



David H Felix



Jane Luker



Crispian Scully

This series provides an overview of current thinking in the more relevant areas of Oral Medicine, for primary care practitioners.

The series gives the detail necessary to assist the primary dental clinical team caring for patients with oral complaints that may be seen in general dental practice. Space precludes inclusion of illustrations of uncommon or rare disorders.

Approaching the subject mainly by the symptomatic approach, as it largely relates to the presenting complaint, was considered to be a more helpful approach for GPs rather than taking a diagnostic category approach. The clinical aspects of the relevant disorders are discussed, including a brief overview of the aetiology, detail on the clinical features and how the diagnosis is made, along with guidance on management and when to refer, in addition to relevant websites which offer further detail.

Oral Medicine: 4. Dry Mouth and Disorders of Salivation

Specialist referral may be indicated if the Practitioner feels:

- The diagnosis is unclear;
- A serious diagnosis is possible;
- Systemic disease may be present;
- Unclear as to investigations indicated;
- Complex investigations unavailable in primary care are indicated;
- Unclear as to treatment indicated;
- Treatment is complex;
- Treatment requires agents not readily available;
- Unclear as to the prognosis;
- The patient wishes this.

Saliva is essential to oral health. The most obvious and important function of saliva is in eating, for taste and to lubricate food, as well as protecting the mucosa and teeth (Table 1). The water, mucins and proline-rich glycoproteins lubricate food and help swallowing. Importantly, saliva is essential for normal taste perception. Saliva is protective *via* the washing action,

via various antimicrobial components such as mucin, histatins, lysozyme and lactoferrin, and *via* specific antibodies to a range of micro-organisms that the host has encountered.

Salivary gland secretion from the major (parotid, submandibular and sublingual) and minor glands (multiple mucous glands scattered throughout the mouth – especially the lips and soft palate), is mainly under neural control, under the influence of the autonomic nervous system, although various hormones may also modulate its composition. In general, parasympathetic stimulation increases salivation, while sympathetic stimulation produces more viscous saliva and therefore appears to depress salivation.

Thus, in acute anxiety, when there is sympathetic stimulation, the mouth feels dry. The mouth is also dry if the parasympathetic system is inhibited by, for example, various drugs. Anything that damages the glands, or reduces body fluids, can also reduce salivation.

- Digestion
- Lubrication
- Buffering
- Mineralization
- Tissue coating
- Anti-microbial

Table 1. Functions of saliva.

- Iatrogenic
 - Drugs
 - Irradiation
 - Graft versus host disease
- Disease
 - Dehydration
 - Psychogenic
 - Salivary gland disease
 - Sjögren's syndrome
 - Sarcoidosis
 - Salivary aplasia
- Drugs

Table 2. Causes of dry mouth.

David H Felix, BDS, MB ChB, FDS RCS(Eng), FDS RCPS(Glasg), FDS RCS(Ed), FRCP(Edin) Postgraduate Dental Dean, NHS Education for Scotland, **Jane Luker**, BDS, PhD, FDS RCS, DDR RCR, Consultant and Senior Lecturer, University Hospitals Bristol NHS Foundation Trust, Bristol, **Professor Crispian Scully**, CBE, MD, PhD, MDS, MRCS, BSc, FDS RCS, FDS RCPS, FFD RCSI, FDS RCSE, FRCPATH, FMedSci, FHEA, FUCL, FSB, DSc, DChD, DMed(HC), Dr HC, Emeritus Professor, University College London, Hon Consultant UCLH and HCA, London, UK.

Dry mouth (xerostomia)

Dry mouth (xerostomia) is a complaint that is the most common salivary problem and is the subjective sense of dryness which may be due to:

- Reduced salivary flow (hyposalivation); and/or
- Changed salivary composition.

Patients who have chronically decreased salivary flow (hyposalivation) suffer from lack of oral lubrication, affecting many functions, and they may complain of dryness (xerostomia), and can develop dental caries and other infections

(candidosis, or acute bacterial sialadenitis) as a consequence of the reduced defences.

Causes

There are physiological causes of hyposalivation. Thus a dry mouth is common during periods of anxiety, due to sympathetic activity; mouthbreathers may also have a dry mouth and advancing age is associated with dry mouth, probably because of a reduction of salivary acini, with a fall in salivary secretory reserve.

Very rarely, salivary glands may be absent at birth – so-called salivary gland aplasia or agenesis.

Most salivary gland dysfunction is acquired (Table 2).

In most older people complaining of xerostomia, the cause is usually due to medication or disease. Indeed, the main causes of dry mouth are iatrogenic, particularly drug use. There is usually a fairly close temporal relationship between starting the drug treatment or increasing the dose, and experiencing the dry mouth. However, the cause for which the drug is being taken may also be important. For example, patients with anxiety or depressive conditions may complain of dry mouth even in the absence of drug therapy (or evidence of reduced salivary flow).

Drugs recognized as causes of reduced salivation include mainly those with anticholinergic, or sympathomimetic, or diuretic activity. These include those cited in Table 3.

Irradiation for malignant tumours in the head and neck region, such as oral cancer, can produce profound xerostomia. Other sources of irradiation, such as radioactive iodine (¹³¹I) used for treating thyroid disease, may also damage the salivary glands, which take up the radioactive iodine.

Dehydration, as in diabetes mellitus, chronic renal failure, hyperparathyroidism or any fever and diabetes insipidus is an occasional cause of xerostomia.

Diseases of salivary glands can also cause salivary dysfunction. These are mainly Sjögren's syndrome (a multisystem condition discussed below); sarcoidosis; HIV disease; liver diseases; and cystic fibrosis (mucoviscidosis) (Figure 1).

Finally, it is important to recognize also that some patients complaining of a dry mouth have no evidence of a reduced salivary flow or a salivary disorder (ie they have xerostomia but not hyposalivation), and in these there may be a psychogenic reason for the complaint.

Clinical features

The patient with hyposalivation may have difficulty in:

- Swallowing – especially dry foods such as biscuits (the cracker sign);
- Controlling dentures;

<ul style="list-style-type: none"> ■ Drugs which directly damage the salivary glands <ul style="list-style-type: none"> ■ Cytotoxic drugs ■ Drugs with anticholinergic activity <ul style="list-style-type: none"> ■ Anticholinergic agents such as atropine, atropinics and hyoscine ■ Antireflux agents eg proton-pump inhibitors (such as omeprazole) ■ Psychoactive agents with anticholinergic activities such as: <ul style="list-style-type: none"> – Antidepressants, including tricyclic (eg amitriptyline, nortriptyline, clomipramine and dothiepin [dosulepin]), selective serotonin re-uptake inhibitors (eg fluoxetine), lithium and others ■ Phenothiazines ■ Benzodiazepines ■ Opioids ■ Antihistamines ■ Bupropion ■ Drugs acting on sympathetic system <ul style="list-style-type: none"> ■ Drugs with sympathomimetics activity eg ephedrine ■ Antihypertensives; alpha 1 antagonists (eg terazosin and prazosin) and alpha 2 agonists (eg clonidine) may reduce salivary flow. Beta blockers (eg atenolol, propranolol) also change salivary protein levels. ■ Drugs which deplete fluid <ul style="list-style-type: none"> ■ Diuretics

Table 3. Drugs associated with dry mouth.

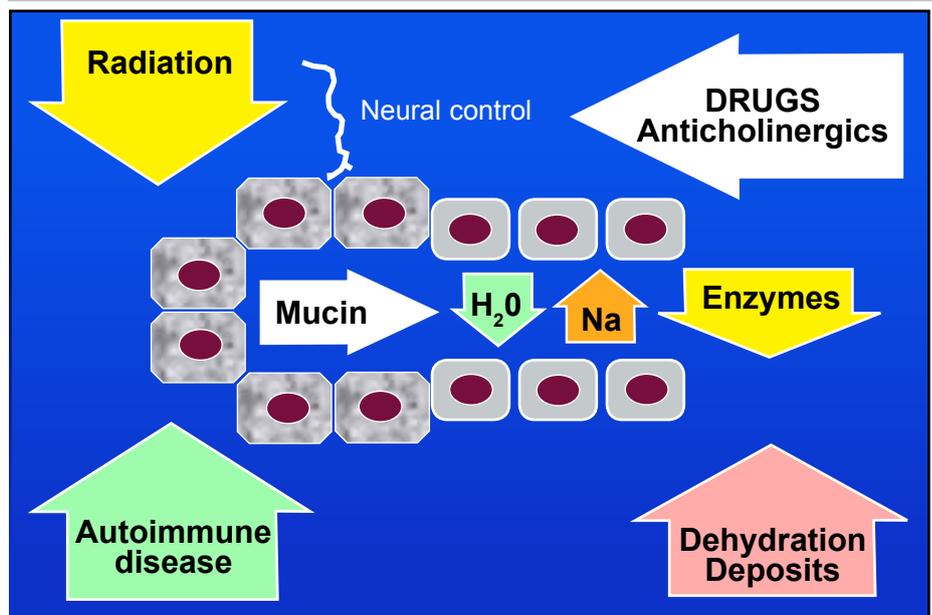


Figure 1. Causes of dry mouth. (Reproduced from Scully C. *Oral and Maxillofacial Medicine*. Elsevier, 2008.)

■ Speaking, as the tongue tends to stick to the palate – leading to ‘clicking’ speech.

Patients may also complain of unpleasant taste or loss of sense of taste, or halitosis.

The patient with hyposalivation may complain of a dry mouth or these sequelae alone, or also complain of dryness of the eyes and other mucosae (nasal, laryngeal, genital). Those with eye



Figure 2. Dry mouth.

complaints have blurring, light intolerance, burning, itching or grittiness, and sometimes an inability to cry.

Systemic features (such as joint pains) may be suggestive of Sjögren's syndrome.

Examination may reveal that the lips adhere one to another, and an examining dental mirror may stick to the mucosa because of the reduced lubrication. Lipstick or food debris may be seen sticking to the teeth or soft tissues, and the usual pooling of saliva in the floor of the mouth may be absent. Thin lines of frothy saliva may form along lines of contact of the oral soft tissues, on the tongue, or in the vestibule. Saliva may not be expressible from the parotid ducts. The tongue is dry (Figure 2) and may become characteristically lobulated and usually red, with partial or complete depapillation (Figure 3).

Complications of hyposalivation can include:

- Dental caries – which tends to involve smooth surfaces and areas otherwise not very prone to caries – such as the lower incisor region and roots (Figure 4).

Hyposalivation may explain why patients, who are apparently complying with dietary advice, have uncontrollable



Figure 3. Xerostomia and lobulated tongue.



Figure 4. Dry mouth and caries in Sjögren's syndrome.



Figure 5. Dry mouth complicated by candidosis.

recurrent caries.

- Candidosis – which may cause a burning sensation or mucosal erythema (Figure 5), lingual filiform papillae atrophy, and angular stomatitis (angular cheilitis).
- Halitosis (Article 5).
- Ascending (suppurative) sialadenitis – which presents with pain and swelling of a major salivary gland, and sometimes purulent discharge from the duct.

Diagnosis

Hyposalivation is a clinical diagnosis which can be made by the practitioner predominantly on the basis of the history and examination.

It can be helpful to document salivary function by salivary function studies, such as salivary flow rates (sialometry). Collection of whole saliva (oral fluid) is currently the routine technique for sialometry used by many clinicians, despite the fact that it is rather inaccurate and non-specific. It is usually carried out by allowing the patient to sit quietly and dribble into a measuring container over 15 minutes; in a normal person, such an unstimulated whole saliva flow rate exceeds 1.5 ml/15 min (0.1 ml/min).

Keypoints: dry mouth

Diagnosis is clinical but investigations *may* be indicated, including:

- Blood tests (ESR and SS-A and SS-B antibodies; see below);
- Eye tests (Schirmer; see below);
- Urinalysis;
- Salivary flow rate tests (sialometry);
- Salivary gland biopsy (labial gland biopsy);
- Imaging;

- Sialography;
- Scintiscanning;
- Ultrasound;
- Chest radiograph (if suspected sarcoidosis).

The Specialist may be needed to:

- Study and document the degree of salivary dysfunction;
- Determine the cause;
- Arrange future dental care, although much of this can be undertaken in the primary care environment.

Investigations that may be indicated to exclude systemic disease, particularly to exclude:

- Sjögren's syndrome and connective tissue disorders;
- Diabetes;
- Sarcoidosis;
- Viral infections (hepatitis C; HIV).

Commonly used investigations may thus include:

- *Blood tests* (mainly to exclude diabetes, Sjögren's syndrome, sarcoidosis, hepatitis

	SS-1	SS-2
Dry mouth	Yes	Yes
Dry eyes	Yes	Yes
Connective tissue disease	No	Yes
Extraglandular problems	More common	Less common

Table 4. Sjögren's syndrome.



Figure 6. Parotid gland swelling.

- and other infections);
- Eye tests (eg Schirmer test mainly to exclude Sjögren's syndrome);
- Salivary gland biopsy (if there is suspicion of organic disease, such as Sjögren's syndrome);
- Imaging (mainly to exclude Sjögren's syndrome, sarcoidosis or neoplasia).

It is important to remember, as stated above that, in some patients complaining of a dry mouth, no evidence of a reduced salivary flow or a salivary disorder can be found. There may then be a psychogenic reason for the complaint.

Management (see below)

Sjögren's syndrome

Sjögren's syndrome (SS) is an uncommon condition found in association with dry mouth and dry eyes. The other key features of SS are evidence of an auto-immune reaction, shown usually by serum

auto-antibodies and sometimes confirmed by demonstrating mononuclear cell infiltrates in a labial salivary gland biopsy. Sjögren's syndrome can affect any age, but the onset is most common in middle age or older. The majority of patients are women with a female:male ratio of 9:1

Aetiopathogenesis

Sjögren's syndrome is an auto-immune disease affecting mainly exocrine glands like the salivary glands, lacrimal glands and pancreas. There may be a viral aetiology and a genetic predisposition.

The most common type of SS is secondary Sjögren's syndrome (SS-2), which comprises dry eyes and dry mouth and a connective tissue or auto-immune disease, most commonly rheumatoid arthritis (RA). Other connective tissue disorders may be associated, eg systemic lupus erythematosus and scleroderma (Table 4). However, SS can appear by itself, and in the absence of a connective tissue disease is often termed sicca syndrome, usually referred to as primary Sjögren's syndrome (SS-1). Nevertheless, both forms

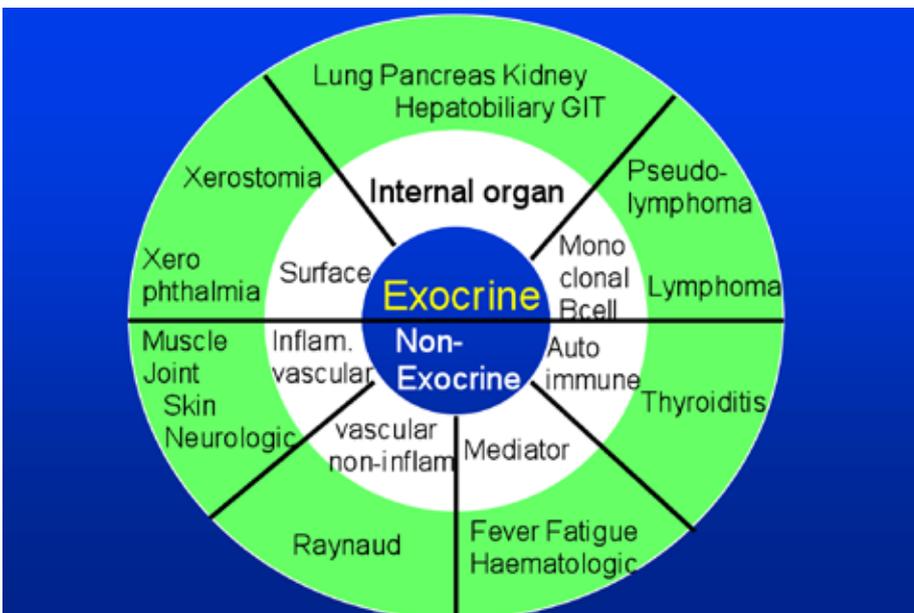


Figure 7. Sjögren's syndrome – a multisystem disease. (Reproduced from Scully C. Oral and Maxillofacial Medicine. Elsevier, 2008.)

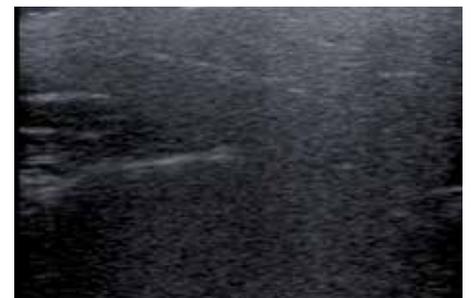


Figure 8. Ultrasound appearance of normal parotid gland showing a uniform echotexture.

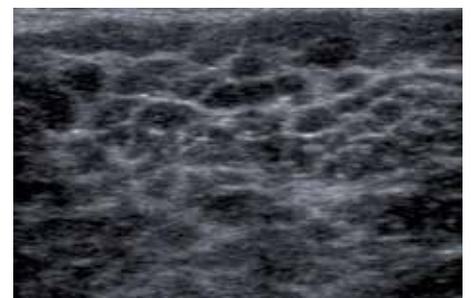


Figure 9. Ultrasound of a parotid gland showing classical appearance of Sjögren's syndrome. Multiple rounded hypo-echoic areas distributed throughout the gland.

are chronic and can affect not only the salivary glands, but also extraglandular tissues. Chronic B lymphocyte stimulation can occasionally lead to B cell neoplasms, such as lymphoma.

Sjögren's syndrome is often characterized by a raised erythrocyte sedimentation rate (ESR) and several auto-antibodies – particularly antinuclear factor (ANF) and rheumatoid factor (RF), and more specific antinuclear antibodies known as SS-A (Ro) and SS-B (La).

Clinical features

Sjögren's syndrome presents mainly with eye complaints which include sensations of grittiness, soreness, itching, dryness, blurred vision or light intolerance. The eyes may be red with inflammation of the conjunctivae and soft crusts at the angles (keratoconjunctivitis sicca). The lacrimal glands may swell.

Oral complaints (often the presenting feature) including:

- Xerostomia;
- Swollen salivary glands (Figure 6); causes include chronic sialadenitis as part of the fundamental auto-immune disease process, ascending bacterial sialadenitis which can arise if bacteria ascend the ducts because salivation is impaired, benign lymphoepithelial lesions/myoepithelial sialadenitis (pseudolymphoma) and lymphoma.

However, SS is a more generalized disorder which involves not only the exocrine salivary and lacrimal glands, but can have a range of other complications, summarized in Figure 7.

Diagnosis

Diagnosis is made from the history and clinical features, and may be confirmed by auto-antibody studies and sometimes by other investigations, such as ultrasound (Figures 8 and 9), sialometry and labial salivary gland biopsy. In Specialist units various international criteria (American/European consensus diagnostic criteria) are used to confirm the diagnosis.

Management of hyposalivation

There is no specific treatment yet for SS, but the hyposalivation can be managed, and dental preventive care

- **Drink enough water, and sip on water and other non-sugary fluids throughout the day.** Rinse with water after meals. Keep water at your bedside.
- **Replace missing saliva** with salivary substitutes (eg *Artificial Saliva, Glandosane, Luborant, Biotene Oralbalance, AS Saliva Orthana, Salivace, Saliveze*). Alcohol-free mouthrinses (*BioXtra and Biotène*), or moisturizing gels (*Oralbalance, BioXtra*) may help.
- **Stimulate saliva** with:
 - Sugar-free chewing gums (eg *EnDeKay, Orbit, Biotène dry mouth gum or BioXtra chewing gum*); or
 - Diabetic sweets; or
 - *Salivix* or *SST* if advised; or
 - Drugs that stimulate salivation (eg pilocarpine [*Salagen*]) if advised by a Specialist.
- **Always take water or non-alcoholic drinks with meals and avoid dry or hard crunchy foods such as biscuits, or dunk in liquids.** Take small bites and eat slowly. Eat soft creamy foods (casseroles, soups), or cool foods with a high liquid content – melon, grapes or ice cream. Moisten foods with gravies, sauces, extra oil, margarine, salad dressings, sour cream, mayonnaise or yoghurt. Pineapple has an enzyme that helps clean the mouth. Avoid spices.
- **Avoid anything that may worsen dryness**, such as:
 - Drugs, unless they are essential (eg antidepressants);
 - Alcohol (including in mouthwashes);
 - Smoking;
 - Caffeine (coffee, some soft drinks such as Colas);
 - Mouthbreathing.
- **Protect against dental caries** by avoiding sugary foods/drinks and by:
 - Reducing sugar intake (avoid snacking and eating last thing at night);
 - Avoiding sticky foods such as toffee;
 - Keeping your mouth very clean (twice daily toothbrushing and flossing);
 - Using a fluoride toothpaste;
 - Using fluoride gels or mouthwashes (0.05% fluoride) daily before going to bed;
 - Using amorphous calcium phosphate (*Tooth Mousse*);
 - Having regular dental checks.
- **Protect against thrush, gum problems and halitosis** by:
 - Keeping your mouth very clean;
 - Keeping your mouth as moist as possible;
 - Rinsing twice daily with chlorhexidine (eg *Chlorohex, Corsodyl, Eludril*) or triclosan (eg *Plax*);
 - Brushing or scraping your tongue;
 - Keeping dentures out at night;
 - Disinfect dentures in hypochlorite (eg *Milton, Dentural*);
 - Use antifungals if recommended by Specialist.
- **Protect the lips** with a lip salve or petroleum jelly (eg *Vaseline*).
- **Avoid hot dry environments**
 - Consider a humidifier for the bedroom.

Table 5. Nine steps for managing a dry mouth.

is essential. The dental team have an important role to play in this.

Any underlying cause of xerostomia should, if possible, be rectified; for example, xerostomia-producing drugs may be changed for an alternative, and causes such as diabetes should be treated.

Patients should be educated into efforts to avoid factors that may increase dryness, and to keep the mouth moist (Table 5).

Salivary substitutes or mouth-wetting agents may help symptomatically; various are available including:

UK trade names	Offered as	Contains fluoride	Main constituents	Comments
<i>AS Saliva Orthana</i>	Spray or lozenge	+/-	Mucin Xylitol	Spray contains fluoride but is unsuitable if there are religious objections to porcine mucin
<i>Biotene Oralbalance</i>	Gel	-	Glycerate polymer base, lactoperoxidase, glucose oxidase, xylitol	
<i>BioXtra</i>	Gel	-	Colostrum, lactoperoxidase, glucose oxidase, xylitol	
<i>Luborant</i>	Spray	+	Carboxymethylcellulose	
<i>Glandosane</i>	Spray	-	Carboxymethylcellulose	'Glandosane' has a low pH and therefore is best avoided in patients with a natural dentition
<i>Saliveze</i>				
<i>Xerotin</i>				
<i>Salinum</i>	Liquid	-	Linseed and phosphate buffer	

Table 6. Some salivary replacements (mouth-wetting agents).

- Water or ice chips: frequent sips of water are generally effective;
- Synthetic salivary substitutes (Table 6).
As patients with objective xerostomia are at increased risk of developing caries, it is important that they take a non-cariogenic diet and maintain a high standard of oral hygiene. The regular use of topical fluoride agents and ACP (amorphous calcium phosphate) form important components of long-term care.
Salivation may be stimulated

by using diabetic sweets or chewing gums (containing sorbitol or xylitol, not sucrose). Cholinergic drugs that stimulate salivation (sialogogues), such as pilocarpine or cevimeline, should be used only by a Specialist. Oral complications should be prevented and treated.

Keypoints for patients: dry mouth

- Saliva helps swallowing, talking and taste, and protects the mouth;

- Where saliva is reduced, there is a risk of dental decay (caries), halitosis, altered taste, mouth soreness and infections;
- Saliva may be reduced by radiotherapy or chemotherapy, various drugs, after bone marrow transplant, in diabetes, in some viral infections, in anxiety/stress/depression, or in salivary gland disorders;
- Diagnosis is clinical but investigations may be indicated, including:
 - Blood tests;
 - Eye tests;
 - Urinalysis;
 - Salivary flow rate;
 - Salivary gland biopsy;
 - X-rays or scans.

Useful websites:

- <http://www.bssa.uk.net/>
- <http://www.nidcr.nih.gov/AtoZ/LetterS/SjogrenSyndrome/>
- <http://sjsworld.org/>
- <http://www.nidcr.nih.gov/OralHealth/Topics/DryMouth/>

Sialorrhoea (hypersalivation; ptyalism)

Infants frequently drool but this is normal. The complaint of sialorrhoea (excess salivation) is uncommon and may be true salivary hypersecretion: usually caused by physiological factors such as menstruation or early pregnancy, local factors such as teething or oral inflammatory lesions, food or medications (those with cholinergic activity such as pilocarpine, tetrabenazine, clozapine), or bynasogastric intubation. In some cases, apparent hypersalivation is caused not by excess saliva production but by an inability to swallow a normal amount of saliva (*False sialorrhoea*) caused by neuromuscular dysfunction (eg in Parkinson's disease, cerebral palsy, or learning disability) or by pharyngeal or oesophageal obstruction, such as by a neoplasm.

Treatment is of the underlying cause if possible and then the use of behavioural approaches or antisialogogues. Occasionally, surgery to redirect the salivary gland ducts into the oropharynx may be helpful.

Patients to refer:

- Suspected Sjögren's syndrome.