

Substances for Targeting Xerostomia

by Linda Douglas, RDH

Nowadays, clinicians encounter increasing numbers of individuals with xerostomia-related problems. According to a recent Hygienetown poll, 73 percent of participants are seeing more patients with xerostomia compared to one year ago.

Salivary lubrication, repair, lavage, antimicrobial and buffering properties contribute significantly to the maintenance of the integrity of the hard and soft oral tissue.¹ Saliva also moistens and lubricates the food bolus, and the esophagus. A dry mouth can lead to multiple complications,² for example: cracked lips, angular cheilitis, fissured tongue, dental hypersensitivity, and caries on roots and cusp tips; plus opportunistic infections such as candidiasis. It can also impair speech, taste, mastication and swallowing. Impaired swallowing (dysphagia) could cause oesophageal damage, and compromise nutritional status; dysphagia might also lead to choking, resulting in pulmonary aspiration of food and pneumonia. These problems require a multifaceted approach to management.

To achieve this, **management of salivary gland hypofunction (SGH) and xerostomia can be based on seven main goals:**

1. Hydration (adequate water intake is crucial)
2. Stimulation of salivary flow
3. Saliva substitution
4. Reduce the loss of functional salivary gland tissue
5. Prevent caries, and promote remineralization
6. Prevent soft tissue injury and infections
7. Improve comfort

There are a variety of xerostomia relief preparations available that help to achieve these goals; this article discusses the constituents of dry mouth relief preparations, and the rationales for their use.

Stimulation of Salivary Flow

According to the Commission on Oral Health, Research and Epidemiology, stimulation of secretion has a great advantage of providing the benefits of natural saliva.³ Salivary glands are highly responsive to stimulation of taste, masticatory muscles, and sensory nerves of the oral mucosa and periodontal ligament. Stimulation of salivary flow is valuable for responders, who retain some salivary gland activity; most salivary gland hypofunction cases are responders.

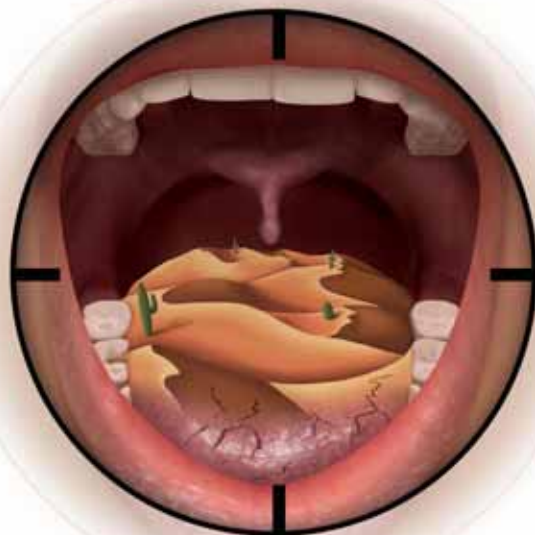
Masticatory stimulation is achieved by chewing sugar-free gum, preferably with xylitol. A regular chewing gum habit also causes a prolonged increase in unstimulated salivary flow rate.⁴

Gustatory stimulation⁵ is achieved by using flavorings, sugar substitutes and buffered fruit acids.

Systemic Sialagogues⁶ might be prescribed, if not contraindicated.

Drug-free options for stimulation of salivary flow include acupuncture,⁷ electronic stimulation⁸ and hypnosis.⁹

Increased salivary secretion aids gastric digestion, as when swallowed, saliva stimulates gastric secretions.



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Saliva Substitution

Saliva substitutes are generally formulations that aim to replicate or approximate the composition and functions of natural saliva in order to protect the hard and soft oral tissues, improve comfort, and facilitate speech, mastication and swallowing.

Constituents of Dry Mouth Relief Preparations

- Most preparations contain a combination of ingredients,¹⁰ which work together to achieve the goals of xerostomia management.
- Water-based products are best, as natural saliva is 99 percent water.
- Milk proteins and amino acids such as betaine (trimethylglycine) approximate the protein content¹¹ of saliva: they form a protective coating on the hard and soft oral tissue, which lubricates and retains moisture. Mucin-based preparations remain in the mouth for longer than other muco-protective substances, and therefore need to be used less frequently.
- Oils, for example evening primrose oil, oxygenated glycerol triesters and olive oil also have dry mouth relieving properties: they coat, lubricate and protect the oral mucosa; olive polyphenols may also have plaque inhibiting properties.
- Folic acid aids healing of trauma and aphthous ulcers. Hyaluronic acid¹² adds moisture, and may also be beneficial for aphthous ulcers.¹³ Lanolin, beeswax or plant oil products lubricate dry lips.
- Bicarbonate, calcium and phosphate buffer acids. Calcium and phosphate combined, as in Recaldent, work with fluoride to promote remineralization. Fluoride and Recaldent are also good desensitizing agents, as are potassium nitrate, and Pro-Argin (a complex of arginine and calcium carbonate).

- Sweeteners, such as anhydrous crystalline maltose,¹⁴ buffered fruit acids and various flavorings provide gustatory stimulation of salivary flow. Xylitol¹⁵ is a sweetener, which is a valuable component of any protocol for promotion of healthy saliva. It is a non-fermentable crystalline alcohol obtained from birch bark, which, in addition to stimulating salivation, reduces the oral population of *Mutans Streptococci*. When ingested by *Mutans Streptococci*, they starve and are rendered unable to replicate. Research on long-term xylitol supplementation has also found that xylitol inhibits growth and inflammatory cytokine expression of porphyromonas gingivalis.¹⁶ Xylitol also has a low glycaemic index (7) and has little effect on blood sugar levels.
- Chamomile tea stimulates salivation, and improves the comfort of a dry mouth. Jaborandi leaf¹⁷ is from a plant used in South and Central America to promote saliva production, and green tea polyphenols reportedly reduce free radical damage to the salivary glands.¹⁷

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Fig. 1: Composition of Natural Saliva

Water 99 percent

Saliva is hypotonic to plasma, in order to dilute food to the osmolality of plasma.

Proteins

Peptides (e.g., histatins, crustatins, cystatins)
Antibodies
Immunoglobulins
Mucins (glycoproteins)
Gustin (carboanhydrase)
Lactoferrin
Growth factors (epidermal, fibroblast and nerve)

Enzymes

Salivary Amylase
Lingual Lipase
Lysosymes
Salivary Peroxidase
Phosphatase
Ribonucleases, Proteases

Minerals

Electrolytes

Sodium
Magnesium
Potassium

Buffers

Bicarbonate
Calcium
Phosphate

Also: Zinc, Fluoride* Glucose, Urea, and Ammonia.

*The concentration of fluoride in saliva is related to its consumption.

- Hydrophilic, demulcent substances (often with mucilage) such as aloe vera and carrageenan improve comfort. They add moisture, form a protective coating on the oral mucosa, and have a “slippery” feel, which replicates the viscosity of saliva.
- The enzymes lysozyme, and lactoperoxidase, and an iron-binding protein, lactoferrin, replicate the antimicrobial properties of natural saliva. Peroxidase enhances production of hypothiocyanite, an antibacterial ion present in natural saliva.
- Synthetic peptides such as Histatin/P-113 have been tested as an antimicrobial component of oral gels.¹⁸

Prescription Preparations

The dental surgeon or MD might prescribe the following preparations:

- Systemic sialagogues such as pilocarpine and cevimeline stimulate salivary flow, and slow the loss of functional salivary gland tissue. These drugs have limitations, due to their contraindications, and side effects, which include flushing, sweating, rhinorrhoea and diarrhea; they are contraindicated for individuals with asthma, acute iritis, acute-angle glaucoma, cardiovascular disease, or a history of kidney or bile stones. In addition, pilocarpine cannot be taken by patients with chronic

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Fig. 2: Ingredients Used in Dry Mouth Preparations

Amino acids and oils coat, lubricate and protect	Betaine (trimethylglycine) – an amino acid found in beets, broccoli, and spinach Castor oil Cottonseed oil Evening primrose oil Glycerin	Oxygenated glycerol triesters Milk proteins Mucin Olive oil
Buffer, remineralize, desensitize	Sodium bicarbonate Calcium Phosphate Recaldent	Neutral fluoride Potassium nitrate-desensitizes Arginine and calcium carbonate (Pro-Argin)
Sweeteners and flavorings for gustatory stimulation of salivary flow	Xylitol – also reduces cariogenic bacteria Anhydrous crystalline maltose Sorbitol – (also a humectant)	Buffered Citric acid Sodium citrate Malic acid
Hydrophilic, demulcent (often with mucilage) add moisture, coat, and protect	Aloe Vera (a succulent plant) Nopal (prickly pear cactus) Slippery elm Carrageenan Linseed Xanthan gum	Carboxymethylcellulose Hydroxyethylcellulose
Healing and protecting soft tissue	Folic acid – for aphthous ulcers Hyaluronic acid – for aphthous ulcers, and to add moisture Lanolin, beeswax, coconut oil, almond oil or shea butter – for lips	
Antibacterial	Lysozyme Lactoperoxidase Lactoferrin Synthetic peptides (Histatin/P-113)	Essential oils: peppermint, eucalyptol, thymol and wintergreen dissolve mucopolysaccharides in biofilm
Other plant extracts	Green tea – an anti-oxidant, which might reduce salivary gland damage Chamomile, ginger, jaborandi leaf, rhubarb – promote salivation	

Fig. 3: Some Products for Relief of Xerostomia and Related Conditions

- ACT Total Care Dry Mouth (with fluoride)
- Biotène Oral Balance
- BioXtra
- Epic
- CloSYS – Chlorine dioxide to help prevent candidiasis
- Entertainer’s secret spray – with Carboxymethylcellulose
- GC Dry mouth gel
- KY jelly
- MI Paste with Recaldent
- Numoisyn
- Oasis
- OMNI TheraSpray, TheraMints, TheraGum
- Optimoist
- Orex
- Oxyfresh
- Salese Soft Lozenges with sustained release technology
- Salivasure
- Saliva Orthana – with porcine gastric mucin.
- Spry Rain – spray with xylitol
- Xero Lube
- Xerostom – toothpaste, rinse, spray and gel with xylitol, fluoride, olive oil and betaine

obstructive pulmonary disease or those taking beta-blockers.

- Initial research results on cevimeline gargle¹⁹ have been inconsistent.
- Research is also being conducted on pilocarpine rinses.²⁰ Pilocarpine HCI has been shown to be effective when used as a mouthwash for one minute in healthy individuals. Some clinicians have also prescribed 5mg pilocarpine lollipops for 20 to 30 seconds, approximately every two hours.
- Amifostine²¹ is a chemoprotective and radioprotective drug, which is administered intravenously. It acts as a free radical scavenger in the tissues, to reduce the incidence of xerostomia and mucositis resulting from chemotherapy or radiation therapy.
- Alcohol-free chlorhexidine rinses reduce the oral population of pathogens, cariogenic bacteria and opportunistic micro-organisms.
- Allopurinol rinse is used for chemotherapy-induced mucositis. It neutralizes uric acid, which is produced as a result of tumor necrosis syndrome.
- Caphosol is used for xerostomia and mucositis. It is an electrolyte solution with calcium and phosphate ion. It is anti-inflammatory, and promotes repair of damaged mucosal surfaces by diffusing into intracellular spaces in the epithelium and permeating mucosal lesions.
- Sucrose sulfate aluminum complex adheres to ulcerated tissue. It is a buffer and is also cytoprotective.

"Integrated mouth care systems, for example, combining toothpaste, gel and mouthwash, showed promising results, and chewing gum appears to increase saliva flow in those with residual secretory capacity."

- Oral rinses for burning mouth – Some clinicians prescribe daily prednisone rinses 5mg/5ml for patients with a burning mouth related to chronic candidiasis – this seems counterintuitive, but it can help to control the redness and soreness associated with chronic candidiasis.
 - Flucanazole 0.05% (or various strengths)
 - Clobetasol 0.05%
 - Betamethosone dipropionate 0.05%
 - Tacrolimus 0.01-0.1%
- Prednisolone 15mg per 5ml
- Dexamethosone (0.5mg/5ml) presents problems with systemic absorption

The 2011 Cochrane systematic review of topical therapies for dry-mouth management found that there is no strong evidence that any topical therapy is effective for xerostomia relief. Further research utilizing well-designed, randomized controlled trials are required to provide evidence to guide clinical care. However, integrated mouth care systems, for example, combining toothpaste, gel and mouthwash, showed promising results, and chewing gum appears to increase saliva flow in those with residual secretory capacity.²² A multifaceted approach using combinations of the above strategies and substances could be helpful in maintaining oral health and quality of life. There are now many preparations at our disposal. The information in this article could help clinicians and patients to make informed choices. ■

Chronic Candidiasis

This is a common complication of a dry mouth, which can be treated with the following:

- Systemic anti-fungals – Fluconazole 200mg for three days once per month; this dose reduces the risk of resistance to this medication. Nystatin does not work as well for chronic candidiasis.

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Author's Bio

Linda Douglas is originally from London, England where she studied dental assisting at the Eastman Dental Hospital and graduated from the Dental Hygiene Program at the Royal Dental Hospital. She has lived and worked in Toronto, Canada for 22 years. Her desire to improve support for xerostomic patients has instigated an in-depth study of saliva and xerostomia management.

