacological activities have been found to cause xerostomia as a side effect. Additionally, xerostomia often is associated with Sjögren’s syndrome and complication of radiation therapy. Xerostomia is related with difficulties in chewing, swallowing, tasting or speaking. Xerostomia can predispose to an increased risk of developing a dental caries. It can also cause oral discomfort for denture wearers. Management strategy for this condition should include caries prevention and elimination of drugs having anticholinergic effects. Treatment is based primarily on replacement therapies and gustatory, masticatory, and pharmacological stimulants. Healthcare professionals can play a vital role in identifying patients at risk for developing xerostomia, and should provide appropriate preventative and therapeutic measures that will help to preserve a person’s health, function, and quality of life. The purpose of this review is to discuss the common causes, clinical manifestations, complications and treatment modalities available, which will assist the clinicians to manage the xerostomic patients.

KEYWORDS: Xerostomia; Sjögren’s syndrome; Oral mucous membrane.

INTRODUCTION:
Saliva is a complex fluid produced by the salivary glands. It forms a film of fluid coating the teeth and mucousa thereby creating and regulating a healthy environment in the oral cavity.[1]

Saliva is derived predominantly from three paired major salivary glands, i.e. the parotid, submandibular and sublingual glands (together accounting for about 90% of the fluid production) as well as from the minor salivary glands in the oral mucosa. Whole saliva also contains gingival crevicular fluid, microorganisms from dental plaque and food debris. In healthy individuals the daily production and swallowing of saliva normally ranges from 0.5 to 1.5 Liters and it is composed of more than 99% water and less than 1% solids, mostly proteins and salts.[2] Saliva is thought to be secreted by a two-stage mechanism. Acinar cells produce an osmotic gradient that is mediated by a co-transporter loop in the basolateral membrane. This osmotic gradient results in the production of salivary fluid.[3, 4]

Reduced saliva, either qualitatively or quantitatively, may negatively impact on oral health. Research indicates that there is a loss of salivary parenchymal acinar cells which occurs in ageing.[5] These effects are often unrecognized as the parotid gland is capable of maintaining function without obvious changes in amount, composition or variability.[6]

Xerostomia is a condition associated with both a decrease in the amount of saliva produced and an alteration in its chemical composition, therefore causing feeling of dry mouth. This can have a deleterious effect on many aspects of oral function and general well being. It can cause a significant decline in quality of life by decreasing taste sensation and impairing chewing ability. Furthermore, it may alter regular eating patterns, reducing the pleasure of eating due to impaired or diminished taste sensation. Patients with xerostomia often report an avoidance of some foods, such as dry foods (bread) and sticky foods, due to the inability to chew or swallow effectively. Also, xerostomia may impair a patient’s ability to speak, cause cracks and fissures in the oral mucosa and halitosis. It can cause denture wearing to be very uncomfortable, exacerbating chewing difficulties. Xerostomia can affect numerous aspects of oral function, contributing to pain, caries and oral infections.[7]

EPIDEMIOLOGY
Xerostomia may develop in any person of any age. But it is frequently described as a symptom of middle-aged and elderly individuals. In a questionnaire based study on 710 American adults ranging in age from 19 to 88 years, it was observed that 24% of females and 18% of males suffered from xerostomia. It was also found that xerostomia was associated with the use of medications and in males, cigarette smoking was the main cause associated. The hyposalivatory side-effects like difficulty in consuming dry foods, cracked lips, dry eyes, difficulty in swallowing were also reported.[8] It has also been reported that the prevalence of dry mouth symptoms increased with age, was more common in women than men and was greater in whites than blacks.[9]

The prevalence of perceived dry mouth among a group of elderly people in Japan was also investigated. It was found that 37.8% reported oral dryness on waking, yet only 9.1% of individuals noticed a subjective feeling of dry mouth during eating.[10] The relationship between complaints of xerostomia and food avoidance in geriatric patients was analysed in a
the soft and hard tissues. [35]

It may be difficult to measure salivary flow rates in common practice. Therefore, following four methods as the clinical measures of salivary flow rates have been suggested. They are dryness of the buccal mucosa, absence of saliva expressible from the ducts, the total number of decayed, missing and filled teeth, and dryness of the lips. [35]

**CLINICAL MANIFESTATIONS**

Patient with xerostomia usually complains of a dry mouth, burning sensation of oral mucosa and a sensation of a loss of or altered taste. Another manifestation may be an increased need to sip or drink water when an increased difficulty with swallowing dry foods or an increasing aversion to dry foods. [11] Patients who develop Sjögren's syndrome secondary to a connective tissue disease also may complain of having dry eyes, and progressive parotid gland enlargement may become evident. These initial manifestations may precede clinically apparent alterations of the oral mucosa or any measurable reduction in salivary gland function.

As the xerostomia progresses, inspection of the oral cavity may disclose an erythematous pebbled, cobblestoned or fissured tongue and atrophy of the filiform papillae. The oral tissues may be erythematous and appear parched. Palpation of the oral mucosa may result in the finger's adhering to the mucosal surfaces instead of readily sliding over the tissues. Application of a dry cotton swab at the parotid and submandibular duct orifices followed by external palpation of the glands may disclose an unapparent salivary flow from the ducts. Halitosis is a common problem and the dryness of the mouth and lips can cause discomfort ranging from mild irritation to a severe burning sensation. [36]

Desiccated oral mucosal tissues are more susceptible to ulcerations and traumatic lesions. Soft tissue management includes maintaining mucosal integrity to avoid local or systemic infections from oral microflora. Dry mouth induced oral lesions are susceptible to developing secondary infections by microbial flora that normally inhabit the oral cavity as well as by exogenous organisms. Patients with significantly decreased salivary output due to prolonged xerostomia have an increased risk of developing dental caries. [37] This is a result of the decrease in pH of saliva and the colonization of cariogenic bacteria, namely Streptococcus mutans and Lactobacillus species. Reduction of saliva increases the risk of developing candidiasis also. [38]

**MANAGEMENT**

The general approach to treat patients with xerostomia is primarily palliative for the relief of symptoms and prevention of oral complications.

**Dental Caries Prevention**

With reduction in saliva, the patients are more prone to dental caries and therefore diligent oral hygiene and regular dental care is essential. A number of therapeutic interventions are available for the control and prevention of dental caries. These primarily consist of rigorous attention to personal oral hygiene, strict adherence to a non-cariogenic diet, placement of sealants and the application of topical fluorides. The latter may be useful if an increased incidence of coronal caries, root caries or both are identified, even when intermittently conditioned water is available. This strategy may be effective for both prevention of caries and possible reversal of decalcification. Supplements that contain sodium fluoride, acidulated phosphate fluoride or sodium mono-fluorophosphate are available for professional applications as well as for home use. [39] Use of fluoride varnishes can provide prolonged exposure to fluoride. [40]

**Saliva Substitutes**

Artificial saliva substitutes have been shown to give relief by rehydrating the oral mucosa. [41] Since saliva is a complex secretory with a variety of functions, it is difficult to mimic through artificial methods.

Milk also contains many chemical and physical properties suitable as a saliva substitute. It acts by moisturizing and lubricating dehydrated tissues, buffering oral acids, decreasing the risk of enamel demineralisation, and it also contributes to remineralization due to its calcium and phosphate content. [42]

Artificial saliva preparations can be categorized based on their contents: glycerine and lemon or carboxy-methyl-cellulose and mucin. They include remineralising contents such as calcium, phosphate, fluoride and sugar alcohols (e.g. sorbitol), which have a low cariogenic potential. They are important for lubrication of the mucosal surfaces and help to clean teeth from bacteria and debris. Saliva substitutes are available as lozenges, rinses, sprays, swab sticks and as reservoirs in dentures. [44]

Treatment with Optimist (liquid spray saliva substitute), Saliva Orthana (mucin-based artificial saliva), Freudent (low-tack, sugar-free chewing gum) and Xerolaine (xylitol gum-based saliva substitute) have also been suggested. [45]

**Cholinergic Agonists - Salivary Secretion Stimulants**

Treating xerostomia with medications that enhance salivation is another therapeutic option, particularly in the relatively healthy person. Secretogogues such as pilocarpine can increase secretions and diminish xerostomic complaints in patients with sufficiently remaining exocrine tissue. Pilocarpine is typically given in a dosage of 5 mg orally three times a day and before bedtime. When taken 30 min before mealtimes, patients may benefit from the increased salivation in eating their meal. The total daily dose should not exceed 30 mg. Adverse effects include increased perspiration, greater bowel and bladder motility, and feeling hot and flushed. Patients with a history of bronchospasm, severe chronic obstructive pulmonary disease, congestive heart disease, and angle closure glaucoma should not take pilocarpine. [45]

A new secretogogue, cevimeline, has recently been approved by the US Food and Drug Administration for the treatment of dry mouth in Sjögren's syndrome in a dosage of 30 mg orally three times daily. Like pilocarpine, it is a muscarinic agonist that increases production of saliva. Pilocarpine is a non-selective muscarinic agonist, whereas cevimeline reportedly has a higher affinity for M1 and M3 muscarinic receptor subtypes. Bethanecol, another cholinergic agonist, has been used (25 mg tid) to stimulate saliva in post head and neck radiotherapy patients, with few reported significant side-effects. [45]

**Regenerative Medicine And Tissue Engineering**

Muscarinic agonist medications such as pilocarpine and cevimeline induce salivary secretions through a residual functional tissue. However, they only provided temporary relief of symptoms and had a limited effect on the recovery of damaged tissue. Accordingly, the development of a novel treatment to restore or regenerate damaged salivary gland tissue is eagerly awaited. Recently, the occurrence of proliferative, multipotent salivary gland progenitor cells in neonatal mice. A similar cell type was also reported in adult mice, although their pluripluripotency was limited. [46, 47] More recently, the potential of mesenchymal stem cells to regenerate salivary glands was reported using a radiation-damage model. [47, 48]

**CONCLUSION**

Without adequate salivary output, oral and pharyngeal health declines along with a person's quality of life. Diagnosis of salivary disorders begins with a careful medical history and examination of head and neck. While complaints of xerostomia may be indicative of a salivary gland disorder, salivary diseases can present without symptoms. Therefore, routine examination of salivary function must be a part of any head, neck, and oral examination. Therapies are designed to prevent the development of oral and pharyngeal sequelae of salivary hypofunction. Current xerostomia-based treatments include replacement therapies and gustatory, masticatory, and pharmacological stimulants. Regenerative medicine and tissue engineering may provide new treatment modalities for atrophic salivary gland. However, such efforts are still in a very early stage, and a more basic understanding of salivary gland tissue regeneration and stem cells is required. Hopefully, this can play a vital role in identifying patients at risk for developing salivary dysfunction, and should provide appropriate preventative and therapeutic techniques that will help to preserve a person's health, function, and quality of life.

**REFERENCES**


