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Xerostomia In Complete Denture

A project submitted to the Prosthodontic Department/College of Dentistry, University of Baghdad in partial fulfillment of the requirement for a B.D.S. degree

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Declaration

This is to certify that the organization and preparation of this research has been made by the graduate student **Mohammed kareem** under my supervision at the College of Dentistry, University of Baghdad in partial fulfillment of the requirement for the degree of Bachelor of Dental Science.

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Dedication

I dedicate this research to my family who have always believed in me and supported me throughout my life. Also, my friends for being there for me. Last but not least, I would like to thank my great supervisor **Dr.Mustafa Shakir** forall her help.

List of contents

List of figures

List of tables

List of abbreviations

AIDS	Acquired immunodeficiency syndrome
CMC	carboxymethylcellulose
HIV	human immunodeficiency virus
OTC	over the counter
hSSPCs	human salivary stem/progenitor cells
PAL	palatal secretion
PAR	parotid secretion
SJS	Stevens-Johnson syndrome
TENS	Transcutaneous electrical nervestimulation
(s-SFR)	Stimulated salivary flow rate
(u-SFR)	unstimulated salivary flow rate

Introduction

Saliva is one of the most versatile, multifunctional substances produced by the body and has a critical role in the preservation of the oropharyngeal health. It comprises a serious and mucinous component and is secreted by the major salivary glands, the mucins in the saliva serve to protect and lubricate the hard and soft tissues of the mouth, protecting them from chemical and mechanical damage. **(cruze *etal*., 2016).**

It is composed of 98% water, the rest 2% is composed of mucus, glycoproteins, enzymes, antibacterial as secretory IgA and lyzoenzyme and bacterial component. **(Narh *et al*., 2008)**

Saliva is a complex mixture of fluids that provides several protective functions, including cleansing the oral cavity, facilitating speech and swallowing, protecting oral tissues (including teeth) against physical and microbial insults, and maintaining a neutral ph**. (Pedersen and Belstrøm, 2019)**

In addition to facilitates oral sugar clearance and serves as a buffer that protects oral mucosa against orally ingested acids or regurgitated stomach acid**. (Dawes *et al*., 2015)**

Reduced salivary flow can cause difficulties in tasting, chewing, swallowing, and speaking; it can also increase the chance of developing dental caries, demineralization of teeth, tooth sensitivity, and/or mucosal infections. **(Plemons *et al.*, 2015)**

Xerostomia is a relatively common complaint that can make the wearing of the dentures extremely discomfortable for the affected edentulous patients. To overcome this problem, various techniques have been proposed including the preventive measures, management of symptoms, measures to increase the salivary flow, use of saliva substitutes and reservoir dentures. **(Chandu and Hombes, 2011]**

Aim of review : Assess the association of dry mouth with age, gender, smoking and medical conditions. Evaluate the impact of dry moth on denture instability, discomfort, soreness in denture-bearing tissues and dissatisfaction with the oral functions, namely chewing, tasting and speaking

Chapter One

Review of the Literature

1.1.Background

Xerostomia is defined as the dryness of the mouth which is due to the changes in the composition of saliva or reduced salivary flow. Patients may have increased susceptibility to periodontal diseases, opportunistic infections like oral candidiasis, chemical, mechanical and biological injuries. The lack of adequate saliva may have negative impact in denture wearing patients resulting in difficulty during mastication and swallowing of food. Reduced retention of dentures may also drive the patients to compromised emotional wellbeing and reduced quality of life**. (Sandra *etal*., 2003)**

Severity of dry mouth symptoms ranges from mild oral discomfort to significant oral disease that can compromise the patient's health, dietary intake, and quality of life. Estimates of xerostomia prevalence in the general population vary widely depending on case definitions used and differences in study samples (e.g., age range, health status**. (Terrie, 2016)**

Previous studies have reported xerostomia prevalence estimates ranging from 10 to 26% in men to 10 to 33% in women. **(Furness *etal*., 2013)**

A 2018 systematic review reported an overall estimated prevalence of xerostomia in approximately 22% of the global population. **(Agostino et al., 2018)**

Xerostomia prevalence is generally higher among older individuals, typically due to polypharmacy and with the onset of various medical conditions over time. Saliva is a mixture of secretions from the major (i.e., parotid, submandibular, sublingual) and minor salivary glands located in the oral mucosa**. (Cohen-Brown and Ship, 2008)**

Table (1.1). Saliva components and functions**.**

Functions	Components
Digestion	Amylase, lipase, ribonucleases, proteases, water, mucins
Phonation	Water, mucin
Taste	Water, gustin
Lubrication	proline-rich glycoproteins, IgA
Antimicrobial action	Lysozyme, lactoferrin, lactoperoxides, mucins, cystins, histatins
Maintaining mucosa integrity	Mucins, electrolytes, water
Cleansing	Water
Buffer capacity andremineralization	Bicarbonate, phosphate, calcium, staterin, proline-rich anionic proteins,fluoride
Preparing food for swallowing	Water, mucins Digestion Amylase, lipase, ribonucleases, proteases, water,mucins

The salivary glands in mammals are exocrine glands that produce saliva through a system of ducts. Humans have three paired major salivary glands (parotid, submandibular, and sublingual), as well as hundreds of minor salivary glands, Salivary glands can be classified as serous, mucous or seromucous (mixed), In serous secretions, the main type of protein secreted is alpha-amylase, an enzyme that breaks down starch into maltose and glucose, whereas in mucous secretions the main protein secreted is mucin, which acts as a lubricant as below when we see in the table 1 . 2 and figure 1.1 **.(Martini *etal.*,2012; ; Al-Quran *etal*. , 2011)**

In humans, between 0.5 and 1.5 liters of saliva are produced every day, the secretion of saliva (salivation) is mediated by parasympathetic stimulation; acetylcholine is the active neurotransmitter and binds to muscarinic receptors in the glands, leading to increased salivation**. (Edgar *etal*.,2012)**

The fourth pair of salivary glands, the tubarial glands discovered in 2020 are named for their location, being positioned in front and over the torus tubarius. However, this finding from one study has to be confirmed. **(Katherine ,2010)**

Table (1.2) Salivary glands secretions and components

Gland	**Secretion type**	**compontes**
Parotid	**serous**	**Amylase** **Proline-rich proteins** **Agglutinins** **Cystatins** **Lysozymes** **Extraparotid glycoproteins** **Na, ca, Cl, P04, K** **IgA**
Sublingual	**mucous**	**Mucins:** **MG1** **MG2** **Lysozymes** **Na, ca, Cl, P04, K** **IgA**
Subrnandibular	**mixed**	**MG1** **Mucin** **Cystatins** **Lysozymes** **Na, ca, Cl, P04, K** **IgA**
Palatine	**mucous**	**Amylase** **Na, K, ca, Cl, P04** **Cystatins** **IgA**

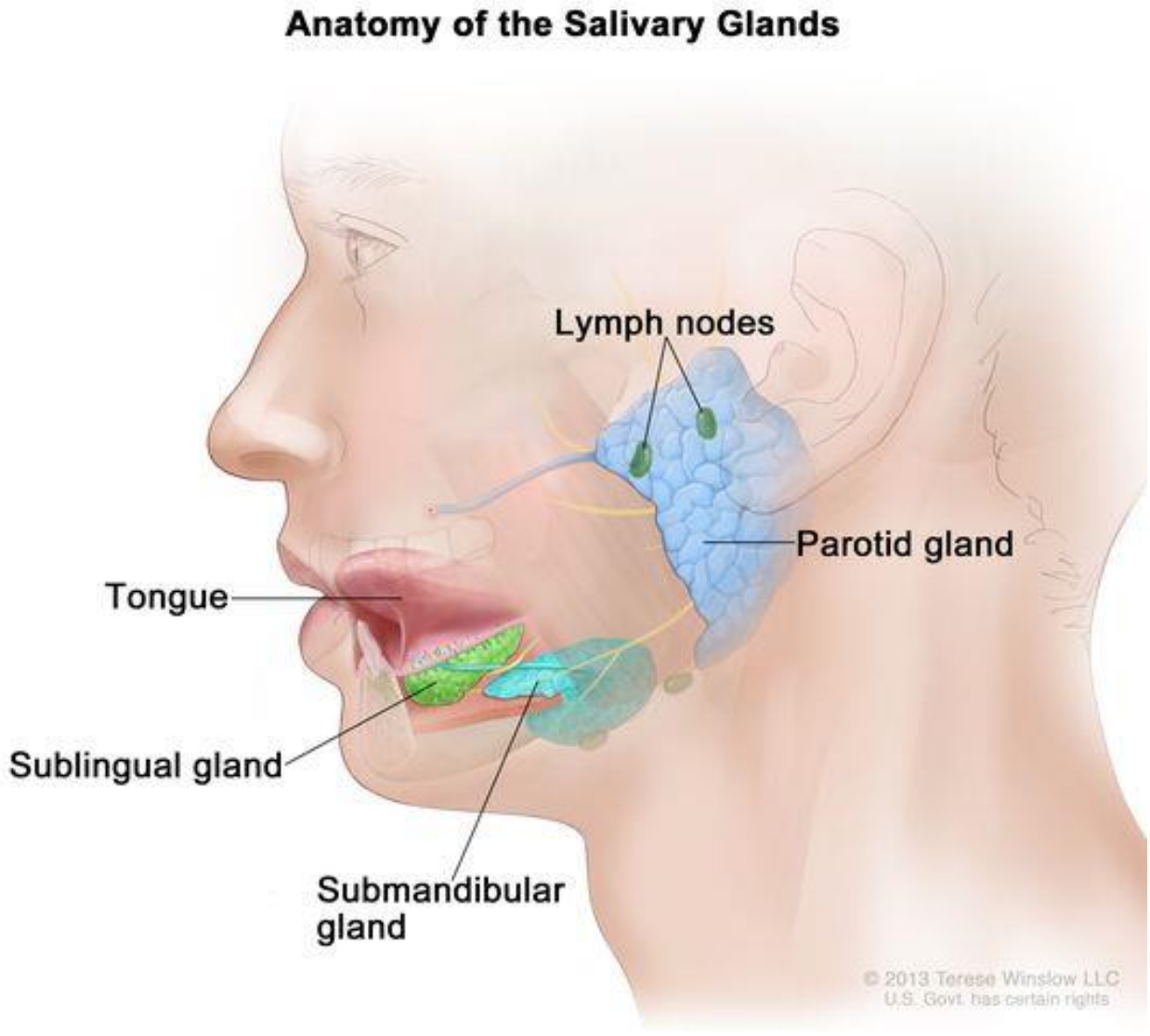

Figure (1.1) Anatomy of salivary glands.

1.2. Diagnosis of xerostomia

The objective of the diagnosis is to provide treatment as early as possible, thus minimizing side effects in patients suffering from xerostomia. In order to establish a diagnosis of xerostomia, a clinical history is essential to identify the possible etiological factors, It is necessary to investigate its causes. Thus, three orders of factors need to be known: the occurrence of systemic diseases, medication, and the history of radiation therapy. Questions are asked to the patient, trying to find out if he feels the dry mouth sensation, whether he needs to wet his mouth, if he can eat a wafer without drinking water, if the tongue chews the food and clings to the teeth, and the daily water intake daily among other issues **(Tschoppe., etal,.2011; Chan *etal*.,2012).**

The qualitative clinical diagnosis of xerostomia is made through the observation of clinical signs such as palpation of the salivary glands, observation of the oral mucosa and its hydration, cracked lips, saliva under the tongue, appearance and texture of saliva, the identification of caries, candidiasis and burning sensation, and others, Several methods have been developed to evaluate the level of dryness of the mouth, the discomfort being the most used: solography, sialo chemistry, sialometry and scintigraphy, salivary gland biopsy, ultrasound, magnetic resonance, and computed tomography **(Visvanathan and Nix ,2016)**.

Sialography is a technique of imaging that involves the injection of a retrograde form of radiopaque material into the salivary duct system in order to define the anatomy of the glands. This test is very important to demonstrate the presence of nodules or sialectasis, but it has its disadvantages, such as: the difficulty of the technique, since it is invasive and the patient can react acutely or chronically with the contrast material. The biopsy of the major or minor salivary glands allows the detection of inflammatory infiltrations, acinar destruction and dilation of salivary channels with thick mucus, and sometimes fibrosis **(Ugga *etal*.,2017)**.

Ultrasound, magnetic resonance, and computed tomography are tests that may also contribute to the diagnosis of diseases of the salivary glands, to establish the condition of the symptom or to evaluate a possible salivary glandular dysfunction **(Singh and Tonk ,2012)**

the determination of salivary flow rate. Sialometry and scintigraphy (an imaging diagnostic method of nuclear medicine that allows the study of the physiology of the various organs) are complementary tests that must be performed in order to evaluate the involvement of the salivary glands in patients with xerostomia. Sialometry is a relatively common procedure in normal clinical practice and include determination of stimulated salivary flow rate (s-SFR), unstimulated salivary flow rate (u-SFR), palatal secretion (PAL), and parotid secretion (PAR). **(Chambers etal.,2004)**

These measurements are the simplest methods of evaluating the salivary glandular function. It is essential to measure the salivary flow, that is, the amount of saliva produced per unit of time. Very low unstimulated and stimulated salivary flow rates or hypo salivation are defined as <0.1 and <0.7 mL/min, respectively **(Delli,2014).**

At rest, secretion ranges from 0.25 to 0.35 mL/min and is mostly produced by the submandibular and sublingual glands, Under stimulation, the parotids account for 50% of salivary volume. Determining the stimulated and unstimulated salivary flow is a procedure to measure the amount of saliva it produces a person at a given time. Generally, the stimulated salivary flow is measured for 5 min and unstimulated salivary flow is measured for 15 min **(McMillan and Tsang,2005).**

This kind of measuring has the advantage of being easily implemented, low-cost, and could be available to most of the population at risk, the diagnosis of salivary gland dysfunction is based on data derived from the symptoms reported by the patient, clinical examination leading to

verification of the clinical signs and determination of stimulated salivary flow **(Fox *etal.*,1987). (figure 1.2)**

Below picture is about an oral oral dryness by photographic appearance of the tongue and show in this appearance.

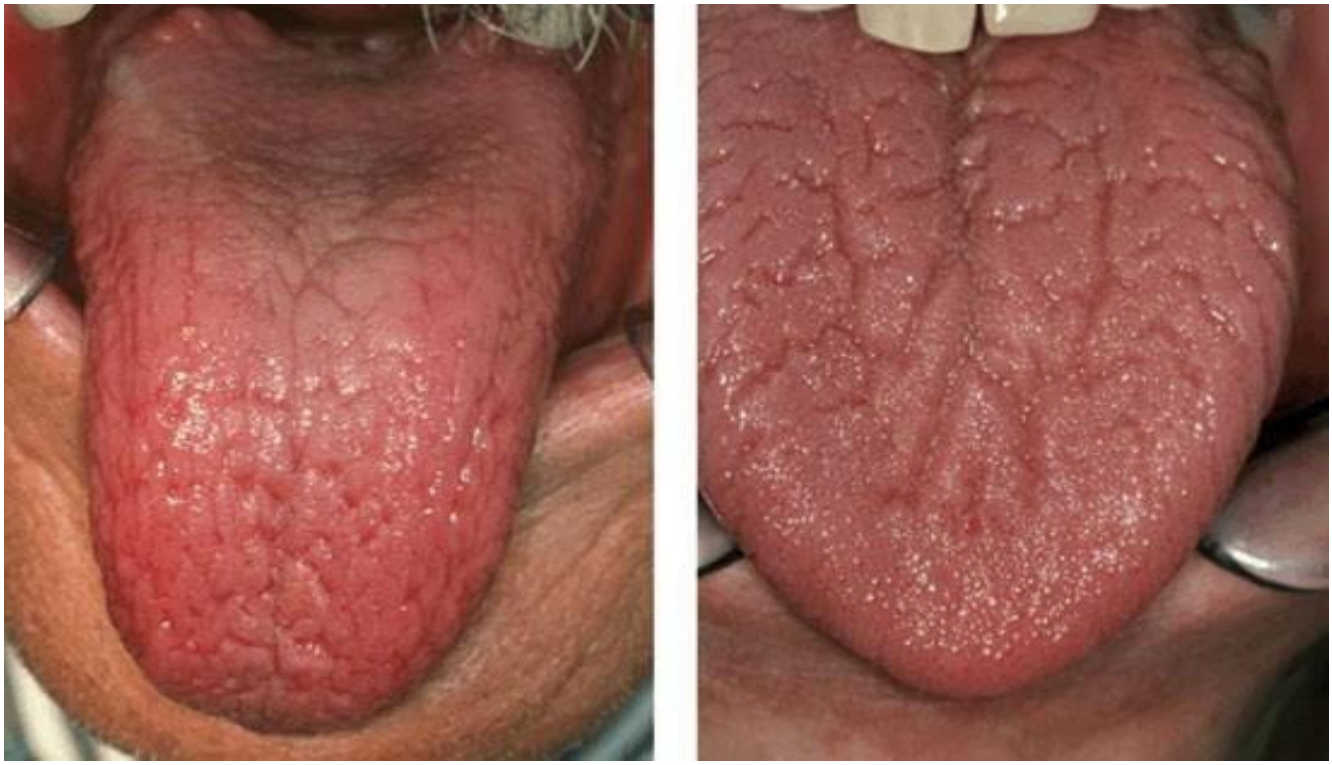

Figure (1.2) oral dryness by photographic appearance of the tongue

1.3. Etiology

1.3.1 Drug Induced Xerostomia

The most frequent cause of hypo salivation is use of certain medications**,** A systematic review in 2017 concluded that urologic medications, antidepressants and psycholeptics were associated with dry mouth in older adults. **.(Villa *et al.*, 2015)**

Another systematic review reported that many medications had strong to moderate evidence of being associated with salivary gland dysfunction like antidepressants and antimuscarinic, antihistamines decongestants, pain medications, diuretics, muscle relaxants, and antidepressants. **(Jouhhjky , 2018)**

The most common types of medications causing salivary dysfunction have anticholinergic effects, e.g., tricyclic antidepressants, antihistamines, antihypertensive medications, and ant seizure/antispasmodic drugs. **(Ship. ,2007)**

Drug substitutions may help reduce the dry mouth effects of certain medications (e.g., selective serotonin-reuptake inhibitor antidepressants tend to cause less dry mouth than tricyclic antidepressants).**(Scully., 2003)**

The therapeutic and controlled doses of medications do not damage the salivary gland structure. For that reason, drug-induced xerostomia is reversible. The discontinued use of these drugs can restore salivary flow and these some drugs with side effect on salivary gland **(Batista *etal*.,2014)**

Table (1.3). Medicines and drugs with side effects on salivary secretion.

Medicine group	Examples
Anxiolytics	Lorazepam, diazepam
Anorectic	Fenfluramine
Anticonvulsants	Gabapentin
Antidepressants—tricyclic	Amitriptyline, imipramine
Antidepressants —SSRI	Sertraline, fluoxetine
Antiemetics	Meclizine
Antihistaminics	Loratadine
Antiparkinsonian	Biperidene, selegiline
Antipsychotics	Clozapine, chlorpromazine
Bronchodilators	Ipratropium, albuterol
Decongestants	Pseudoephedrine
Diuretics	Spironolactone, furosemide
Muscle relaxants	Baclofen
Narcotic analgesics	Meperidine, morphine
Sedatives	Flurazepam
Antihyperptensive	Prazosin hydrochloride
Antiarthritic	Piroxicam

1.3.2 Toxicity Related to Cancer Radiotherapy and chemotherapy.

Oral complications of cancer chemotherapy or head and neck cancer radiotherapy. can be acute or chronic.

(**Dodds, 2002**)

These therapies can cause xerostomia/salivary gland hypo function via direct toxicity to salivary glands and oral tissues or indirect damage due to regional or systemic toxicity. Generally, cancer chemotherapy causes acute toxicities that resolve following discontinuation of therapy and healing of damaged tissue, whereas radiation therapy can cause acute oral toxicity, as well as induce permanent tissue damage that can put patients at lifelong risk**.**

(Ship, 2007)

Xerostomia can also occur following hematopoietic stem-cell transplantation and as part of salivary gland graft-versus-host disease. Sialadenitis, or infection of the salivary gland, is another potential acute oral toxicity associated with chemo/radiotherapy. Radioactive iodine, which is used to treat some thyroid cancers, can damage salivary glands (primarily the parotid glands) in a dose-dependent fashion **(Bailyn, 1928)**

1.3.3 Physiological or Disease-Related Aging.

Xerostomia affects 30% of patients older than 65 years and up to 40% of patients older than 80 years; this is primarily an adverse effect of medication(s), although it can also result from comorbid conditions such as diabetes, Alzheimer's disease, or Parkinson's disease.

(Stein and Aalboe, 2015)

Xerostomia, while common among older patients, has been found to be twice as likely to occur in adult patients who take one of more drugs daily when compared with medication-free individuals. Xerostomia prevalence is also higher among individuals with an intake of more than four daily prescription medication, the exact mechanisms whereby some drugs determine xerostomia or hypo salivation are still unknown. Salivary dysfunction associated to drugs may occur through anticholinergic, cytotoxic action, sympathomimetic, or by damaged ion transport pathways in the acinar cells

(Yellowitz and Schneiderman,2014; Devan,1999)

1.3.4 Automation Disease.

Sjögren disease (formerly known as Sjögren syndrome) is the second most common autoimmune connective-tissue disease and is the systemic condition most frequently associated with salivary dysfunction and xerostomia. Sjögren's syndrome (SjS, SS) is a long-term autoimmune disease that affects the body's moisture-producing (lacrimal and salivary) glands, and often seriously affects other organs systems, such as the lungs, kidneys, and nervous system. Primary symptoms are dryness (dry mouth and dry eyes, pain and fatigue. Other symptoms can include dry skin, vaginal dryness, a chronic cough, numbness in the arms and legs, feeling tired, muscle and joint pains, and thyroid problems. Those affected are also at an increased risk (15%) of lymphoma. **(Aida ,2006; John H., Klippel, 2012)**

1.3.5 Other Conditions.

Other conditions associated with dry mouth include:

- Cystic fibrosis
- Graft-versus-host disease
- Hepatitis C virus infection
- HIV infection/AIDS
- Hormonal changes (e.g., pregnancy or menopause)
- Lymphoma
- Nerve damage from a head or neck injury
- Poorly controlled diabetes
- Psychogenic causes

• **Salivary gland agenesis or aplasia**

• **Uncontrolled hypertension**

Potential lifestyle causes of xerostomia include the use of alcohol or tobacco use, or the consumption of excessive caffeine or spicy food.

(Terrie ,2016)

1.4. signs and symptoms of Xerostomia:

- a sticky, dry, or burning feeling in the mouth
- trouble chewing, swallowing, tasting, or speaking
- altered taste or intolerance for spicy, salty, or sour foods or drinks
- a dry or sore throat
- cracked, peeling, or atrophic lips
- a dry, rough tongue
- mouth sores
- an infection in the mouth (e.g., oral candidiasis)
- hoarseness of the voice
- halitosis (bad breath)
- inability to retain dentures or otherwise poorly fitting removable prostheses.

(Fox and Ship, 2008)

Xerostomia symptoms may also worsen at night because salivary output reaches its lowest circadian levels during sleep, and the problem can be exacerbated by mouth breathing. **(Turner and Ship ,2007)**

1.5. Dental Implications of Xerostomia

The goals of treating xerostomia include identifying the possible cause(s), relieving discomfort, and preventing complications, e.g., dental caries and periodontal infections. **(Tanaka *etal*.,2021)**

Patients with complaints of dry mouth should undergo a detailed medical and dental history to help with early detection and identification of potential underlying causes.

(Ying and Thomson, 2015)

In patients with xerostomia or salivary gland hypo function, oral examination may reveal dry and friable oral mucosa and the tongue may appear dry and fissured. Patients may commonly have dental caries (especially root, cervical, or incisal/cuspal tips), plaque accumulation, gingivitis, and/or periodontitis.

Infections (e.g., oral candidiasis) and enlargement of salivary glands from sialadenitis may also be present. Other oral manifestations evident on examination may include angular cheilitis, mucositis, traumatic oral lesions, and/or difficulty in wearing/retaining oral prostheses.

(Agostini *etal*., 2018)

1.6. Treatments of xerostomia

1.6.1. Patient education

Patients should receive detailed information about the potential causes of dry mouth and the potential sequelae of impaired salivary secretion, such as dental caries, candidiasis, and mucosal complications. Therefore, patients should be encouraged to have preventive oral health care such as dental hygiene habits and regular dental visits, Another palliative action to minimizing symptoms and preventing oral complications is water intake, drinking water frequently, and remaining hydrated is an important treatment for symptoms of dry mouth. (**Devishree etal.,1981; • Fossaluzza,2008).**

1.6.2. Preventive therapies:

Pharmacological interventions for the prevention of radiation-induced salivary gland dysfunction have been studied. The use of chemical radioprotectors represents an obvious strategy to improve the therapeutic index in radiotherapy. However, the vast majority of these are either too weak in terms of radioprotection, too toxic, or without any, apparent mechanisms to ensure selective normal tissue protection. The sulfhydryl compound amifostine is an oxygen scavenger that may protect salivary glands from free-radical damage during radiation therapy without attenuation of the anti-tumor effects in many experiments performed.

(Saavedra *etal*.,1989 ; Nin *etal*.,2003)

Amifostine has been approved for prevention of xerostomia, in head and neck squamous cell carcinoma patients undergoing radiotherapy, A recent systematic review that included randomized controlled trials suggested that the drug amifostine prevents the feeling of dry mouth in people receiving radiotherapy to head and neck (with or without chemotherapy) in the short- (end of radiotherapy) to medium-term (3

months after radiotherapy),However, amifostine has adverse effects such as nausea, vomiting, hypotension, transient, hypocalcemia, and allergic reactions **(Seinfeld etal.,2002; Khurshudian,2003)**

Then, the benefits of amifostine should be weighed against its high cost and side effects and this a picture to the injection in figure (3) below:

Figure (1.3) Amifostine Injection

1.6.3. Symptomatic treatment of xerostomia

Saliva substitutes can provide some relief since provide higher viscosity and protection to the oral mucosa, an ideal saliva substitute must simulate natural human saliva, providing long lasting and intense hydration of the oral mucosa, be inexpensive, edible, easy-to-swallow but retainable in the mouth and should allow a minimal number of applications, Saliva substitutes are available in various formulations, e.g., lozenges, sprays, mouth rinses, gels, oils, chewing gums, or toothpastes. Most available in the market contain carboxymethylcellulose (CMC), mucins, xanthan gum, hydroxyethyl cellulose, linseed oil, or polyethylene oxide.

(Fox,2004; Ditolla ,2004).

Subjective impressions of patients suffering from severe xerostomia showed that artificial saliva containing mucins and xanthan gum are better in their rheological and moisturizing properties than those with CMC, because mucin-based substitutes had viscosities that were more similar to natural saliva. Recently, it was reported that a polysaccharide-based oral rinse was effective in symptom control in patients with xerostomia and may lead to an increase in saliva production, Other studies include the use of natural products, in this line, a recent double blinded, placebo-controlled clinical trial, evaluated the efficacy of topical lycopene-enriched virgin olive oil. It showed an improvement of oral quality of life and reduction of xerostomia symptoms.

(Itthagarun and Wei,1997; Craig, 2002).

Also, gelatinous substitutes of saliva showed a significant reduction of the Xerostomia: dryness-related complaints in patients

suffering from severe xerostomia, A randomized, double-blind, crossover study in patients affected by medication-induced xerostomia showed that two commercial mouthwash plus gel (GUM® Hydral versus Biotène® Oral balance) achieve a significant improvement in oral health and xerostomia-related quality of life, Recently, a novel edible saliva substitute, oral moisturizing jelly (OMJ), showed a higher grade of satisfaction than a commercially available saliva gel **[Van Loveren. ,2004].**

1.6.4. Systemic and topical salivary stimulants

Pilocarpine and cevimeline are two systemic US Food and Drug Administration-approved systemic sialogogues for treatment of dry mouth; both can increase secretions and diminish xerostomic complaints in patients, although they must have functional salivary gland cells. Pilocarpine is a cholinergic parasympathomimetic agent that stimulates muscarinic cholinergic receptors on the surfaces of exocrine glands and has been indicated for the treatment of xerostomia, The usual oral dosage for pilocarpine is 5–10 mg three times per day. The initial recommended dose is 5 mg three times per day oral route (OR), which can be increased up to 30 mg/day depending on response and tolerance. The onset of action is 30 min, and the duration of action is approximately 2–3 h.

(Strietzel *etal*.,2011; Alajbeg *etal*.,2012).

The recommended dose is 30 mg three times a day OR, and the most common associated side effect is dyspepsia. Bethanecol is anotherdrug whose action mechanism is on M3 receptors. It has been used to decrease unwanted effects caused by antidepressant and antipsychoticdrugs, the dose indicated is four times a day in doses from 10 to 50 mg, Adverse effects, despite being infrequent, include nausea and diarrhea.

(Konidena *etal*.,2009; Dyasnoor and Kamath ,2017)

Topical salivary stimulants include sugar-free chewing gum and jellybeans, they can increase salivary secretion by mechanical stimulation and improve the sensation of dry mouth. These products usually contain fluoride, chlorhexidine, calcium phosphate, and xylitol releasers, which inhibits the growth of cariogenic bacteria and reduces the incidence of caries **(Pringle *etal*.,2016).**

Direct stimulation with electro stimulating device mounted on an intra-oral removable appliance has been used in patients with salivary dysfunction with good results and no significant side-effects [95, 96]. Moreover, non-invasive electrical stimulation systems such as transcutaneous electrical nerve stimulation (TENS) was highly effective in stimulating whole salivary flow in patients with xerostomia and hypo salivation caused by DM and postmenopausal condition **(Baum. etal.,2012; Srinivasan etal.,2017)**

1.6.5. Glandular regeneration and gene therapy

Stem cell replacement therapy may be a good option to treat radiation-induced hypo salivation. Stem cell therapy attempts the repair of damaged salivary glands at the cellular level. In this regard, bone marrow stem cells, adipose tissue-derived stromal cells, dental pulp cells have been tested as a form of treatment for hypo salivation after radiotherapy.

(Hai *etal*.,2014).

Interestingly, human salivary stem/progenitor cells (hSSPCs) (derived from parotid and submandibular glands) can be cultured using the salisphere technique and can be introduced to a damaged salivary gland tissue to replace dead or damaged cells, showed the presence of SSPCs in cultured human salipheres, these cells were capable of self-renewal and

differentiation, which when transplanted into irradiated recipients and restored glandular function**. (Jiang,2017).**

Considering that an ultimate goal is to develop fully functioning bioengineered organs to replace lost or damaged. It was recently reported that a population of SSPCs can be reliably isolated and expanded in sufficient number, suitable for use in a unique 3D hydrogel model of a human implantable salivary gland However, independent and collaborative work in stem cells research and tissue engineering is still necessary to have fully functional human salivary glands**. (Palaniyandi and Odaka,2014)**

Gene therapy involves injecting a vector with genetic information into a tissue to result in some beneficial change. Originally, gene transfer was considered for use in treating congenital genetic disorders, but the basic principles have now been applied virtually to every organ, for acquired as well as inherited disorders. Regarding salivary glands, Baum et al., in phase I/II study, showed an increased saliva flow rate from the targeted parotid gland, as well as a reduction in symptoms related to the radiation-induced xerostomia in subjects treated with the transferring of cDNA for human aquaporin-1 (hAQP1) through an adenoviral (Ad5) vector (AdhAQP1). **(Arany *etal*.,2013; Tan *et al*., 2018)**

1.6.6. strategies for relieving dry mouth:

these include: **(Kumar etal.,2009 ;Navazesh,2012)**

- sipping water or sugarless, caffeine-free drinks
- sucking on ice chips
- using lip lubricants frequently (e.g., every two hours)
- chewing sugar-free gum or sucking on sugar-free candy
- avoiding salty or spicy food or dry, hard-to-chew foods
- avoiding sticky, sugary foods
- avoiding irritants such as alcohol (including alcohol-containing mouthrinses20), tobacco, and caffeine
- drinking fluids while eating carefully
- using a humidifier at night

1.6.7 oral health-specific recommendations:

include the following for patients with dry mouth: **(Hayes Met al., 2016)**

- brush teeth gently at least twice a day with fluoridated toothpaste
- floss teeth every day
- schedule dental visits at least twice a year (with yearly bitewing radiographs)
- use of a prescription-strength fluoride gel (0.4% stannous fluoride, 1.1% sodium fluoride) daily to help prevent dental decay
- prompt treatment of oral fungal or bacterial infections
- application of 0.5% fluoride varnish to teeth
- dental soft- and hard-tissue relines of poorly fitting prostheses and use of denture adhesives

1.7. prosthic therapy

1.7.1 denture reservoir

a particular method for prosthetic rehabilitation, the so-called "reservoir" denture, is presented. A complete denture is produced with conventional techniques but has a small container for artificial saliva. For mandibular dentures the container is sub-divided into 3 inter-communicating chambers and is situated in the lingual flange; for maxillary dentures, a single chamber is situated in the palatine concavity.. **(Branchi et al., 2003),** The reservoir of the upper denture functiones satisfactorily, this was found to effective in reducing the discharge of saliva substitute from the reservoir below in figure (4) the dental resvior in lower arch. **(Hirvikangas et al., 1989)**

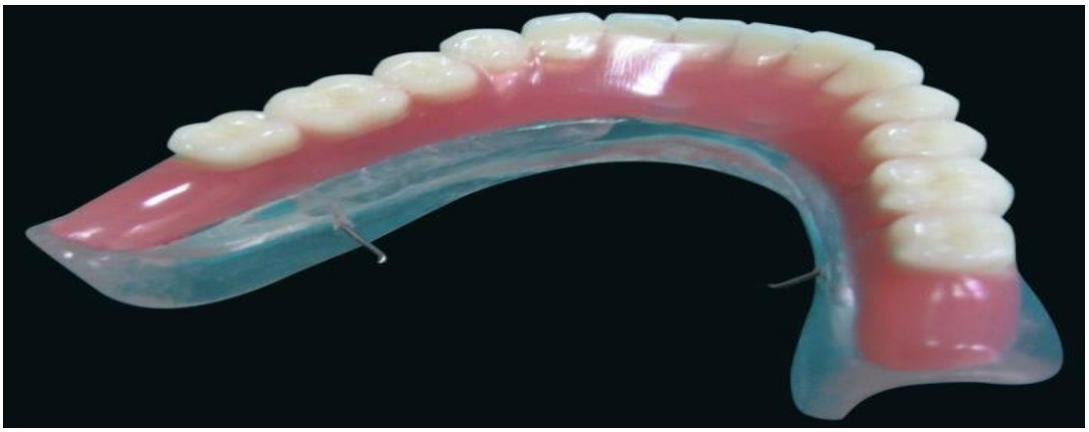

Figure (1.4) denture reservoir

Chapter two

2.1 Conclusion

1. association of the perception of dry mouth among denture wearers with oral symptoms and function. Xerostomia is significantly associated with increased age and smoking. Xerostomia adversely affects oral functions and overall satisfaction with dentures. Dry mouth [Xerostomia] may lead to loose dentures, irritations, sores and possible infection for denture wearers. Clinician needs to identify the possible cause for the xerostomia condition and provide the patient with appropriate treatment.

2.it is important to have an appropriate comprehension of diverse causes of xerostomia to develop a systematic approach that includes collaboration with physicians to facilitate interdisciplinary patient care.

3. a comprehensive management of xerostomia is also necessary and it should incorporate patient education, lifestyle modifications, and adequate pharmacological and non-pharmacological therapies to improve the patient's quality of life.

4. Since most of the successful therapies are depending on the parenchymal gland affection, it is essential to know new therapeutic approaches to fully recover in vivo the gland's function or to develop new bioengineered salivary tissues.

5. Wearing complete dentures can be an extremely uncomfortable experience for the people with Xerostomia. Various treatment modalities have been suggested in the literature to overcome the problem of xerostomia in complete denture patients. Incorporating reservoirs containing salivary substitutes, into dentures, is one of these treatment modalities. This new split denture technique resulted in a reservoir denture that provided good lubrication of the oral tissues, was easily cleaned by the wearer and was produced from routine denture materials.

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