

Clinical Implications of Xerostomia in Geriatric Population

Surender Kumar¹, Prashant Gupta²

ABSTRACT

Xerostomia is a common undiagnosed disorder of mostly geriatric population caused by decrease in production of saliva. It can be presenting symptoms of many local and systemic factors with varied etiology. Xerostomia leading to salivary dysfunction resulting in oro-pharyngeal disorder, impairing quality of life. Xerostomia patient have difficulty wearing dentures as it compromises retention of prosthesis. Establishing the complex etiology presents a big challenge to oral physicians, so that proper management of xerostomia can be done, thus improving oral health as saliva contributes to oral immunity.

Keywords: Xerostomia, Geriatric, Prosthesis.

INTRODUCTION

Xerostomia is a common undiagnosed disorder of mostly geriatric populations (30% of > 65 years)¹, caused by a decrease in the production of saliva by 0.1-0.2ml/min (1-1.5lit. normal/day)² giving a '*subjective feeling of oral dryness*' due to salivary gland dysfunction resulting in impaired mastication, swallowing, speech and host defense mechanism which are facilitated through anti-bacterial peptides and mucins present in saliva required for the protection of soft tissues and teeth.³

The prevalence of xerostomia has been assessed to be 20% of the elderly population^{4,5} Ship et al. revealed 30% of the population 65 years and above experience these disorders whereas; study has shown approximately 100% association with Sjogren Syndrome⁶ and head and neck radiation for the treatment of cancer causes permanent xerostomia.^{4,7}

Chronic xerostomia and salivary dysfunction results in oro-pharyngeal disorders, impairing a person's lifestyle. It can present itself as a local symptom or in association with systemic disease such as Sjogren's syndrome, diabetics, alcoholism, adverse effects of medications or following therapeutic radiation to the head and neck regions. Xerostomia patient have difficulty wearing removable dentures as saliva deficiency compromises the retention of the prosthesis.

Etiology

Xerostomic conditions can arise as a result of multiple factors. [TABLE 1]

Hormone induced xerostomia

The surge in estrogen and progesterone levels during puberty and menstrual cycle causes gingival inflammation, swelling, bleeding and periodontal disease due to the exaggerated reaction of the gingival tissue to the toxins produced from plaque, as seen in women taking birth control pills. Pregnancy gingivitis appears between second to eight months of pregnancy. Hormonal imbalance due to menopause alters

oral conditions including burning sensations, dysgnesia and reduced salivary secretion.⁸

Manifestation of xerostomia

This clinical disorder manifests itself with dryness and burning sensation of oral mucosa, atrophic, pale and translucent or inflamed according to severity. Tongue reveals bald, atrophy of papillae, inflammation and cracking. Denture wearing patients having deficiency of saliva in the denture-mucosal interface can cause adherence and mucosal irritation⁹ leading to denture stomatitis and loss of retention of the prostheses associated with soreness, pain and burning sensation of mucous membrane and tongue. Taste sensations may be altered, as saliva is required to stimulate gustatory receptors located on the taste buds. Normal salivary pH (6.8-7.2) is maintained with sufficient saliva and regulates bacterial populations. Xerostomia exhibits acidic environment (pH 5.5) and rapidly colonizes acidophilic microorganisms (streptococci mutans) resulting in rampant dental caries.^{2,4} Halitosis, Stomatodynia (burning mouth and tongue) and intolerance to acidic and spicy foods also have been reported. Xerostomia patients are more susceptible for oral candidiasis (tongue, angular cheilitis, and cracked lips) and erythema of the underlying tissues. Complication of persistent xerostomia associated with Sjogren Syndrome, post head and neck radiotherapy are reduced gustatory stimuli (dysgnesia), dry mouth, radiation caries, trismus, osteonecrosis and salivary gland (major) enlargement (Sialadenitis) following infection or obstruction of the duct which impairs patients's oral health and function.[Table 2]

Diagnosis

Sialometric Analysis – A diagnostic tool for the estimation of salivary flow or production either as a collective salivary secretions or as a separate glandular secretion. It is a convenient method and most commonly used to estimate the salivary flow of the gland. It is measured as ml/min/gland. This tool can be of utmost importance in diagnosing xerostomia conditions.⁹ Qualitative analysis and composition of saliva cannot be assessed thus limiting the use of sialometry for

¹Assistant Professor, Department of Prosthodontics, Crown Bridge, Aesthetic Dentistry and Oral Implantology, ²Associate Professor, Department of Oral Medicine and Radiology, Dental Institute, Rajendra Institute of Medical Sciences, Ranchi, India

Corresponding author: Dr. Surender Kumar, MDS, Assistant Professor, Department of Prosthodontics, Crown Bridge, Aesthetic Dentistry and Oral Implantology, Dental Institute, Rajendra Institute of Medical Sciences, Ranchi, India

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Sr. No.	Local Factors	Systemic Factors
1	Sialolithiasis	Autoimmune – Sjogren’s syndrome, Rheumatic disease
2	Radiation Therapy – for squamous cell carcinoma of oral, head and neck region.	Drug Induced – Anticholinergic, Antihistaminics, Anti-psychotics, Antihypertensives, Bronchodilators, Diuretics, Opioids.
3	Mucocele	Systemic disorders - Diabetes mellitus, Thyroid dysfunction, Nephritis.
4	Adenoids	Psychological disorders - Parkinsonism, Cerebral palsy, mood and anxiety disorder
5	Geriatric patients	Immune dysfunction – HIV/AIDS Infection
6	Sialadenitis	Hormone induced - Estrogen and Progesterone
7	Benign/malignant tumor of Salivary gland	Obstructive Sleep Apnoea - Chronic mouth breathing
8	Aplasia of salivary gland	Graft- versus-host disease
9	Salivary gland disorder- Sarcoidosis, Amyloidosis.	Chemotherapy for malignancies of head and neck regions.

Table-1: Etiology of xerostomia.

identifying the severity of xerostomia but not the probable causative factor.

Management

Most important step in treating xerostomia is to determine the diagnosis. In drug induced xerostomia, the dosage, timing or even change in the medication may relieve the condition.

Salivary substitute

Commercial artificial saliva (carboxymethylcellulose, orthana, luborant, xerolube and glandosane)^{10,11} containing calcium, phosphate ions, 2ppm fluoride and biotene mouthwash¹² assist in lubricating the oral mucosa in patient of salivary gland aplasia or total absence of saliva production.

Caries protection

Fluoridated water (1ppm) can also aid in mouth moisturizer. Fluoridated toothpaste and 1% sodium fluoride gel/mouthrinse with fluoride varnish¹³ applications may prevent xerostomia induced caries (radiation caries). Xylitol inhibits caries producing bacteria (streptococci mutans)²

Acupuncture

Acupuncture has revealed to enhance parasympathetic activity, which liberates neuropeptides promoting salivary flow and secretions.¹³ Treatment areas are ears and radial aspect of index finger for 3 to 4 weeks. Dawidson I, et al. noticed Calcitonin Gene-Related Peptide (CGRP) may be the inducing factor for salivary secretion in treating xerostomia patients with acupuncture technique.^{14,15}

Salivary Stimulants

Salivary parenchyma cell may be stimulated by Sialogogues; chewing xylitol-containing gum or lozenges and sucking ice chips.

Pharmaceutical therapy

Medications stimulating salivary secretion include parasympathomimetic agent like Pilocarpine, a non specific cholinergic agonist that stimulates muscarinic receptors M₃ (exocrine gland) and M₂ (heart) causing water and electrolyte secretion.^{4,13} Bethanecol stimulates salivary flow in radiation induced xerostomia patient with 25mg thrice orally dose. Anethole trithione¹³ enhances salivation in Sjogren’s syndrome patient by inflating the number of receptor site on the salivary acinar cells with dose of 25mgTDS.⁴

Amifostine (Ethiol) is an aminothioliol prodrug used to treat xerostomia in post radiotherapy (RT) of head and neck cancer patients.¹⁶ The recommended dose for amifostine is 200 mg/m² OD daily as a 3 minute intravenous (IV) infusion 15 to 30 minutes prior RT.¹⁷ Amifostine is transformed to its active form which is 100 times better absorbed in normal cells than in tumor cells thus protects normal cells against post RT and CT damage by scavenging free radicals, donating hydrogen ions to free radicals, depleting oxygen and inactivating cytotoxic drugs.^{18,19} Clinical trial are undergoing for this drug to have a potent antitumor efficacy in post RT and CT xerostomia condition.

Cevimeline

Cevimeline^{4,13} has similar action as pilocarpine with little cardiac and respiratory adverse effects, a safe drug in asthma and pregnancy with enhanced duration of action (5 hrs). Dianne Petrone et al. investigated the efficacy of cevimeline hydrochloride (Evoxac) on xerostomia and keratoconjunctivitis sicca syndrome and resulted in remarkable improvement in saliva and tear flow in Sjogren syndrome patients with 30mg dose thrice daily.²⁰

Fungal infection

Oral candidiasis (Thrush) are most prevalent in dry mouth conditions and are effectively treated with azole systemic medications (Fluconazole 100mg tab. and Itraconazole 100mg/10ml suspension) as topical Nystatin solution contain 50% sucrose which may enhance caries and require saliva for dissolution resulting in mucosal abrasion.² Other topical preparation that can be used is clotrimazole (0.1%) for managing candidiasis. Recent investigations proved the efficacy of Caphosol (calcium and phosphate solution) on oral fungal infection in xerostomia patients, exhibiting enhanced saliva secretion with an antifungal activity as compared to sodium bicarbonate solution and showed no significant variation along with myconazole.²¹ Sialadenitis is a bacterial inflammatory condition associated with swelling of the salivary gland and requires antibiotics for treatment.²

Prosthetic management

Retention is that quality inherent in the dental prosthesis acting to resist the forces of dislodgment along the path of

Disorders	Etiology	Management
*Dry mouth:- Radiation induced in head and neck cancer	Radiation Exposure (>20Gy)	Thyroid collar (lead Apron) Tab Amifostine 200mg/m ² once daily Tab Pilocarpine 5mg thrice daily Tab Cevimeline 30mg thrice daily Tab Bethanecol 25mg thrice daily Tab Anethole trithione 25mg thrice daily
Bacterial Infection (Sialadenitis)	Staphylococcus Aureus	Glandular massage Tab Penicillin VK 500mg Tab. Amoxicillin 500mg Tab Clindamycin 300mg
Physical (duct obstruction)	Calculus, mucus plug	Heat application over the swelling, Diuresis to flush out the stone, Antibiotics and Analgesics
*Dental caries	Streptococcus mutans	Dentifrice (0.05% NaF) Fluoride gel (1%NaF,0.4% SnF) Sodium fluoride varnish (0.5%) Restoration
*Autoimmune disease Sjogren's syndrome	Auto-antibodies detected: RF ANF Anti-Ro Anti-La	Artificial saliva: Carboxymethylcellulose Orthana Xerolube Sugar free chewing gums/ lozenges Lubrication: water Tab. Pilocarpine 5mg thrice daily Hypromellose (lachrymal substitute) Tab Cevimeline 30mg thrice daily
*Psycho-pathological	Stress, anxiety	Tab Ketazolam 15-30mg HS
*Oral candidiasis (Thrush)	Fungal infection (Candida albican)	Chlorhexidine mouthwash (0.12%) 10ml 1BD Clotrimazole troches: 10mg dissolved orally 4-5 times daily. Tab. Fluconazole 100mg Tab. Itraconazole 100mg/10ml suspension Topical nystatin/ lozenges
*Angular cheilitis/ lip cracking	1. Absence of saliva (protective effect) 2. Decreased vertical relation of denture	Nystatin/triamcinolone ointment (topical application) QID. B complex vitamin tablets 1OD x 7days Relining/rebasing/refabrication of denture Saliva substitute (carboxymethylcellulose/ milk etc.)
*Ill fitting denture	Loss of retention due to absence of saliva.	Denture adjustment Hard and Soft Reline Implant supported prosthesis Lubricating prosthesis (saliva reservoir)
*Dysguesia	Absence of normal salivary flow and concentration are necessary for taste	Saliva substitute: (carboxymethylcellulose/xerolube/milk/ salinum/ salivix) Sialogogues: chewing sugar-free gum Drugs: Tab Pilocarpine 5mg thrice daily
Arthritis	Auto-antibodies Immune complex (T-cell-mediated antigen-specific responses)	Tab. Methotrexate 0.2-0.3mg/kg body wt weekly. Tab. Prednisolone 10mg daily orally/ Tab. Hydroxychloroquine 200-400mg daily
Raynaud's phenomenon	Unknown cause (rare disease of blood vessels)	Cold protection by gloves Tab. Nifedipine 10mg thrice daily
Lymphoma	human T-cell leukemia virus type 1 and adult T-cell lymphoma	CHOP regimen + Anti CD20
Renal tubular acidosis	Renal impairment (metabolic acidosis)	Bicarbonate replacement
Vaginal dryness	Hormonal alteration (menopause, pregnancy)	Propionic acid gel

Table-2: Xerostomia Related Disorders

placement. Saliva plays an important role to aid in denture retention along various factors such as adhesion, cohesion and interfacial surface tension. Denture wearing patients are more prone to dry mouth resulting in oral infection as stated by John Wiley and Sons. The acrylic dentures contain minute pores which may harbor fungal infection (*Candida albicans*) leading to halitosis and discomfort.²² Denture immersion in benzoic acid, 0.12% chlorhexidine and 1% sodium hypochlorite once or twice daily is required. Soft denture liners and specialized dentures with innovative techniques are constructed incorporating artificial saliva reservoir like split denture technique in mandibular denture²³ and palatal closed lid techniques in maxillary dentures providing good lubrication of the oral tissues has shown remarkable reduction in patient discomfort and denture stomatitis.²⁴ Xerostomia patient should be advised to wet the denture before wearing alongwith increased fluid intake to replace electrolytes and reduce discomfort. Flexible denture fabrication in radiation induced xerostomic patient with minimal tissue damage have shown promising results.²¹ Salivary substitutes are available as solutions, sprays and gel forms.

Radio-protectors

Study has revealed that Lidocaine has a radioprotective effect on the capacity of muscarinic agonist-induced water secretion in irradiated salivary glands.²⁵ Research has proved evidence that Sodium selenite, Vitamin A, C and E (Antioxidants), Mesna (2-mercaptoethanesulfonic acid), Dexrazoxane and Amifostine has radio protective and chemo preventive activity in cancer treatment of submandibular glands.^{26,27} Herbal medication, Hippophae Rhamnoides leaves and sea buckthorn berries has shown to have radio protective action against radiation induced xerostomia.²⁸ Gerardo Gómez-Moreno revealed that 1% malic acid shows a positive response in treating antihypertensive-induced xerostomia.²⁹ Recent advancements in radiation preventive techniques A recently developed multileaf collimators and Intensity-Modulated Radiation Therapy (IMRT) reduces the radiation of salivary glands and the surrounding normal tissues as investigated by Eisbruch et al. that IMRT prevents parotid gland mutilation resulting in xerostomia.^{30,31} Conformal 3D radiotherapy (3DCRT) has been proved to deliver greater dose of radiation on the target site without much complications (e.g. xerostomia) compared to conventional RT.^{32,33} Seikaly et al³⁴ and Al-Qahtani et al³⁵ suggested that the surgical transplantation of submandibular glands prior to radiotherapy can prevent radiation-induced xerostomia.

Gene therapy

Animal experiments are under trial for preventing post radiation xerostomia by transferring genetic coding for water channels in the acinar cells and genes coding for enzymes that engulf the free radicals generated during radiation.³⁶

CONCLUSION

Radiation-induced xerostomia is one of the major etiologies of xerostomia, which augments the risk of oral and dental disease in patients with head and neck cancer. Palliative agents, such as topical fluoride gel, oral lubricants, saliva

substitutes and pharmacological stimulation of salivary flow may manage the symptoms in some patients. Xerostomia may be reduced with recently developed radio-protective drugs or by certain radiologic techniques that minimize radiation doses to normal tissues during RT. The definitive aim of management of head and neck cancer should be curative treatment while preserving the overall quality of life for patients.

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